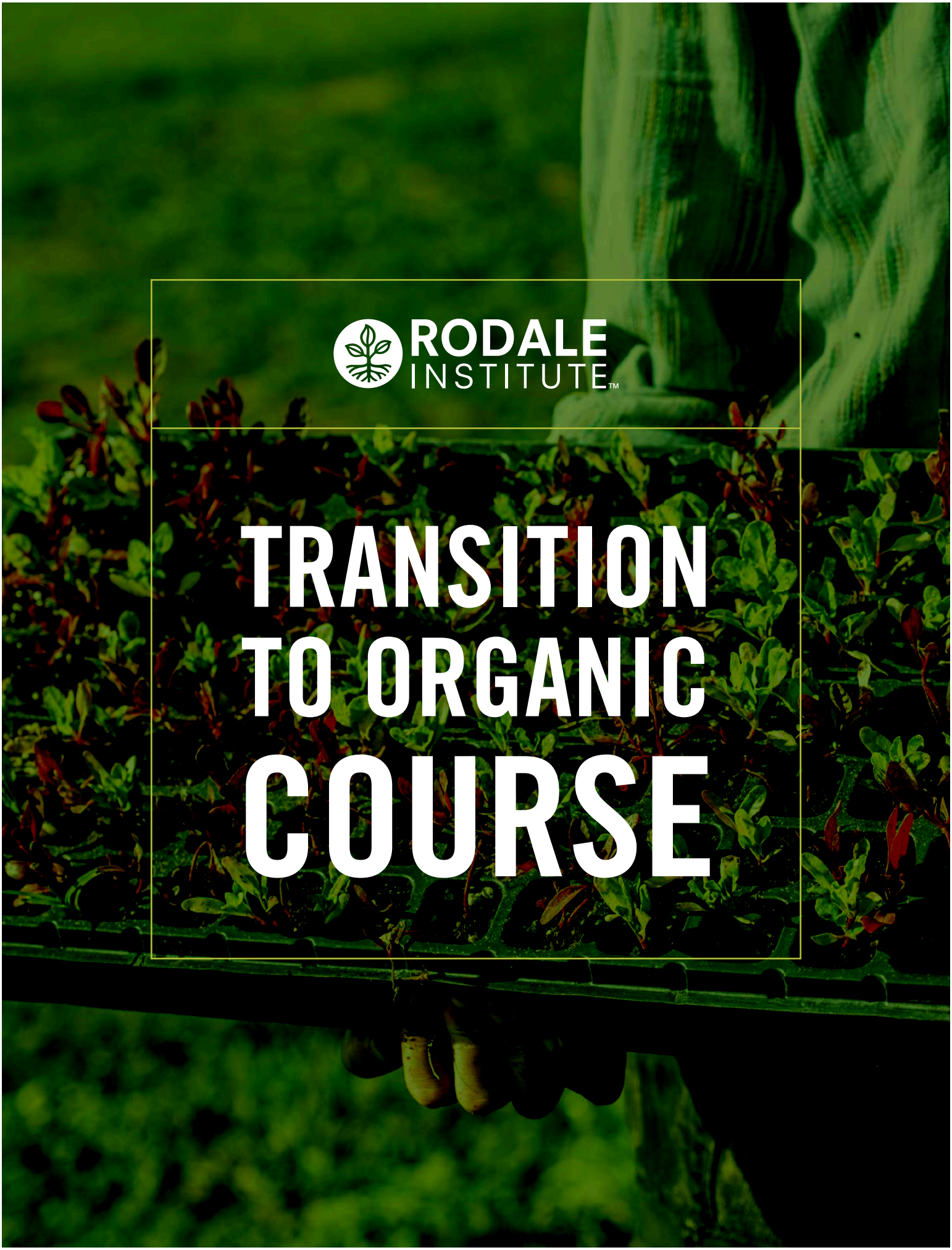

RODALE INSTITUTE™

TRANSITION TO ORGANIC COURSE

CHAPTER 1

WHY ORGANIC?

TABLEOFCONTENTS

Photo Credit: Jack Sherman

CHAPTER 1

WHY ORGANIC?

INTRODUCTION

WHY ORGANIC?

There are several considerations in the argument for transitioning to organic agriculture. From an environmental standpoint, organic agriculture builds life in the soil while avoiding the use of toxic chemicals that can accumulate in soil, water, food, and people. Non-organic farming relies on dwindling fossil fuel resources, while organic farmers build their own fertility into their systems, which improve over time and do not rely on outside inputs.

From an economic point of view, organic farming has been one of the fastest-growing sectors of agriculture for more than a decade—by 20 to 24 percent annually since 1990—and allows farmers to reap up to three times the profit margins of non-organically raised meat and produce. The U.S. Department of Agriculture estimates that U.S. sales of organic food and beverages grew from $1 billion in 1990 to nearly $35 billion in 2014, and the

Agricultural Marketing Service expects this trend to continue.

From the perspective of community, organic food and agriculture are a means of supporting local and regional businesses that build the vitality and strength of our communities. The growth of both farmers markets and the Community Supported Agriculture movements serve as a testament to the ability of organic farming to revitalize downtown centers and reestablish partnerships between regional agricultural and urban areas.

OBSTACLES TO THE TRANSITION

According to the Economic Research Service of the U.S. Department of Agriculture, "obstacles to adoption by farmers include high managerial costs and risks of shifting to a new way of farming, limited awareness of organic farming systems, lack of marketing and infrastructure, and inability to capture marketing economies." Initial reduction in yield during the transition process, as the soil recovers from previous management, can also be a disincentive to adopt organic farming.

Still, reports the USDA, many U.S. producers are embracing organic farming in order to lower input costs, conserve nonrenewable resources, capture high-value markets, and boost income

FARMER-TO-FARMER

"We strongly believe in looking at the farm as a whole system. On our farm, the three biggest challenges are weeds, insects and fertility, but I love our switch to organics. I've seen better health in our soil because of it, and the farm has a better balance. What stops my neighbors from doing the same thing? I think it's the work, the record keeping and the uncertainty."

—Ron Rosmann, Harlan, IA

By breaking the process into manageable steps, you will probably find the transition from non-organic to organic management to be both profitable and rewarding. Many farmers who have made this transition have told us that their organic management practices have brought a new sense of fun and satisfaction to their work and to their lives as a whole.

Photo Credit: Jack Sherman

Picture of organic farmland

A BRIEF HISTORY

A BRIEF HISTORY

Prior to the mid-20th century, agriculture was generally smaller in scale and was largely organic-based. Farmers and gardeners utilized cover crops, animal and green manures, and other natural means of managing the fertility of the soil, thereby also limiting the effects of pests and diseases on their crops by encouraging a healthy and balanced ecosystem.

From the Second World War to the conflict in Vietnam, chemical manufacturers produced a surplus of chemical nerve agents, ammonium nitrate (used in explosives), and various defoliants that soon became the pesticides, fertilizers, and herbicides of the Green Revolution.

The publication of Rachel Carson's Silent Spring in 1962 spurred the environmental awakening of the 1970s that gave rise to early sustainable agriculture efforts. These, in turn, evolved into the organic agriculture and food movements of today. Now farming with chemicals is being questioned more carefully as people begin to realize that—to put a twist on Newton's third law of motion—what goes in must come out, somewhere and sometime.

PIONEERING ORGANICS

J.I. Rodale popularized the term "organic" when he founded Organic Farming and Gardening magazine in 1942. J.I. and early contemporaries—such as Rudolf Steiner, Sir Albert Howard, and Lady Eve Balfour—believed that healthy soil was the key to proper nutrition and human health. Now, in the 21st century, modern science is proving that they were right.

J.I. bought his farm outside Emmaus, Pennsylvania, in 1941, and in 1947 founded the Soil and Health Foundation—known today as the Rodale Institute—to "conduct, engage, foster, and encourage scientific research and study, teaching, training, informing, and educating the public on and concerning the soil, food, and the health of people and their relationship to each other."

When J.I. Rodale died in 1971, Robert Rodale and his wife, Ardath, continued the work that he had begun. In 1972, they bought the 333-acre farm near Kutztown that is the present-day home of the Rodale Institute, and in 1979, they introduced The New Farm magazine to educate farmers about organic agriculture.

INPUT FROM RODALE

"One of these days the public is going to wake up and will pay for eggs, meat and vegetables according to how they were produced. A sustainable premium will be paid for high quality products, such as those raised by the organic method."

—J.I. Rodale

Source: *Organic Farming and Gardening, May 1942*

RESEARCHING THE TRANSITION

In 1981, the Conversion Project (now known as the Rodale Institute Farming Systems Trial) was undertaken to compare the performance of organic and non-organic systems in a replicated, side-by-side research trial. It has provided some of the first modern scientific evidence of the advantages of organic methods. That experiment continues today.

For 70 years, the Rodale Institute has been a pioneer in organic research, education and outreach, advocating organic food production

Photo Credit: Jack Sherman

Rodale Institute
Kutztown, PA

- Years: owned and operated organically since 1972
- Size: 333 Acres
- Crops: corn, soybeans, small grains, apples, mixed vegetables
- Marketing Methods: direct-to-farmer (feed), grain mills, brokers, CSA, visitors center
- Soil: shaley silt loam
- Season: Frost-free period, generally May 15 to September 15

techniques as a means of renewing human and environmental health. The Institute's organic and regenerative research empowers millions of people around the globe to reshape their lives and their communities. Our research helped launch today's global organic movement and continues to provide rigorous, credible scientific data to promote organics in mainstream markets in the U.S. and throughout the world.

Our farm operations programs support our field research and grow certified organic corn, soybeans, small grains, vegetables, apples, and other crops on our farm in southeastern Pennsylvania.

Our international programs work with people in Latin America and the Caribbean, Africa, Europe, and Asia to provide solutions to the issues of soil improvement, nutrition, hunger, poverty, community regeneration, and natural resource management.

Our education, training and outreach

programs teach children, adults, and institutions about organics and regenerative agriculture.

WHOLE-SYSTEM FARMING

Our research shows that agricultural productivity can be judiciously enhanced through long-proven, ecologically sound soil-improvement methods without resorting to synthetic pesticides and chemical fertilizers.

Organic agriculture considers the farm as a complete, fully integrated, and self-sustaining ecosystem—which includes you—with the ultimate goal being to minimize or eliminate costly outside inputs. While some fertilizers—and even some naturally occurring pesticides and herbicides—may be allowable in some instances in organic production, it's much cheaper to build fertility as well as pest and disease resistance into the system.

How is this done? We're going to explore this thoroughly later on, but basically:

- You build fertility by adding organic matter such as compost, crop residues, and animal manures to your soil and by augmenting your cash crops with cover crops that improve the biological, chemical, and physical makeup of your soil.
- You manage pests and diseases by increasing the diversity of species on your farm.

FARMER-TO-FARMER

"Organic farming must be considered as a multiyear, whole farm system where no single management decision or individual crop can be viewed separately. Short-term profitability must be balanced with long-term sustainability."

—Mary-Howell and Klaas Martens
Penn Yan, NY

ORGANIC FARMING IS...

- Minimal use of external, off-farm inputs coupled with the exclusion of synthetic pesticides and fertilizers as well as growth hormones, genetically modified organisms, and antibiotics for livestock
- A focus on renewable resources, soil and water conservation, and management practices that maintain and enhance ecological balance and improve soil quality as measured in structure or tilth, total soil organic matter, and biological activity
- An increase of biodiversity both in the farm system itself and in the surrounding environment
- Use of cover crops and green manures in a crop rotation scheme that recycles nutrients, builds soil quality, and disrupts pest cycles
- Use of allowed biological and mechanical controls for those problems not handled by the cultural systems above

And…

"A production system that is managed in accordance with the [Organic Foods Production] Act ... to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity."

—National Organic Program Standards, 2002

A SELF-SUPPORTING ECOSYSTEM

Organic farming is not simply the substitution of approved input materials. It is the replacement of a treatment approach with a process approach to create a balanced system of plant and animal interactions.

Once it is up and running, the organic system gains its own biological momentum. You begin to rely more on your own expertise and less on outside experts. As an organic farmer, you can be:

- More self-sufficient
- Less dependent on purchased inputs (which tend to get more costly as the price of oil rises)
- Paid for what you know and how hard you work
- The proprietor of a more family- and community-friendly business

- Building a complex enterprise focused on improved environmental and human health and long-term sustainability

PESTS, DISEASES, AND WEEDS

Organic farmers break pest and disease cycles by interspersing crop plots and by not planting the same crop year after year on the same piece of land, but instead rotating them.

Most insects on your farm are actually beneficial. Different plants attract different insects, and each one, in turn, has its own favorite food. The beneficial insects on your farm prey on the pests whose favorite foods happen to be your crops. This is another way diversity encourages a healthy and resilient system—the balance shifts in your favor when you encourage a diversity of species rather than upsetting the balance by killing pests and beneficial predators alike.

Crop diversity also reduces financial risks by avoiding the "all your eggs in one basket" scenario.

Picture of organic produce on grocery shelf

FARMER-TO-FARMER

"I don't look at organic farming as a return to old methods before chemical use, because a lot of the old methods weren't sustainable either. What we're really trying to do is focus on understanding the whole system and have a rotation that provides weed and pest management and quality crop production."

—Bob Quinn
Big Sandy, MT

One of the big mental shifts required for making the transition to organic production is how you think about weeds on your farm. While organic farmers surveyed consistently list weeds as one of their biggest challenges, we know from our research that crop plants will tolerate some level of weed pressure before yields are adversely affected.

Weeds can even have some beneficial qualities: they add organic matter to the soil when they are turned under, they keep the ground covered, and they contribute to the richness of the rhizosphere, or root zone, where an abundance of beneficial microbial activity takes place. Too many weeds, of course, can choke your crop plants by robbing them of water, nutrients, sunlight, and space. It's important to manage weeds by tillage or mowing before they go to seed.

ORGANIC CERTIFICATION

ORGANIC CERTIFICATION

In the early days of the organic farming movement in the 1960s, most organic farmers' production was sold locally to people who knew and trusted them. As demand increased in the 1970s, the supply chain grew, with processors and distributors buying up large quantities of organic commodities and then selling them to retail outlets far from the fields where the food had been grown. The need arose for some kind of verification that the products had indeed been grown on farms following recognized organic practices.

The third-party certification system was developed to meet this need. By the 1980s, dozens of certification groups—many of them founded by farmers—had been created both here in the U.S. and in other countries. Robert Rodale and Rodale Institute were instrumental in these early efforts, helping to write and administer one of the first organic certification programs in the United

States.

All of these early, regional organic standards had a lot in common in terms of basic principles, but they sometimes differed in details. Consistent international standards were needed, especially for exporters. European importers were balking at buying U.S. products not certified to European standards. Concern was also growing about fraudulent organic labels on products that were actually not organic at all.

In 1990, in response to widespread demand from the organic sector, Congress passed the Organic Foods Production Act, charging the U.S. Department of Agriculture (USDA) with creating a federal system for organic certification. After prolonged debate, the National Organic Program Standards were finally implemented in 2002.

WHAT THE STANDARDS SAY

Once the USDA's National Organic Program (NOP)—the culmination of the Organic Foods Production Act of 1990—went into effect, all products labeled as "organic" were required to carry the USDA Certified Organic label. (Farmers who generate less than $5,000 in sales annually are exempt from certification but still must follow the NOP Standards in order to market their products as organic.)

The NOP Standards require organic producers to manage soil fertility through the use of rotations, cover crops, and the application of plant and animal materials or low-solubility natural minerals. These practices must either maintain or improve soil organic matter content, manage deficient and excess plant nutrients, and control erosion.

FARMER-TO-FARMER

"When I first started farming, I used all the latest herbicides and fertilizers. But I didn't give up on the livestock and the crop rotations, because I recognized their value to the long-term health of the farm. This made the transition to organic farming much smoother."

—Ron Rosmann
Harlan, IA

Producers must use preventive practices to manage crop pests, weeds, and disease. Organic livestock must have access to the outdoors, shade, shelter, exercise areas, fresh air and direct sunlight as is appropriate for the type of animal and the local climate. Organic livestock may not be given antibiotics or hormones and must be fed 100% organically grown feed. Ruminant livestock must have access to open pasture.

THE TRANSITION PROCESS

A period of three years is required for the transition from conventional to organic production, during which time products may be marketed as "transitional organic," but not as certified organic. This time is calculated from the date of application of the last prohibited material or practice to the date of harvest of the first organic crop. Land where no prohibited materials have been used for three or more years can be put directly into certified organic production.

The centerpiece of your application for certification is your Organic System Plan. This might include an Organic Livestock Plan (for livestock producers) and an Organic Handling Plan (for on-farm or off-farm handling, processing or retailing).

Your Organic System Plan should include details about the crop rotation you intend to follow (including cover crops). It should include a conservation plan detailing how you plan to improve your soil and manage runoff and erosion, and it must address how you'll control pests, diseases and weeds organically.

The audit trail involves meticulous recordkeeping and documentation to show that you are following your plan, monitoring your results, and not using any prohibited substances. Once these systems are in place, an inspector employed by your certifier will schedule a farm visit, which usually lasts about three to five hours. Following the visit, the inspector submits a report to the certifying agency, where a committee will review your application.

Once you are certified, you are still required to maintain a system plan, keep good records, and have your soil tested regularly. Water used for irrigation, washing, or livestock is also subject to

testing for contaminants. You can expect a visit from an inspector at least once a year.

A WORD ABOUT CERTIFYING AGENCIES

Many of the agencies that offered certification prior to implementation of the National Organic Program Standards—such as California Certified Organic Farmers (CCOF) and Oregon Tilth—are now sanctioned by the National Organic Program to continue in this role. Since 2002, all certifiers—there are currently 101 of them—have been governed by uniform standards adopted by the USDA.

Regions of operation and areas of expertise vary widely among certifiers, as do fee schedules—some charge by farm size, others by the number of farm visits, and others as a percentage of gross sales—so it's prudent to do your homework before choosing a certifier.

The 2002 Farm Bill also provided up to $500 per farm to help offset certification fees. Check with your certifier and state organic farming groups to learn what federal or state assistance for certification may be available to you.

Logos of various organic certifications

Photo Credit: USDA, Oregon Tilth, CCOF

RESOURCES TO HELP YOU PLAN

Farmers today can benefit from a wide array of resources on transitioning to organic. Here are a few:

- Your neighbors. Organic farmers in your area are often your best resource. Find a sustainable agriculture organization in your region, make a few phone calls, and choose the next on-farm field day that fits your needs. Most certification agencies publish farmer and business directories that you can use to contact individuals directly.
- The Natural Resources Conservation Service can assist you in creating a conservation plan and tell you what practices may be eligible for cost-share.
- The Cooperative Extension service of your state's land-grant university system can provide a wealth of local information.
- Non-governmental agricultural organizations such as Rodale Institute host conferences, conduct research, and publish educational materials.
- Federally funded sustainable agricultural information centers, including the National Sustainable Agriculture Information Service (ATTRA) and the USDA's Sustainable Agriculture Research and Education (SARE) program publish free bulletins on a wide range of topics from soil health to direct marketing. SARE also awards small grants to farmers undertaking on-farm research projects.

FARMER-TO-FARMER

"Building a sense of community and cooperation is essential for organic success. Without the examples of other organic farmers who were successful, we might have concluded that organic farming would not work."

—Mary-Howell and Klaas Martens
Penn Yan, NY

SOME KEY PLAYERS

Here are some of the agencies and organizations involved in the organic certification process:

- The National Organic Standards Board (NOSB) is a 15-member body including farmers, processors, retailers, scientists, public interest advocates, environmentalists, and certifying agents. The NOSB advises the U.S. Secretary of Agriculture concerning implementation of the National Organic Program.
- The National Organic Program (NOP) is the administering body within the USDA that carries out the mandates of the Organic Foods Production Act of 1990. The NOP is housed within the USDA's Agricultural Marketing Service.
- The Organic Materials Review Institute (OMRI) is an independent, nonprofit organization that reviews substances for use in organic production and maintains a database (searchable by brand name or generic material) indicating whether a given substance is "allowed" without restrictions, "restricted" (permitted within specific limits) or "prohibited" (not allowed under any circumstances). All organic producers work from the National List of Allowed Synthetic and Prohibited Non- Synthetic Substances (better known as the National List), which is updated and maintained by NOP officials, with input from the NOSB.

YOUR CHOICE

BUILDING COMMUNITY

Certification is a choice

Growers who sell most of their crops directly to the end consumer—via a farm stand, farmers market, or Community Supported Agriculture (CSA)—may consider organic certification unnecessary because their customers know them and trust their farming practices. Keep in mind, however, that if you intend to sell any of your product through a third party—such as a grocery retailer—certification is imperative to ensure customer confidence (and a grocer can't label your product as "organic" unless it is certified). One of the strongest arguments for uniform federal organic standards was that consumers would be able to rest assured that "organic" meant something specific. A federal standard also makes organic interstate commerce a lot less of a headache.

Photo Credit: Rodale Institute

Some farmers who sell direct to consumers through farmers markets, on-farm stands or the CSA model choose not to get certified.

Building Community Through Organic Farming

Besides health and nutrition concerns, a growing number of Americans are placing both the environment and their community at the top of their priority list these days. We now know that organic farming is better for the water we drink and bathe in, the air we breathe, and all the plants and animals of the earth, including ourselves. It has been proven that the nutritional content of organically raised food can be higher than that of foods raised non-organically.

Organic is better for our communities, too. Downtown farmer's markets "build commerce, culture, and community," according to an article by the Michigan Land Use Institute. Many of these markets are "producer only"—you can sell there only if you grew it or made it—and an increasing

percentage of the vendors are organic. Here, community members meet face to face with each other and with the farmers who grow their food. Pickup at a local farm or roadside farm stand also offers this personal touch. More grocery stores are offering local and organic produce and will sometimes put the name of the farm or a picture of the farmer next to the product as a marketing tactic. Why? Because retailers know that customers want food "with a story" and are willing to pay a premium for it.

PRACTICAL FARMER WISDOM

Wherever you farm in the United States, you're probably within driving distance of a sustainable farming conference. Featuring workshops, farm tours, keynote speakers, and informal networking opportunities, these events can be invaluable for gaining practical advice and inspiration. These farmer- centered gatherings are also the best places to become acquainted with the networks of people exploring organic production and marketing in your area and your type of enterprise.

Organic agriculture is continually evolving. This course will give you a basic understanding of organic agriculture and the tools you need to begin farming successfully. Our approach is to pass on practical farmer wisdom that will help you farm well. We're going to give you what you need to know to begin building a self-sustaining, self-reliant, and self-correcting organic system. Each farm is unique. It's up to you—through careful observation, application, and fine-tuning—to create the best model for your particular situation.

LET'S GET STARTED

The next chapter we visit will be Soils, where you'll learn what "healthy soil" really is and how to achieve this critical goal that is (literally) at the foundation of everything on your farm. We'll follow with crop management, organic livestock management, marketing, and finally, the nuts and bolts of certification.

Even if you feel that a particular section of the course—for instance, livestock management—doesn't directly apply to your operation, we encourage you to stick with it anyway. It will help you to appreciate your organic neighbor's operation and how his or her needs and expectations might relate to your own. Plus, as you diversify your own operation, you might just find that the information does apply to you after all.

FARMER-TO-FARMER

"America is hungry for food that comes from the family farm just down the road, not from the other side of the country or the world."

—George DeVault
Emmaus, PA

CHAPTER 2

SOILS

TABLEOFCONTENTS

Photo Credit: Jack Sherman

CHAPTER 2

SOILS

INTRODUCTION

OVERVIEW

In this chapter, I'll explain why it is important to build the soil as the foundation of your organic future. Investing in a healthy soil ecosystem creates a hospitable and beneficial environment that accumulates and pays dividends over time.

This chapter has four lessons:

- Healthy soil
- Soil monitoring
- Soil management practices
- Composts

By the end of this chapter, you will be able to identify healthy soil and its relationship to healthy crops, understand soil testing, understand soil management practices and begin filling out your Organic System Plan.

Photo Credit: Rodale Institute

Soils from our organic (right) and conventional (left) research plots are very different in appearance due to the increase in soil organic matter in the organically managed soils. The organic soil is darker and its aggregates more visible, compared to the conventionally managed soil.

LESSON 1: HEALTHY SOIL

OVERVIEW

No matter what soil type or types you have, a sound soil-building program that includes the wise use of tillage, attention to soil organic matter, and the use of crop rotations, cover crops, soil amendments and compost will improve the health of the soil. Furthermore, this improved soil health will translate into more predictable yields, higher-quality products and greater returns.

Your soil is the foundation of your organic future. The beauty of "farming the soil" is twofold: you increase your ability to succeed year after year, and you leave a legacy of fertility and resilience for the next generation of farmers.

Through our decades of farming and research, we have learned a lot about developing poor soil into healthy, productive soil. As we move through this course, I'll share that knowledge, along with the experience of other farmers and researchers around the country. Our goal is to help you make a successful transition to certified organic production.

By the end of this lesson, you should appreciate the importance of soil biodiversity and know how to develop a soil fertility plan in keeping with NOP Standards. Understanding soil biodiversity and fertility is critical to how you will meet your obligation to improve soil under the USDA organic standards.

WHAT THE STANDARDS SAY ABOUT SOIL MANAGEMENT

Organic regulations direct farmers to use practices that will sustain or improve soil conditions without causing pollution of crops, soil or water by contaminants or prohibited substances.

Section §205.203 of the NOP Standards identifies objectives that serve to protect the soil and the environment. These include:

- "Select and implement tillage and cultivation practices that maintain or improve the physical, chemical and biological condition of soil and minimize erosion."
- "Manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant materials."
- "Manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances."

SOIL LIFE BOOSTS PRODUCTIVITY

Healthy soil is living soil. Biological activity and diversity are critical benchmarks of healthy soil because each soil organism has its own special functions. These soil organisms digest soil organic matter and convert it into substances used by plants and other soil organisms.

Soil is the most complex and diverse ecosystem on earth, with more than a billion

microorganisms representing some 10,000 species of life per thimbleful, all interconnected in complex food chains, breaking down organic matter into smaller and smaller "bites" that feed crop plants and act as storehouses for water and nutrients.

These living organisms in soil—including microorganisms like algae and fungi and macroorganisms such as worms and beneficial insects—form a "soil food web" that works very much like a spiderweb. The more strands this web contains, the more likely it is to catch food and hold nutrients. The more creatures you have eating and being eaten in your soil, the more nutrients will be cycling in the system and available to your plants.

Healthy soil means healthier and more productive crops. Organic farming practices improve soil cumulatively over time. This cumulative soil improvement:

- Increases biological activity
- Makes the soil a better host for plants
- Improves soil structure
- Improves soil moisture holding and drainage capacity
- Can help reduce negative environmental impacts of agriculture, such as nitrate leaching and erosion
- Helps increase your land's productivity and your profits each year

RESEARCH

In side-by-side comparisons at Rodale Institute over 36 years, organically managed crops surpassed production levels of chemically raised crops by 28 to 34% in drought years. This has been associated with a 25 to 50% increase in soil water infiltration.

Read more: Organic challenges conventional for yield potential in current Rodale tests

SOIL ORGANIC MATTER

In most soils, organic matter accounts for less than 5% of the total weight.

Soil organic matter (SOM) is the fraction of the soil composed of anything that once lived and includes plant and animal remains in various stages of decomposition, cells and tissues of soil organisms, and substances from plant roots and soil microbes. Well-decomposed organic matter becomes humus, a dark brown porous, spongy material that has a pleasant, earthy smell.

As plants, insects and microorganisms that live in or on the soil die, they contribute to SOM. SOM may also be added to the system through incorporation of amendments such as compost or animal manure, or off-farm amendments such as rock phosphate and green sand. Beneficial fungi, bacteria and other soil organisms recycle SOM and convert it into nutrients and other substances that ultimately benefit your crop plants.

RESEARCH

Humus can store carbon in the soil for decades or even centuries. Recent studies of pre-Columbian indigenous agriculture in South America suggest that natives of the region used charcoal to convert infertile red soils to deep, dark fertile earth. Even after hundreds of years, these terra preta soils are rich in carbon and improve crop production in an area larger than modern-day France.

Read more: Carbon is the key

As SOM levels increase, more of it gets converted into humus. Humus is a relatively stable form of soil left over after myriad soil organisms—from earthworms to arthropods—have used and digested the decaying organic materials. Carbon-rich humus:

- Is resistant to further decay
- Acts as a reservoir for water and nutrients
- Improves soil structure
- Continues to feed beneficial soil microorganisms
- Sequesters significant amounts of atmospheric carbon to mitigate climate change

FARMING FOR THE FUTURE

In the 36 years we've been comparing organic and non-organic systems side by side, soil carbon in our organic plots has increased by as much as 30%, while soil nitrogen has increased by 16%. The conventionally farmed plots showed no change in soil carbon or nitrogen over the same time frame.

You will see the benefits and changes in how the soil looks, feels, and performs long before your test results show much of a change.

Investing in soil is like putting money in the bank: The value of that investment increases over time. Chemical fertilizers offer a short-term payoff; they are gone by the end of the season. Properly managed organic soils improve cumulatively over time.

It is important to determine what condition the soil is in now for two reasons—so you can set goals for improvement and so you can develop a plan for getting there. You will need a soil plan to boost your yields and profits. You will also need the soil plan for certification and as part of your formal Organic System Plan.

FARMER-TO-FARMER

"I remember one of my professors telling me years ago, 'If you can build the organic matter level in your soil, you can solve most of your production problems right away.' He was right."

—Bob Muth
Williamstown, NJ

ORGANIC MATTER RELEASES AVAILABLE NUTRIENTS

Annual cycles of plant growth and decay support both fertility and high organic matter levels in well-managed organic systems.

As organic matter decomposes, it produces large quantities of carbon dioxide, which dissolves in the soil water to form carbonic acid. This acid formation lowers the soil pH, which can increase the release rate of other elements such as boron, zinc, manganese, iron, and phosphorus.

Some of the intermediate products of organic matter decomposition such as fulvic and humic acids can hold and transport minerals that are otherwise insoluble in the soil. This action, called chelation, is very important in the beneficial effects of soil organic substances. (Chelates are mobilizing minerals and metals in the soil, and for their uptake by microorganisms and plants.)

Phosphorus and some micronutrients attach to these ions and are maintained in a weakly ionized state, which makes them available to plants. Phosphorus and zinc—both very insoluble normally—are brought to plants by the far-reaching hyphae pipelines of beneficial mycorrhizal fungi, which flourish in organic farming systems.

SOM LEVELS

Soil organic matter levels can be maintained and increased by incorporating amendments such as:

- Residues from cash crops
- Cover crops grown in the crop rotation
- Animal manures applied with organic bedding materials such as straw or shredded newspaper
- Compost, which will increase organic matter levels quicker than animal manures alone because it's already broken down, so the materials are longer lasting and more stable in the soil
- Perennial hay or sod crops grown for several years in the rotation

THE ROOT ZONE

Roots are the interface between soil fertility and plant nutrition. The only soil nutrients that matter to a crop are those that can be absorbed by the plant through its roots.

GLOSSARY TERMS

Fulvic: One of two types of organic acidic polymer contained in humus, its name deriving from the Latin *fulvus*, indicative of its yellow color.

Humic: One of two types of organic acidic polymer contained in *humus*, its name deriving from the Latin humus, meaning earth, indicative of its brown color.

Chelating: Resulting in a chelate and by which process nutrients are held in the soil and made available for plant uptake.

The area within 2 millimeters of a root (called the root zone or rhizosphere) is one of the richest and most diverse zones of soil microbial activity. Plants are farmers, too; about 60% of a plant's photosynthetic energy is exuded out through the roots to feed colonies of beneficial microbes and fungal associations that then mineralize soil nutrients and transport nutrients and water back to plants. Plant-root exudates, or secretions, create a supportive area for microorganisms to thrive and reproduce and protect the plant from soilborne disease organisms. The microorganisms decompose humus particles in the soil, converting nutrients into plant-available forms.

In addition, hydrogen released from root hairs acidifies the root zone, which also helps make soil nutrients more available for root absorption.

Soil nutrients are delivered to the root surfaces through interception by roots and root hairs that penetrate the soil and come in direct contact with the soil colloids and with the nutrients the colloids hold. Soil nutrients are dissolved in water and then flow to the roots.

Symbiotic relationships exist between some microorganisms and plants, such as nitrogen-fixing bacteria with legume plants, or beneficial soil fungi like mycorrhizae and the roots of plants that support them.

DIVERSITY AND CROP RESPONSE

We know from our own experience, and from those shared by other farmers, that there's a direct relationship between species diversity in our soil and positive crop response. One benefit of having a wide range of crops in your farming system is that the decaying plants encourage a diversity of life in soil by providing a smorgasbord of food options to a wide range of soil microorganisms.

In the soil food web, these microorganisms produce myriad substances beneficial to healthy soil and crops, from the glues that hold the soil aggregates together, to substances that stimulate plant growth and improve the uptake of nutrients and water. Other soil organisms discourage plant pathogens, while still others can activate a plant's immune system to resist disease. The microorganisms that decompose decaying plant tissue in soil use carbon for energy and nitrogen to build tissue.

Planting a diversity of crops, instead of the same crop in the same space year after year, is one of a farmer's most effective tools for breaking weed, pest, and disease cycles.

GLOSSARY TERMS

Colloids: The particles of soil with a large surface-area-to-mass ratio and generally having a net negative charge, essential to the absorption, holding, and release of ions and thus in the processes of nutrient fixation and uptake.

Soil aggregates: The building blocks formed when soil minerals and organic matter are bound together.

SOIL TYPES

Most farmers are familiar with the concepts of "sandy," "clay," and "loamy" soils. Let's begin by looking at a comparison of these soil types.

"Aggregation" describes the ability of SOM to physically bind with the minerals in both clay and sandy soils. With clay soils, the process "opens up" the space between soil particles to allow optimal water retention and drainage, delivery and storage of nutrients, and circulation of oxygen.

Soils

Soil types	*Soil characteristics*
Sandy soils	• Composed of large mineral particles • Offer good drainage • Deliver plenty of oxygen to a plant's roots • Lack structural integrity • Have poor capacity to hold water and nutrients
Clay soils	• Composed of very fine mineral particles • Have high water- and mineral-holding capacity • Drain poorly • Prone to compaction
Loamy soils	• Mixtures of sand, clay, and soil organic matter • Most productive soils

Good aggregate stability maintains the interconnected pores that the soil air can move through, maintaining an aerobic soil environment. This circulation of oxygen stimulates soil biological activity and release of nutrients to your crop plants. Plant roots need oxygen when respiring, and there must be sufficient air, especially oxygen, in the soil to support most forms of soil life. For sandy soils, organic matter allows the coarse particles to stick together to better capture water and nutrients.

SOIL WATER DYNAMICS

The concept of feeding the soil and not the plant is one of the most critical and basic concepts of successful organic farming. By creating a hospitable environment for a diversity of life underground, we increase our yields and the quality of our crops aboveground. This also improves the crops' ability to withstand pest, disease and environmental pressures such as drought.

Synthetic approaches to fertilizing plants have the opposite effect. "When you apply soluble nitrogen, you actually burn off organic matter and acidify the soil," says Paul Hepperly, Ph.D., former research manager for the Rodale Institute.

The importance of soil water to dissolve and deliver nutrients to plants cannot be overstated. Even if a soil has adequate nutrients, the plants cannot access the nutrients they need for growth if water is limited.

For crops dependent on irrigation, soil moisture should be maintained at 50 to 100% of field capacity (i.e. the water retained in a freely drained soil about two to three days after it has been saturated). In soils that receive adequate rainfall but are subject to periodic drought conditions, maintaining soil organic matter will increase both the water infiltration and water-holding capacities of a soil. We have seen this on our own Farming Systems Trial. During droughts, organic production fields have consistently outproduced the conventional ones. During excessive wet times, organic soils drain better, protecting crops and allowing farmers to get back on their fields sooner.

SOIL TILTH

Tilth refers to the physical condition of the soil, such as its texture and relative ability to hold moisture and circulate oxygen. It is a key indicator of soil's health. This definition from a Colorado State extension bulletin describes tilth very well:

"Soil tilth refers to the soil's general suitability to support plant growth—or more specifically, root growth. Tilth is defined as the physical condition of soil as it relates to ease of tillage, seedling emergence and root penetration, as well as its fitness as a seedbed."

A soil with good tilth has adequately sized pore spaces between soil particles for the air infiltration and water movement essential to plant growth. It also holds a reasonable supply of water and nutrients. Roots grow only where the soil tilth allows for adequate soil oxygen levels.

Improving soil tilth through the addition of soil organic matter is effective in any type of soil, from clay to sand. Developing good tilth in clay soils means increasing the size of pore spaces, since clay soils are more compacted and need more space for water and air movement. Developing good tilth in sandy soils means increasing the amount of water-absorbing material.

Good soil structure allows for the free flow of water, air, and nutrients surrounding crop plants' root systems, and the free flow of oxygen stimulates the activity of microorganisms to release nutrients to the plants.

Soil tilth also affects the ability of a plant's root system to expand and explore for nutrients. Many factors have an impact on soil's tilth: tillage,

GLOSSARY TERMS

Soil water: Water suspended in the soil, namely the region from which water is discharged by plant transpiration and evaporation.

Field capacity: The amount of water left in a given soil plot after free drainage has practically ceased, usually two to three days following its saturation.

Water infiltration: The process by which water on the ground surface enters the soil.

crop rotations, crop residue management, soil amendments, even vehicular and foot traffic. While the influence of these factors may not show up on chemical soil tests, they will affect the soil's productivity.

CATION EXCHANGE CAPACITY

Soils are mixtures of sand, silt, clay and organic matter in varying amounts. The relative proportion determines the soil type. Here's how the "macro" management practices actually play out at the "micro" level: both the clay and organic matter particles (called colloids) have a net negative charge. These soil particles will attract and hold positively charged particles of plant nutrients, called cations.

The cations attached to the clay and organic matter particles in soils can be replaced by other cations; so they are exchangeable. For example, potassium can be replaced by calcium or hydrogen, and vice versa. The total number of cations a soil can hold—or its total negative charge—is the soil's cation exchange capacity (CEC).

The higher the CEC, the higher the negative charge and the more cations that can be held. If more cations are held, then fewer are leached below the root zone. This, in turn, has a significant effect on soil fertility: the higher the CEC, the better the soil's fertility potential. Combined with other key indicators, CEC is a good measure of soil quality and productivity.

Cations include these positively charged plant nutrients: calcium (Ca++), magnesium (Mg++), potassium (K+) and ammonium (NH4+). It is undesirable to add clay material to increase CEC, but adding organic matter improves CEC and tilth. Organic matter colloids are more chemically reactive and have a bigger impact on soil characteristics than do clay-based particles, which is why SOM is so important.

NPK

Nitrogen (N) and phosphorus (P) are almost always present in mineral soils and can be found in relatively large quantities. However, the largest portion of the total content is held in chemical complexes and is unavailable to plants. Even the simpler compounds of phosphorus are relatively insoluble in most soils.

The total quantity of potassium (K) is usually plentiful (except in sandy soils). But there is still a problem of availability.

Calcium (Ca) will vary more than potassium in soils, but it is generally present in lesser amounts. When a soil lacks calcium, it tends to be acidic. Calcium-containing limestone is generally added to correct this condition. (A proper pH level of around 6.0 to 7.5 is critical to soil microorganism populations.)

Magnesium is an important plant nutrient and, like calcium, neutralizes acid soils. Dolomitic limestone contains both calcium and magnesium; calcitic limestone contains primarily calcium. Magnesium deficiency is a major problem in many soils in the eastern United States.

Sulfur is usually as plentiful as phosphorus. However, it is more available in soils because its simple compounds remain soluble when reacting with other soil constituents, while the compounds of phosphorus do not. Adding sulfur to the soil through farm manure, rainwater, and composts resolves possible sulfur deficiencies in humid temperate regions. In certain areas, such as the

RESEARCH

The Rodale Institute's Farming Systems Trial, soils under organic management have gained about 0.025% carbon and 0.01% nitrogen annually, while there was no change under non- organic management. This suggests that, over time, organic soils can better supply the needs of beneficial soil organisms and crop plants.

GLOSSARY TERMS

Crop residue: The plant parts remaining in a field after the harvest of a crop, which include stalks, stems, leaves, roots, and weeds. *(NOP definition)*

Cations: Positively charged ions

Dolomitic: Containing dolomite, a mineral and a sedimentary carbonate rock, both composed of calcium magnesium carbonate, $CaMg(CO_3)_2$

Calcitic: Containing calcite, a common crystalline form of calcium carbonate, $CaCO_3$

western and southern United States, specific additions of sulfur-containing compounds may be required.

SOIL RESPIRATION

While improving the chemical and physical properties of soil is important to organic and non-organic agriculture alike, building and maintaining the soil biology is absolutely critical to successful organic farming.

Soil organisms are the building blocks of healthy, productive soils. Like all other living things, soil organisms need food, water, and a place to live. Proper organic management creates this sustenance and habitat for both visible soil inhabitants—such as earthworms and insects—and those too small to see—such as beneficial bacteria and fungi (the primary decomposers that support this microscopic ecosystem).

Equally important is the activity in the soil. We call this activity respiration.

When plants die, the insects, worms and microorganisms in the soil begin to break down the plants' carbon and use some of it for food. Through the process of photosynthesis, living plants take in air containing a large percentage of carbon dioxide and convert it to cellulose, starches, and sugars in the plant tissue. When these plant residues are incorporated into the soil, microorganisms use the carbon, cellulose, starches, and sugars for their food. Through this same process, other nutrients and micronutrients from the decaying plant tissue are made available for subsequent crops. The "life in the soil" is what makes nutrients available to plants.

Scientists measure soil respiration by determining the amount of carbon dioxide being released. In our Farming Systems Trial, we have found that carbon dioxide respiration is significantly higher in the organic farming systems than in the non-organic system. This is because organically managed soils are able to store or sequester carbon for use by plants as needed. This means microorganisms are more active and numerous in the organic systems and are recycling more nutrients.

In good organic systems, soil is working hard for you. Here's what it looks like in equation form: $C_6H_{12}O_6$ (carbohydrate in the form of plant material) + O_2 (oxygen) = CO_2 (carbon dioxide) + H_2O (water) + energy.

SUMMARY

This concludes the Healthy Soil lesson. Let's review some key points relevant to your Organic System Plan.

- Soil is an investment that builds up over time.
- You have an obligation to improve your soil under the NOP Standards.
- Soil organic matter plays a major role in healthy soil biology.
- Chemical, physical and biological processes interact in soils.
- Biodiversity is important below, as well as aboveground.

By now, you should be able to:

- Understand the concept of biodiversity related to your farming practices
- Keep nutrients cycling back into your system through chemical, physical and biological processes
- Meet your obligation to improve your soil under the National Organic Program Standards

In the next lesson we'll discuss how to evaluate your soil.

LESSON 2: MONITORING

OVERVIEW

In the last lesson, we looked at some basics of soil health and soil biology. Now, let's look into transitioning to healthy soil. We will discuss soil testing, building healthy soil and monitoring changes that may occur as you improve your soil.

On any given day, you make many decisions that could influence outcomes on your farm. Soil testing and observation are goals that you need to include in your farm plan. If you don't know where you're going, how will you know if you've arrived at the right place? These goals can help you establish where you're going and how you'll

get there, and help you determine if you have arrived at your ideal soil goals. In addition, your Organic System Plan requires you "to monitor the effectiveness of your fertility management program."

Soil texture, water movement, crop response and earthworm populations are key indicators of soil health. You will need additional information from formal soil tests to help you set soil-improvement benchmarks and track changes over time.

By the end of this section, you will know how to create your soil fertility plan. To help you do that, we will lay out the highlights of how to build and measure soil health, control erosion and test your soil.

PLANNING YOUR SOIL IMPROVEMENT PROGRESS

Although the NOP Standards don't spell out the particulars, your certifier is going to have questions if your fertility management plan simply substitutes expensive bags of organic fertilizers for chemical fertilizers. Your certifier will ask you to demonstrate how you're improving your soil. The building blocks of your fertility program should be crop variety, cultural practices, composting, cover crop/green manure management, and manure management (whether you have animals on your farm or are importing manure from a trustworthy source nearby).

A soil fertility plan has several key ingredients to help fine-tune or verify target nutrients for each field. Let's begin with nutrient goals:

- Set nutrient goals for each field
- Create a cropping system that provides the soil nutrients you need for successful crop production while protecting the environment (don't forget to consider crops in the rotation that have the ability to tie up any excess nutrients)
- Monitor and record soil nutritional deficiencies or excesses
- Look at the entire rotation to balance what crops use with what comes back by way of amendments and soil-building practices
- Verify or adjust soil nutrient target levels based on crop responses and yields

You will need to track your soil improvement and explain the monitoring tools you are using. Methods might include traditional chemical soil testing, microbiological testing, plant tissue testing and crop health observations.

Managing your soils is a critical requirement of your farm plan. The NOP Standards reference soil erosion at §205.203a and require a formal soil conservation plan adapted to your farm. Testing and amending your soil is a waste of time if your topsoil is eroding into the nearest stream.

KEEPING YOUR SOIL ON THE FARM

The first step toward healthy soil is the keep the soil you have in place. Topsoil is the fertile top layer of soil representing centuries of growth and decay and is both a protector from, and vulnerable to, erosion. Erosion is not always readily visible on cropland because farming operations may cover up its signs. Loss of only 1/32 of an inch of topsoil can represent a five-ton-per-acre loss. Watch for the following signs that you may be exporting soil

MAKING PROGRESS

Thanks to the efforts of the Natural Resources Conservation Service (NRCS) and partnering farmers, erosion is a declining problem. We still have a long way to go, though in preserving valuable topsoil resources. A 2011 NRCS report found that conservation practices used during the period 2003-2006 have:Significant gains in erosion control that were made between 1982 and 1997 were sustained between 1997 and 2001.

- Reduced wind erosion by 44%;
- Reduced waterborne sediment loss from fields by 47%;
- Reduced nitrogen lost with surface runoff by 43%;
- Reduced total phosphorus loss from fields by 39%;
- Reduced pesticide loss from fields to surface water, resulting in a 26% reduction in edge-of-field pesticide

Read the full report

fertility:

- Dust clouds
- Soil accumulation along fence lines or snowbanks
- A "drift" appearance on the soil surface
- Small rills and channels on the soil surface
- Soil deposited at the base of slopes
- Sediments in streams, lakes and reservoirs
- Pedestals of soil supporting pebbles and plant material

Erosion damage is twofold:

- Surface soil erosion causes a loss of nutrients and biodiversity within the system, and often creates a less favorable environment for plant growth.
- Soil nutrients enter and accumulate in bodies of water. The nutrients can cause problems such as algal blooms and related oxygen depletion due to high nutrient levels. This type of nutrient runoff is responsible for large "dead zones" in bodies of water such as the Gulf of Mexico and the Chesapeake Bay.

BIG PROBLEMS COME IN SMALL PACKAGES

Sheet erosion is very difficult to see from year to year. Soil is removed more or less uniformly from every part of the slope. Wind and the force of raindrops hitting bare soil dislodge particles of earth. Water that does not infiltrate the soil forms puddles. The puddles flow into one, and the water carries fine particles.

Rill erosion is indicated by tiny gullies irregularly dispersed, especially on bare, newly planted or fallow land. On close examination of fields, rill erosion is noticeable, but may not seem like a problem that needs immediate attention.

Gully erosion is dramatic and difficult to ignore. The volume of water is concentrated, forming large or small ravines.

Losses due to sheet and rill erosion are less noticeable than gully erosion but are even more important from the standpoint of field soil deterioration. On sloping or impermeable soils, most of the precipitation can be lost to runoff, depriving crop plants of water and carrying valuable topsoil with it.

A field with examples of several kinds of erosion

PREVENTING EROSION

1. Keep the soil covered year-round with living crops or residue to prevent erosion by rainfall or runoff. Plant roots also help hold the soil in place, and the plants themselves act as a barrier to

slow the flow of water across the surface of the earth. The Natural Resources Conservation Service (NRCS) suggests that crop residues should cover at least 30% of the soil surface following harvest. Three ways to keep the soil covered are growing forage crops in rotation or as a permanent cover, growing winter cover crops, and interseeding a crop by establishing it with or under another crop. Clovers are often planted with or relay planted into small grains. The small grain shelters the legume seedling, and the clover continues developing after the small grain is harvested.

2. Apply organic matter. The conservation and addition of soil organic matter such as compost, green manures and animal manures help soil resist erosive forces. The infiltrating (soaking) capacity is influenced heavily by the structural stability of soil (especially near the surface) as well as its texture and organic matter content. Soil depth, the kind and amount of clays, and the presence of impervious layers also influence infiltration capacity.
3. Minimize tillage to maintain and enhance soil aggregate size and stability. The stability of soil aggregates has great bearing on the extent of erosion damage. The resistance of surface granules to the beating action of the rain saves soil; the bigger and more stable the soil granules are, the more they will resist the erosive action of rain. Wind and water run hard and fast through long, straight lines. The following techniques can mitigate these problems:
4. Plant shelterbelts of trees, shrubs or tall crops to slow down wind and its negative effects. Shelterbelts can do double duty as buffers, which are planted barriers that are required between adjacent organic and non- organic fields.
5. Modify the landscape with contours or terraces to slow runoff and reduce the amount of soil it can carry. Other techniques such as strip cropping interrupt the flow of soil and water down steep exposed slopes.

RESEARCH

Scientists at the Institute of Plant Nutrition and Soil Science and the Institute of Organic Farming in Germany have demonstrated that organic farming could help prevent flooding. Researchers measured seven times more earthworms and infiltration rates twice as high in organically managed soils as in conventionally managed soils.

Read more: FAL Study

PRACTICAL SOIL ASSESSEMENT

Once you have made sure you are not exporting your existing soil, you can begin to assess the health of your soil. Healthy soil must contain the essential nutrients for vigorous plant growth and retain moisture without becoming soggy. In addition, healthy soil provides good aeration to plant roots and soil microorganisms, and resists the erosive effects of wind and water.

Healthy soil is:

- Soft and porous at the surface—not crusty—allowing water to infiltrate and reducing the potential for runoff erosion
- "Greasy" feeling but not pasty; it should ball up in your hand but readily crumble if you gently poke the ball with your finger
- Earthy smelling—a sign of bacteria breaking down organic matter
- Teeming with visible beneficial organisms
- Well drained and warms up quickly in spring
- Free of clods and hardpan layers

But how do we measure these qualities? Some biological processes cannot always be measured exactly, but they can be verified through observation over time. Some of the physical signs that soil is improving include:

- An abundance of earthworms
- The presence of organic matter residues

- Dark topsoil
- Vigorous, healthy (white) root growth
- Loose subsoil
- No runoff or signs of erosion and no ponding up
- Ability to hold water well, supporting plants in dryer times
- Vigorous, healthy (dark green) crop growth
- Fertility improving over time (as indicated by soil tests)

THE WATER TEST

Perform a simple soil aggregate stability test at home. Collect soil clod samples including your worst as well as your best fields. Allow the clods to dry at room temperature for a few days. Fill two glass jars halfway with water. Place a dry clod of soil from each sample into a jar.

If the soil clod remains intact and sends up air bubbles, you have a good level of organic matter. If the clod disintegrates and clouds the water, then the organic matter content of that soil is too low and requires attention.

FERTILITY INDICATORS

Fertility is basically the ability of your farming system to grow healthy, vigorous crops. Organic agriculture is like preventive medicine and proactively seeks to address fertility imbalances to mitigate symptoms of an unhealthy system, such as pests and diseases. Following are some signs that might indicate the need for fertility intervention:

Weeds. Certain weed species can be indicators of specific soil conditions. If there are large, vigorous populations of weeds that prefer hard, compacted soil (foxtail) or that thrive on excess nutrients (lambsquarter, pigweed), you may need to correct a fertility imbalance.

Crops. Do they grow vigorously and outcompete weeds? Are the leaves a healthy green and the stems strong? Or do the plants lodge easily, with foliage showing yellow or purple streaking? The latter may be an indicator for a need to build soil fertility.

Insects. Which are more prolific, the beneficial or the harmful insects? Harmful insects are attracted to stressed plants, indicating that soil nutrients may be imbalanced and microbes may not be thriving as well as they could be.

SOIL LAB TESTS

Although careful observation is key in organic farming, soil lab tests can still offer valuable benchmarks. The first part of the standard soil-test report shows levels of critical nutrients, soil acidity and soil nutrient exchange dynamics. The second part offers recommendations to adjust fertility, salinity or acidity for the target yield of the anticipated crop.

Generally, soil tests:

- Classify the soil based on the percentage of sand, clay and loam. This information can help to better estimate how the soil will respond to cultivation and additional organic matter, as well as the soil's nutrient and water-holding capacity.
- Measure pH, exchangeable acidity and cation exchange capacity—important indicators of fertility in organic soils.
- Measure "plant-available" levels of phosphorus, potassium, calcium,

Our researchers once sent a soil sample from the Rodale Institute to 70 different labs. The pH of the sample ranged from 4.7 to 6.9, with lime recommendations ranging from "none necessary" to 7 tons per acre. Readings and recommendations for NPK and micronutrients were just as varied. Our advice: Find a lab that's familiar with organic farming and with your general geographic area. Compare your results year to year from the same lab, rather than trying a different lab each year. Collect samples around the same time each year, and if you're using a consultant, make sure he or she knows you're transitioning to organic.

magnesium, sodium, sulfur, manganese, copper and zinc.

As an organic farmer, you will use your soil test recommendations differently than a non-organic farmer would. In non-organic agriculture, the goal is to buy just enough fertilizer to produce optimum yield without allowing excess nutrients to escape into the environment.

Organic management, on the other hand, focuses on improving soil nutrient levels and soil health over the long term, balancing use of manures, cover crops, composts, approved organic fertilizers and naturally occurring mineral supplements so the soil tests better and better each year. So, for soils under organic management, a chemical soil test will not give the full picture of your soil's health and productivity. Soil tests estimate the nutrients present in the soil, but they can't measure the nutrients the crop will receive through biological activity during the growing season.

TILTH, SOIL CARBON AND BIOLOGICAL ACTIVITY MEASUREMENTS

Three tests can be helpful in further assessing your soil health: tilth measurement, total soil carbon and biological activity:

- Tilth measurement: tilth can be measured by calculating soil density. You can measure tilth by weighing out 100 grams of dry soil and noting the volume it occupies in a measuring vessel. The weight divided by the volume will give the soil density in grams per cubic centimeter.
- Total soil carbon: Total soil carbon is measured in a lab by igniting a soil sample of known weight, weighing the dry remains and then calculating the weight lost to determine the amount of soil carbon in the sample. Since soil organic matter is approximately 50% carbon by weight, doubling soil carbon values gives a good approximation of soil organic matter.
- Biological activity: Biological activity involves measuring soil respiration, or the release of carbon dioxide. "What you are measuring in the breathing of the soil is the activity of the microorganisms and their ability to break down soil organic matter," Paul Hepperly, TRI research manager explains. "This is done by measuring the release of carbon dioxide, which is a decompositional gas. It's the opposite of photosynthesis."

RESEARCH

Dr. Ray Weil has developed an inexpensive, easy-to-use kit to help farmers determine the active organic matter fraction in their soil. Remember, when soil is mismanaged, active organic matter is the type that is lost first. Farmers can use the test to determine which of their fields need the most urgent input of organic materials.

Using the kit, you can mix a solution of potassium permanganate with soil, then use the color of the solution to determine active organic matter. The only expensive component is the hand- held colorimeter, sold by Hach Co, for about $200. (To avoid this expense, you can also use a color chart for more approximate comparisons.) All the other items should cost less than $20. (Find more soil biology test kits under "Resources" at the end of this module.)

SUMMARY

Improving your soil health and crop performance begins with careful observation and good recordkeeping. If your crops show poor growth, look at the growth environment and take plant tissue samples to see which nutrients your crop may be lacking. Record all soil fertility and plant-tissue test results, along with yields and management practices.

Sampling and recordkeeping are essential because they help you assess the agronomic and economic success of farming practices over time. Also, these records are required by the NOP. Develop a site-specific, long-term fertility plan based on the characteristics of the soils on that site, the crops in the rotation and the farmer.

In building soil health and your long-term fertility plan, taking several approaches is more effective than trying to put all your soil improvement tactics in one basket. Many practices

TIMING IS EVERYTHING

If your fertility plan includes plant or animal residue application in the fall, you should soil test in the spring, once your microbial community has had a chance to do its thing and make nutrients available. To find out if you need to plant a cover crop to store excess nutrients for the next planting cycle, soil test again after harvest. (Testing should be done at the same times of the year and at similar soil temperatures.)

can influence crop response to nutrients. Some of these practices include:

- Timing and type of tillage
- Planting a hybrid or a particular variety of plant
- Adjusting planting dates
- Using crop rotations, green manures and cover crops
- Interplanting two or more crops in the same area
- Incorporating crop residues
- Subsoiling
- Adding approved amendments, foliar fertilizers and soil inoculants

We'll talk more about these practices in the next lesson.

LESSON 3: PRACTICES

OVERVIEW

In the previous lesson, we discussed soil and testing to help assess your soil building program. Now, we'll move to practical organic soil management during crop tillage and cultivation. We will also discuss the value of planting cover crops and implementing crop rotations.

Tillage can be used to manage weeds, incorporate organic amendments and crop residues into your soil and ready the soil for seed establishment. However, too much tillage, or tilling under the wrong conditions, can harm your soil in a number of ways. Even though opening up the space between soil particles for oxygen can stimulate microbial life and increase soil carbon, ripping the lid off your soil can burn up carbon at an alarming rate.

Tillage and any wheeled-implement traffic can also cause soil compaction, particularly in clay soils. Loose, uncovered soil is more susceptible to erosion by wind and water.

Strip cropping can mitigate soil erosion. Alternating strips of sod crops with row crops in strips perpendicular to the slope slows water movement and has the added benefit of increasing diversity.

In organic systems, conserving and increasing soil organic matter (SOM) are keys to a productive system. There are several ways to offset the reduction of SOM from tillage:

- Adding compost
- Using cover crops in the rotation
- Using fast-growing catch crops for soil protection between crops
- Using longer rotations
- Using rotational no-till
- Incorporating several years of sod pasture or hay in rotation

RESEARCH

Organic farming is a developing science, one that might someday be considered a real Green Revolution because of emerging evidence of its ability to put the brakes on global warming. Here at the Rodale Institute we're demonstrating how organically managed soils actually act as carbon sinks, storing carbon in the form of soil organic matter rather than releasing it into the atmosphere as CO2, a major greenhouse gas.

Read more: Organic farming sequesters atmospheric carbon and nutrients in soils

GLOSSARY TERMS

Subsoiling: A method of deep plowing used to break up compacted subsoil, or hardpan, produced by many conventional tillage methods.

COVER SOIL, MINIMIZE TILLAGE

Under NOP Standards, cover crops need to be part of your plan to build the soil. §205.203 of the Standard states that plant materials must be managed to maintain or improve soil organic matter.

Covered fields conserve topsoil and nutrients. Here in Pennsylvania, a winter crop of vetch or rye works well with our principal crops of corn and soybeans. Vetch provides nitrogen for the corn, while rye soaks up nutrients and helps manage weeds in the soybeans.

Much of what you know about tillage from non-organic farming also applies to organic farming. Most conscientious farmers are careful to restrict tillage activities. However, because of the explicit NOP requirement to protect and build soil quality, organic farmers must plan their tillage regime before the season begins and document the actual tillage that occurs.

PLOWING TIPS

Plowing fields that are too wet or too dry can produce dense soil clods that are difficult to manage and prevent good seed-to-soil contact. Even after careful tillage that leaves lots of residue on loosened soil, a heavy rain can badly impact the quality of your soil bed.

To plan your tillage, you have to use your best judgment to factor soil type, field slope, depth of loosened soil, field drainage and the weather forecast in balance with the benefits you hope to achieve.

Tillage is like fire in a forest. Both have to be managed wisely, and both generate inevitable physical changes to achieve their benefits. However, tillage has risks in that it:

- Accelerates the rate and extent of decline in soil quality
- Increases subsoil compaction
- Increases fossil fuel use and labor costs
- Can lead to soils that are too wet, and crusting of bare soils

TILLAGE TO INCORPORATE AND PREPARE

Tillage accelerates decomposition of crop residues, compost and animal manures into soil organic matter. Successful incorporation of tillage:

- Encourages the rapid growth of soil organisms, given sufficient warmth and moisture, by adding extra nitrogen, oxygen and carbon to their environment. Organically managed soils encourage soil animal predators that feed on weed seeds, helping to lower weed pressure.
- Increases soil contact with plant and manure residues. By breaking down residue into smaller pieces, incorporation increases the surface area for microbes to contact, consume and digest the materials.
- Decreases the bulk density of the soil, promoting both drainage in wet times and moisture-holding capacity during drought.
- Deepens the aerobic (oxygenated) soil layer that is rich in microbial activity due to favorable temperature and moisture conditions.

Photo Credit: Steven Lybeck

Careful tillage incorporates crop residues, in this case alfalfa, into the soil without pulverizing soil aggregates or overly disturbing the microbial community. The incorporated plant residues feed the microbes in the soil, which in turn feed the next crop planted.

- Helps maintain soil tilth in the upper horizon when soil is worked at the proper moisture content and receives sufficient organic residue.

The goal of tilling for seedbed preparation is to work the topsoil just enough to allow optimum seedling vigor. Successful seedbed preparation provides:

- Good seed-to-soil contact in firm, moist soil for vigorous seed germination and root development.
- Sufficient soil aeration for plant growth without creating large voids and clods and without stirring soil any more than necessary.
- Warmer soil to enhance seed germination. Bare soil warms faster than mulched soil but is vulnerable to erosion and moisture loss.

The "stale seedbed" technique uses a series of light cultivations to sprout weed seeds, then tills them, exhausting the surface weed supply.

REDUCING TILLAGE IN ORGANIC SYSTEMS

At the Rodale Institute, we evaluate our tillage as carefully as we choose our crops and our crop rotation. We want to make sure each tillage pass returns more than it costs by increasing yield and/or improving soil conditions. The soil needs to be worked only enough to ensure optimum (not maximum) crop production and weed control. Optimum production is a yield that is as high as is practical and efficient, given other considerations. Any tillage activity beyond that is of questionable value because there is no benefit in coaxing maximum yields from a field using practices that cause long-term damage to the soil.

We've found that occasional plowing offers significant weed-management advantages. Our soil organic matter levels continue to increase, especially with the addition of cover-crop biomass, so we believe we can overcome the limited amount of tillage-generated carbon loss by use of cover crops.

We're developing a one-pass no-till system that uses fall-planted winter annual cover crops to suppress weeds. In this system, we mechanically knock down the standing cover crop and plant right into it, mimicking a garden mulching system. Our system utilizes a specially designed front-mounted steel roller and a rear-mounted precision no-till planter.

Photo Credit: FarmHack

The no-till roller in action.

Some farmers use reduced-tillage methods in which soil disturbance is restricted to the seed zone. Attachments such as vertical coulter blades on a no-till planter prepare a planting slot by cutting through crop residues down into the top soil. A subsoiling foot can create a deeper slot for transplants.

NO-TILL CONSIDERATIONS

Machinery: Both organic and non-organic systems require specific no-till machinery. For example, no-till planters are equipped with coulters that slice the soil (and cover-crop mat, if present), allowing the double-disk opener that follows to place the seed at the proper depth. The slot is closed with a spring-wheel press, cast iron wheels or a combination of star coulters and press wheels. In any no-till system that uses cover crops, the biomass mat created by the killed cover crop is much heavier than the residue from a previous year's crop; thus, no-till planters must be weighted and adjusted accordingly to cut through

the cover-crop mat and place the seed effectively. As we've found here on our farm, calibrating and modifying your equipment to facilitate a good roll-down and adequate seed-to-soil contact is a matter of trial and error.

Soil temperatures: In most areas of the United States, spring soil temperatures are lower in untilled fields than in tilled soils. Dry, bare soil warms faster than mulch- covered soil, so no-till plantings may be slower to germinate. Also, most soil microorganisms responsible for crop nutrition "awaken" when soil temperatures climb above 60°F. As a result, no-till planting may have to be delayed to a later date and shorter-season seed varieties may need to be planted. Colder soil temperatures under mulch may also present problems in abnormally cold or wet seasons. However, most locally adapted crops can tolerate some temperature variations.

Pests and diseases: Increased insect and rodent pest problems have been reported in some non-organic no-till systems. Dense covers may incite disease and insect problems. In all such cases, crop rotation to break weed, insect and disease cycles is a key factor in managing insect and disease problems in an organic system.

CROP ROTATION

Crop rotation is the practice of strategically selecting the sequence of crops grown on a specific field. The goal is to plant annual crops of different species or families in each consecutive year on a field in order to avoid fertility depletion and buildup of crop-specific pest and disease problems.

Organic farmers rely on crop rotations as their primary tool for managing nutrients and breaking weed, pest, and disease cycles. According to the NOP, producers must use appropriate crop rotations to:

- Maintain or improve soil organic matter content
- Provide for pest management in annual and perennial crops
- Manage deficient or excess plant nutrients
- Provide erosion control

Most organic crop rotations include at least three primary crop species and two or more secondary cover-crop species. Some rules of thumb for rotation design are:

- Keep the soil covered. Bare soil is the worst-case scenario for soil health and carbon/organic-matter depletion.
- Position nitrogen-demanding crops (corn, vegetables) after nitrogen- building crops (legumes). In the second or third year after the legume, grow a less-nitrogen-demanding crop.
- Use sod crops (grasses, clovers, alfalfa) periodically to build soil structure and fertility.
- Maximize active root growth throughout the year.
- Include deep-rooted crops such as alfalfa, sunflower, and safflower to help open up channels to deeper layers and bring up nutrients from the subsoil.
- Use perennial crops for longer periods on sloped or erodible land.
- Change the variables of plant families, rooting depth, seasonality, nutrient demand, cultivation requirements and incorporation method.

CHOOSING A COVER CROP FOR BETTER SOIL

There are lots of things to think about when you select a cover crop for a given field. Begin by focusing on your soil-improvement needs. Then think about crop sequencing, labor and equipment availability. Some questions to consider:

- What condition is your soil in now, and what are your soil-improvement goals?
- What are your "windows of opportunity" between frost dates and cash-crop planting and removal?
- How consistent is rainfall when you need it to induce germination and early growth, or will you have irrigation to assist you?
- What equipment options do you have to sow, kill and incorporate covers?

Last but not least, consider what your cover crops can do for subsequent cash crops. Effects include everything from providing fertility to weed suppression.

Some of these questions can be answered right away; others will be answered with time and observation. Here at the Rodale Institute, we continue to evaluate our approaches and change our rotation lineup as we accumulate knowledge, field conditions and markets change.

We'll talk more about cover crops in the Crops chapter.

Photo Credit: Resmburg, Inc.

Hairy vetch

LEGUMES IN ROTATION

Legumes are a mainstay of organic rotations because they can supply nitrogen (N) to companion or succeeding crops. Used for hay or pasture, they can supply large amounts of high-quality forage rich in plant proteins while still offering benefits as a cover crop.

About 78% of the atmosphere by volume is nitrogen, but it is unavailable to most plants directly. A group of soil-dwelling bacteria called Rhizobia attach to the roots of legumes and cause nodules to form. Within these nodules, the bacteria "fix" free nitrogen from the soil air to make proteins and other nitrogen-containing compounds. Some of the nitrogen is excreted into the soil and can be used by other plants growing nearby. More is released by decomposition of the root and plant tissues after plow down or senescence.

The amount of nitrogen fixed by a legume planting will vary depending on:

- How effectively the roots are colonized by the bacteria, either from existing soil bacteria or inoculum added to the legume seed
- How much nitrogen is already present in the soil
- The growth stage and total biomass of the legume

The nodule bacteria on the roots from air within the soil fix 50 to 80% of the total nitrogen in a mature legume; the remainder is drawn from plant-available nitrogen in the soil. In forage or hay crops, legumes grown in combination with grasses generally supply enough nitrogen for both crops.

Photo Credit: Remsburg Inc.

Crimson clover is one example of a legume crop that can benefit from use of an inoculant to help it fix nitrogen from the atmosphere.

GREEN MANURE

A green manure is a crop that is incorporated into the soil when it is green, or soon after flowering, for the purpose of improving the soil. Widely used green-manure crops in North America include winter rye and the common legumes, such as vetches, clovers and alfalfa. Rye also has the ability to tie up large amounts of nitrates.

A major benefit of green manures is the addition of organic matter to the soil. The addition of crop residues combined with the physical penetration of cover- crop roots—and their chemical interactivity with soil microbes—helps to build complex soil structure. Nutrient availability also improves, because a high percentage of the sugars a plant produces are released by the roots. These sugars feed the soil-building microorganisms, which liberate nutrients from insoluble sources, then store them for the crop that follows.

If building SOM is a primary goal, look for high-biomass-producing cover crops such as sorghum-Sudangrass, cereal rye, annual ryegrass and triticale. High- biomass legume covers include subclover, woolly-pod vetch, cowpeas and hairy vetch. Mixes of legumes and cereal crops can be used as well.

Increased plant biomass residues delivered by cover crops will improve the ability of your fields to host beneficial organisms. These include microorganisms that cannot be seen and larger earthworms and insects that can. All are hard at work improving your soil structure and nutrient availability as they make and break down organic matter.

SCAVENGE NUTRIENTS AND PREVENT EROSION

Once a cash crop has been harvested, remaining soluble nutrients, particularly nitrogen, are susceptible to leaching. Well-timed cover crops can "catch" these nutrients, store them in their tissues, then slowly release them as they decompose. With no catch crop, soluble nutrients can be leached out of the soil by rain and snowmelt.

Good nutrient scavengers include cover crops with extensive root systems and those that develop rapidly after planting:

- Winter annual grasses, such as rye, wheat, barley and triticale
- Annual ryegrass
- Fall-seeded cover crops such as oats, winter-kill, or rye, which can gather in as much as 80 pounds per acre of nitrogen
- Summer-seeded buckwheat, which sequesters phosphorus for use by the following crop and suppresses weeds
- Deep-rooted brassicas such as rapeseed, oilseed radish and mustards, which can send roots down more than 9 feet

Photo Credit: Edwin Remsberg

Buckwheat is fast-growing, warm-season cover crop that readily outcompetes weeds, offers excellent insect habitat, and help mine phosphorous for use by subsequent crops.

A short-season catch crop (millet or buckwheat, for example) may be planted in short rotation windows or if a cash crop fails.

Deep-rooted cover-crop species can help break through compacted soils and improve drainage. Soil scientist Ray Weil refers to these crops as "bio-drills" because of their remarkable ability to substitute for mechanical tillage.

Bell beans and the clovers, especially biennial sweet clover, are excellent choices to break through subsoil. Winter cover crops with

large taproots can penetrate the compacted layer when the soil is wet and relatively soft. The roots of brassica and mustard species are known to penetrate about 1 foot deeper than cereals and nearly 2 feet deeper than grain legumes.

MANAGE SOIL MOISTURE

Well-managed crop rotations that increase soil organic matter to sufficient levels help to moderate soil moisture, retain moisture in dry conditions and allow excess moisture to drain away in wet seasons.

Shifting crop types also helps vary water demand within the soil profile. Spring-seeded small grains use water in the 2-to-4-foot range and sunflower, safflower, corn and sugar beets pull water from the 5-to-6-foot range. The deeper-rooted crops following shallow-rooted crops can access moisture reserves as well as capture any nutrients that have leached below the shallower root zones before they reach groundwater. Following with a grass crop allows the field to build its moisture reserve back up.

Mulch effect: Generally, the higher the carbon-to-nitrogen ratio (C:N) of the cover crop residue, the longer the residue will serve to suppress weeds and conserve moisture. Small grain cover crops are well suited for this; most legume residues with higher nitrogen content will decompose more rapidly and be less effective as mulch.

The microbes that decompose crop residues use carbon as an energy source and nitrogen to build tissue. If residues have a C:N ratio higher than 20:1, such as mature rye, the microbes will need to gather nitrogen from the surrounding soil to do their work.

This concludes the Practices lesson. By now, you should have an understanding of tillage and cultivation practices related to organic agriculture. You should also realize the value in planting cover crops and using crop rotations.

LESSON 4: COMPOSTS

OVERVIEW

Mature, well-made compost is fundamental to organic farming. It is a stable, slow-release fertilizer that builds up soil life and will not "burn" plants. Synthetic amendments and manure can provide soluble nutrients for plant growth but do not build the soil's long-term biological reserves as well as compost does. At its best, compost can:

- Recycle nutrients
- Stabilize volatile nitrogen (composted organic matter contains nitrogen in a relatively stable form (nitrate) that is readily usable by plants)
- Improve soil structure and stability
- Add a concentrated supply of humus and plant nutrients to the soil
- Convert wastes into resources
- Increase moisture retention (one hundred pounds of dry humus can absorb as much as 195 pounds of water)
- Buffer pH (Optimal pH for compost is 6.5 to 7)
- Suppress soilborne diseases

The basic secret of making good compost is the right mix of nitrogen-rich green materials, such as green leafy crop residues, and carbon-rich brown materials, such as cornstalks or old straw bedding.

Photo Credit: Jack Sherman

Unfinished compost at Rodale Institute

Because compost is alive with microbes (bacteria and fungi), the composting process continues even after compost is applied, breaking down raw materials and reassembling them into more-stable humus.

WHAT THE STANDARDS SAY ABOUT COMPOST

NOP Standards define compost as "the product of a managed process through which microorganisms break down plant and animal materials into more available forms suitable for application to the soil." The definition continues with a precise description of how to make compost (NOP§205.203):

1. Established an initial C:N ratio of between 25:1 and 40:1; and
2. Maintained a temperature of between 131°F and 170°F for 3 days using an in-vessel or static aerated pile system; or
3. Maintained a temperature of between 131°F and 170°F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.

All feedstock materials must be approved for organic systems, as listed in§205.203 and §205.601, and free of prohibited contaminants.

Adding composts to your fields can:

- Introduce diverse and abundant populations of microorganisms
- Speed the development of soil humus
- Add slow-decomposing materials that will become humus
- Improve soil structure and soil aggregate stability

Microorganisms continually mineralize soil nutrients, making them available to crop plants in the soil. Compost provides carbon-rich food for these microbes, which secrete glue-like compounds to help bind soil particles together, improving soil structure.

! Stay tuned. Discussions of possible changes to the compost regulation are ongoing. Check with your certifier for the latest information.

RODALE INSTITUTE'S TAKE ON COMPOST

At Rodale Institute, we import and experiment with a variety of compost feedstocks. Our research indicates that it's entirely possible to build and retain fertility without the use of animal manures. But if you have livestock on your farm (or another good manure supply close to home), our advice is to use it.

Making your own compost minimizes external inputs and expenses, and offers you more control of the product. Your choice to compost on-farm livestock wastes or apply them directly to the field will depend on your availability of labor, space and equipment. Composting has added value in that it:

- Reduces the volume and weight of feedstock materials by more than half
- Kills weed seeds and pathogens
- Eliminates flies and odors
- Stabilizes nutrients

Photo Credit: Jack Sherman

Commercial compost turners can cost $250,000 or more.

GUARDING AGAINST CONTAMINATION

NOP Standards define compost strictly to guard against contamination of food crops with animal wastes that can carry dangerous bacteria such as the infamous E. coli 0157H7. NOP Standards define all manures, including those that have been stockpiled and/or mixed with plant materials, as "raw" unless they can be shown to have been composted according to NOP Standards.

A few words of warning: There are serious concerns about the consistency of ingredients, levels of foreign matter and possibility of toxins.

To minimize potential problems, try to keep your number of feedstock suppliers to a minimum. Be aware of state and local waste-handling regulations that may affect what materials you can receive and how and where you store them.

90/120-day rule

If you're growing crops for human consumption, the NOP stipulates that no manures may be applied within:

- 120 days prior to harvest for crops whose edible portion has direct contact with the soil surface (such as lettuce, carrots, or potatoes), or
- 90 days prior to harvest for crops whose edible portion does not have direct contact with the soil surface (such as sweet corn, tomatoes and peppers).

Properly made compost, on the other hand, may be applied within these time windows. In general, these restrictions will affect only vegetable growers, who commonly raise short-season crops with high nutrient demands in tight rotations. Many organic grain and dairy farmers "compost" on-farm livestock manures without having to worry about maintaining time-temperature-and- turning logs. In practice, most certified organic farmers either abide by the 90/120-day rule or use thermometers that automatically record time and temperature data within their compost piles.

BUYING QUALITY COMPOSTS

If you can find a reputable compost producer reasonably nearby, the quickest way to get organic compost is to buy it.

Photo Credit: Rodale Institute

Some commercial composters, such as Vermont Natural Ag Products (makers of Moo Grow, above), sell compost products by the bagful or the truckload. Some farmers augment their income by selling their excess compost.

Before you place an order, be sure you know what you're getting. Ask for references, test results and other information. The main quality criteria for commercial compost, assuming there are no toxins present, include:

- Compost maturity (immature compost can be harmful to plant growth because it can rob nutrients to finish composting, but overmature compost may lack microbial activity)
- Feedstock sources
- Percentage of nitrogen (0.5 to 4% is a good range)
- Particle size
- Salt content (lower salt content indicates greater maturity)
- Organic matter content (20 to 30% dry weight is optimum)
- Presence of weed seeds
- pH-buffering capacity

MAKING YOUR OWN COMPOST

It's easier than you think. Don't shy away from the challenges of making your own compost.

Many people have succeeded and now include compost sales as an important income stream in their total farm economic picture.

Site location for your compost operation will be critical to your success and may involve local and/or state approval. Avoid areas near surface water, such as streams, lakes, ponds and rivers, and your own well. Use of biofilters such as sod fields will go a long way toward avoiding potential pollution problems.

Photo Credit: Jack Sherman

Here at the Rodale Institute, we use most of the compost we make right here on our farm.

The three key mixing factors that set the stage for good composting are:

- A carbon-to-nitrogen ratio of somewhere between 25:1 and 50:1
- Adequate pore space for air to promote beneficial aerobic microorganism
- The right moisture content—around 50 to 60%

As you construct your piles, use the right combinations of high-carbon materials (such as straw, leaves and crop residues) and nitrogen rich materials (such as manures or green plant material) to ensure targeted carbon-to-nitrogen ratio and pore space structure.

Give the compost the squeeze test to check the moisture. If the material releases a few drops when squeezed, moisture is probably in the right range. If water drips out liberally, the compost is too wet, in which case you may want to cover your pile with a tarp or blanket to prevent more water from getting into the pile. If the material falls apart in your hand, it's too dry, indicating that you should wet the pile to improve the speed and quality of the composting process.

TURNING COMPOST

You will need to turn the compost three or four times a month for the first two to three months. After that, your turning regime will depend on your labor availability and how fast you need to produce compost. Here at our farm, we sometimes let the piles sit for six months, which slows the compost-making process but saves on labor. The more compost is turned, the faster it matures.

As with tillage, turning exposes microorganisms and organic materials to oxygen and accelerates their biological breakdown. It also promotes the escape of airborne ammonia, which not only reduces the nitrogen level of the pile but contributes to acid rain and greenhouse-gas production.

A less common, but allowable, option for compost aeration is to force air into a static (unturned) pile via pipes. Using hollow-stemmed, oxygen-containing grasses such as reed canary grass as a compost feedstock also introduces a source of air into the pile without turning it.

HEATING AND CURING

In the first stage of compost making (the thermophilic stage), heat-loving microbes (mostly bacteria) bloom, organic matter is degraded and particle size is reduced. Pathogens are destroyed above 131°F, and most weed seeds are destroyed at temperatures above 145°F. Even though 170°F is the top of the NOP Standards' temperature range, compost temperatures above 155°F are generally undesirable because they can kill the beneficial microbes so important to bioactive composts and healthy soils. Composts that have reached these temperatures are often black in color.

The curing stage is the post-thermal stage of the composting process, when most of the available carbon has been consumed. This is the growth stage for fungi and actinomycetes, two important members of the compost microbial roster.

Attaining proper compost maturity is critical to compost performance as a soil amendment, because immature composts can increase salt levels in the soil, may not provide adequate nutrients, can rob nutrients in order to finish breaking down and could even burn the crop (mostly a concern with vegetables). Mature composts have converted much of the raw organic matter to stable humic substances. At maturity, compost does not generate a microbial bloom with accompanying heat, and it contains low levels of ammonium and salts.

COMPONENTS OF COMPOST QUALITY

In mature high-quality compost:

- Parent feedstock material should not be recognizable
- Structure includes medium- and fine-size particles and humus crumbs
- Moisture content should be 40 to 50%, dry enough that the compost doesn't ball up in your fist
- Smell should be earthy, like humus or forest soil (this is the actinomycete microbe population); no ammonia, sour, putrid or manure odors, which are byproducts of anaerobic microorganisms
- Temperature should be near that of the air temperature; the material shouldn't steam unless the ambient temperature is below freezing

If quick-germinating seeds like cress, radish or wheat sown in a sample grow well, the compost is mature and likely of good quality. You can also buy on-farm test kits and laboratory analysis services for compost.

The carbon-to-nitrogen (C:N) ratio plays a crucial role in the availability of nitrogen from any organic material added to the soil. The higher the C:N ratio, the more the balance favors carbon, and the slower the release of the nitrogen will be.

According to the NOP, the initial C:N ratio of a newly mixed compost pile should be between 25:1 and 40:1. Finished compost C:N ratios generally range from 14:1 to 22:1, depending on the feedstocks.

If the C:N ratio is much above 30:1, then the microorganisms that use the carbon in the material as an energy source will also immobilize the nitrogen. The nitrogen will remain in the soil, unavailable for use by plants until later.

FINISHED COMPOST

Finished compost is a dilute organic fertilizer with analyses in the range of 1-1-1 to 2-1-2 (nitrogen-phosphorus-potassium (N-P-K)). Values will vary according to the types of materials used and how they were composted.

Like soil, compost can be lab-tested for major and minor elements (phosphorous, potassium, calcium, magnesium, zinc, boron, iron, manganese, and copper), water content, pH, organic matter, total nitrogen, nitrate, ammonium, C:N, soluble salts, and extractable heavy metals. This information can be used to determine how much compost to apply for maximum plant growth and minimum nutrient loss.

Some labs can also analyze the microbial makeup of your compost, but the value of such testing is more difficult to assess. To evaluate compost's effect on soil fertility, test soils several months after application (but not during the winter or under drought conditions).

The pH of finished compost tends to be slightly alkaline. Compost usually does not raise field soil pH to undesirable levels, because the total amount of compost applied is small relative to the amount of soil in the field. In greenhouse applications, where the amount of compost as a percentage of the growing medium is much higher, you'll need to monitor the compost's pH

GLOSSARY TERMS

Actinomycete: One of a class of bacteria largely responsible for the decomposition of organic matter in soil, and thus for the production of humus and replenishment of soil nutrients.

more closely. The alkalinity of the media can be neutralized if necessary with an NOP-approved sulfur or acidifying compound.

MANURES IN COMPOST

Manures can be especially useful after crops that leave little plant residue, such as silage corn. You can realize the full benefits of the manure by coordinating its use with cover crops, liming and other soil management practices.

The nutrient value of manures is influenced by what the livestock are fed. In general, about 75% of the nitrogen, 80% of the phosphorus, 90% of the potassium and 50% of the organic matter in livestock feed are recovered in the "end product." After losses to volatilization and leaching, only about a third to half of these values is realized in crop production.

Even "solid" manure is 50 to 80% water, so an application of 10 tons per acre provides 2 to 5 tons of organic matter. Liquid manure, produced in many confinement operations, will lose nitrogen rapidly through volatilization if it is not incorporated into the soil.

Combining liquid manure with high-carbon organic matter and composting will vastly improve its benefits for your fields.

RESEARCH

Research by the Rodale Institute found that raw manure, synthetic fertilizer and broiler litter/leaf compost lost 100, 75 and 32 pounds of nitrate, respectively, during a 9-year trial. Each material was applied to optimize vegetable crop yield within a rotation including corn and wheat, and each produced statistically equivalent yields over the 11-year trial. However, compost did more to increase soil carbon levels than the manure or chemical fertilizer, suggesting that it has greater positive impact on soil stability, tilth and fertility with long-term use.

GUARDING AGAINST NUTRIENT LOSSES

Organic manure poses as much of a risk of nutrient loss as non-organic manure. Nutrients from any source can become pollutants when they move below the root zone, beyond the reach of plants. Slurry (semisolid) and liquid manure contain highly available nutrients, which increase the need for careful handling and application.

Photo Credit: Jack Sherman

Nutrient runoff can be a problem on organic farms, too. Well-made compost is much less susceptible to this problem than straight manure.

In order to prevent leaching and runoff of manure nutrients:

- The receiving crop should be a heavy feeder able to use all the available nutrients.
- The crop should be already present, or planted shortly after application, to ensure maximum uptake of the nutrients.
- The soil should be capable of absorbing and storing those nutrients not used by the production crop.
- Never apply manure when conditions will allow runoff to waterways, such as on frozen soils.
- Other soil amendments permitted in organic systems

§205.203(d) of the NOP Standards provides for a fourth category of soil amendment, other than composts, manures and uncomposted plant materials. Producers may apply:

- A crop nutrient or soil amendment included on the National List of synthetic substances allowed for use in organic crop production;
- A mined substance of low solubility;
- A mined substance of high solubility ... provided that the substance is used in compliance with the conditions established on the National List of nonsynthetic materials prohibited for crop production;
- Ash obtained from the burning of a plant or animal material … provided, that the material burned has not been treated or combined with a prohibited substance;
- A plant or animal material that has been chemically altered by a manufacturing process ... provided that the material is included on the National List of synthetic substances allowed for use in organic crop production.

Allowable fertility products can provide supplemental nitrogen (from bloodmeal, cottonseed meal, fish byproducts, feathermeal and processed livestock manure); phosphorus (from soft rock phosphate or bone meal); potassium (from sulfate of potash or greensand); and calcium (from oystershell lime or mined limestone in low-pH soils and from gypsum in balanced or high-pH soils).

PROHIBITED PRACTICES AND AMENDMENTS IN ORGANIC SYSTEMS

§205.203(d) of the NOP Standards prohibits burning as a disposal strategy for crop residues produced on the farm except "to suppress the spread of disease or to stimulate seed germination."

In addition, organic producers may not use any fertilizer or composted plant or animal material that contains a synthetic substance not included on the National List of those allowed for use in organic crop production. Sewage sludge (commonly called biosolids) also may not be used.

As mentioned in the "Why organic?" chapter, the NOP Standards include a set of guidelines governing materials for use in certified organic systems. In general, natural materials are considered "innocent until proven guilty," while synthetic materials are considered "guilty until proven innocent." The National List of Allowed and Prohibited Substances is a list of exceptions to that rule: allowed synthetic substances and prohibited natural substances

Photo Credit: Miracle Gro

Just because a soil amendment uses the word "organic" in the label, don't assume it's approved for organic production. The word is not regulated for agronomic products in the same manner that it is for crops, livestock feed and human food. Always check with your certifier.

BUYER BEWARE

Just because a soil amendment label says "organic" doesn't necessarily mean it meets NOP Standards. Soil amendments cannot be "certified organic," because they don't fall under the NOP Standards. Some materials may be labeled "organic" based on the fact that they contain carbon.

Even if a soil amendment says "meets NOP Standards" or bears the Organic Materials Review Institute (OMRI) logo, you should still check with your certifier before you use it. It's your responsibility to make sure everything you bring onto your organic farm meets NOP Standards and your certifier's approval.

Review package ingredients against the National List, consult OMRI and check with your

certifier before using any new product. Failure to do so could cost you three years' certification. And remember, any equipment used to apply organic amendments that might also be used to apply prohibited substances to non-organic fields must be thoroughly cleaned to prevent contamination.

This caution holds true for purchased compost and livestock feed mixes as well. If a product claim sounds too good to be true, it probably is.

OMRI

The Organic Materials Review Institute OMRI is a nonprofit technical- assessment entity specializing in the review of substances for use in organic production, processing and handling. OMRI tests items submitted to it by manufacturers, then lists those that comply and may bear the OMRI label. However, final determination of product use rests with individual certifiers, in compliance with the NOP.

CONCLUSION

This concludes the Soils chapter. You should now be able to identify healthy soil when you see it—and touch it and smell it—and have a basic idea of the various types of soil tests and how you can make use of them as you move forward. You now have the basic tools to begin feeding—and building—your soil, so your soil can feed your crop plants.

Remember, building a healthy organic system isn't about expensive packaged inputs; it's about encouraging a diverse web of life both above and below the ground. Your soil is much more than a medium that holds up your plants; healthy soil actually breathes, delivers nutrients to plants more efficiently, comes to the aid of your crop in time of stress such as drought, and is less susceptible to the erosive power of wind and moving water.

In this chapter, we discussed crop rotation and cover crops as they relate to building healthy soil. In the next chapter, Crops, we will cover these topics in more detail and learn how cover crops can not only help protect your soil and build fertility, but can help break pest and disease cycles, suppress weeds and more.

It's time to update your Organic System Plan. Then, go out and take a walk around your farm, let what we've covered so far sink in a little bit, and I'll meet you back here when you're ready to continue.

RESOURCES

Resources are free online unless otherwise noted.

SOIL HEALTH

Organic and Conventional Beyond Transition
Steve Peters
(The Rodale Institute, 1991)

Edaphos : Dynamics of a Natural Soil System
Paul Sachs
(Edaphic Press, 1999)
197 pp. $15.00+

ATTRA soils page

Cornell Soil Health website

Soil Food Web

Alternative Soil Testing Laboratories
Steve Diver
(ATTRA, 2002)
24 pp

SOIL MANAGEMENT

Building Soils for Better Crops
Fred Magdoff and Harold van Es
(SAN, 2000)
241 pp.

Soil Management: National Organic Program Regulations
B. Bellows
(ATTRA, 2005).
20 pp.

Effect of tillage and intensity on nitrogen dynamics and productivity in legume based grain systems
Laurie Drinkwater, et al
Plant and Soil 227(2):99-113.

Pursuing Conservation Tillage Systems for Organic Crop Production
George Kuepper
(ATTRA, 2001).
28 pp.

COMPOSTING

Biodynamic Farming and Compost Preparations
(ATTRA, 1999)
20 pp.

Woods End Research Laboratory, Inc.
Compost analysis pioneers and specialists.

CHAPTER 3

CROPS

TABLEOFCONTENTS

Photo Credit: Jack Sherman

CHAPTER 3

CROPS

INTRODUCTION

In the first two chapters of this course, we've talked about the basic principles of organic farming and how the USDA's National Organic Program (NOP) certification system works. We've covered some fundamentals of soil science and emphasized how, in organic agriculture, the focus is on building and caring for the soil. If your soil is in good shape, chances are your crops and livestock—and your bottom line—will be, too.

In this chapter, we'll dig into the details of organic crop management: planning crop rotations and working with cover crops; sourcing seeds and other planting materials in accordance with organic regulations; and developing effective weed and pest management strategies. We'll also talk briefly about harvesting and certification of wild crops, known as wildcrafting.

LESSON 1: ROTATIONS

OVERVIEW

In real estate, experts say, there are three key factors: location, location, location. Likewise, there are three key factors in sustainable farming: rotation, rotation, rotation. Rotate your crops, rotate your cover crops and rotate your tillage. Sounds simple enough, but in practice it takes thought, planning, observation, and flexibility.

Crop rotations and cover crops are part of the answer to nearly every farm management issue discussed in this course. Many organic farmers say they've included more cover crops in their rotations as they've gained experience and realized new things the cover crops could do. A good crop rotation keeps the soil covered with vegetation for as much of the year as possible. Protecting the entire soil surface with growing crops is a big first step in soil improvement.

Effective crop rotations can supply fertility, improve soil quality, help manage weeds, and help reduce pests and diseases. They can also help you balance your workload and spread risk.

Research has established that crops grown in rotation outperform monoculture, for example (Berzsenyi et al., 2000); Mourtzinis et al. (2017); and Pimentel et al. (2005). While scientists have not yet figured out all the reasons why crops grown in rotation perform better, several reasons have been established, including increased soil organic matter, enhanced soil aggregate stability, and other soil quality parameters—all leading to increased nutrient and water use efficiency.

GLOSSARY TERMS

Crop rotation: The practice of alternating the annual crops grown on a specific field in a planned pattern or sequence in successive crop years so that crops of the same species or family are not grown repeatedly without interruption on the same field. Perennial cropping systems employ means such as alley cropping, intercropping, and hedgerows to introduce biological diversity in lieu of crop rotation. *(NOP definition)*

Organic matter: The remains, residues, or waste products of any organism. *(NOP definition)*

Crop rotations also enables crops to fill as many different ecological niches as possible, so your crops and cover crops complement one another.

Researchers are also studying how diverse cropping systems foster a greater number of other kinds of organisms, from soil microorganisms to beneficial insects to birds and bats. This complex variety of organisms is called biodiversity. Understanding how they interact will take further investigation. But in the end, what matters most about rotations is that they work.

WHAT THE STANDARDS SAY ABOUT ROTATIONS

The NOP definition of crop rotation highlights the basic principle of crop rotations, which is to alternate different types of crops within a single field over time. Rotations can include alternating:

- Crops from different plant family groups
- Annual crops with perennial crops
- Row crops, drilled crops, and sod-forming crops
- Cool-season crops with warm-season crops
- Heavy feeders, medium feeders, and light feeders
- Deep-rooted crops with shallow-rooted crops

Section 205.205 of the Standards sets requirements for the producer to implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops. The crop rotation must provide functions that are applicable to the operation. These functions include maintaining or improving soil organic matter content, providing for pest management in annual and perennial crops, managing deficient or excess plant nutrients, and providing erosion control.

Note that §205.205 applies to all kinds of organic crops: managers of orchards, vineyards or other perennial crops must use "alley cropping, intercropping, and hedgerows to introduce biological diversity in lieu of crop rotations" (§205.2, "Crop rotation").

GOALS OF A SUCCESSFUL CROP ROTATION

Adequate cash flow and overall farm profitability. Spread your major cash crops over your rotations to ensure cash flow at different times of the year from different crops. Consider the value of crops with multiple marketing outcomes such as alfalfa which can be sold as hay, fed as haylage, or harvested for seed.

Sustainable on-farm fertility from a crop sequence that balances soil-improving crops (perennial forages, annual green manures) with soil-depleting crops (most cash crops). Successful rotations can improve fertility over time.

Cover crops that provide multiple benefits. Scheduling cover crops into the rotation wherever possible can protect the soil from erosion, supplement nitrogen fixation with legumes, build organic matter, smother weeds, suppress soil pests and diseases, and manage nutrients.

Sustainable pest management. Crops sequenced in a diverse rotation that helps break the cycles of insect pests, diseases, and weeds.

Crop rotation based on available resources. Crop rotations vary widely according to region and farm type. You need to develop a rotation based on available resources, including soil, equipment, labor, market opportunities, and storage capacity. Good organic crop rotations include both cash crops and cover crops. If you've got plenty of land, you can include long periods of hay or pasture to break weed cycles and build fertility. If you're pressed for space, you may need to rely more heavily on composts or other soil amendments to supply fertility.

Generally speaking, your certifier will expect to see a rotation sequence of three to five crops suitable to your part of the country. You will need to outline your basic rotation sequence (or sequences) when you fill out your Organic System Plan. The best cropping plans are flexible so you can respond to changing conditions. The plans can be different for various fields.

PLANNING CROP ROTATIONS

Rotations require you to think in several dimensions at once. This can be tricky at first. You need to integrate field-level decisions with farm-level decisions, short-term needs with long-term objectives, soil capacity with economic outcomes. Key characteristics of successful crop rotations are flexibility and farm-by-farm application.

Photo Credit: Rodale Institute

Winter rye no-tilled (at 2.5 bushels per acre) after corn harvested for grain (yield about 120 bushels per acre), shown in April. The rye planting yielded about 1,500 pounds of dry matter per acre as a cover crop.

These tips will help you as you plan your crop rotations.

- Talk to experienced organic farmers in your area to find out what works and what doesn't.
- Consider various candidates for winter cover crops. Winter cereals such as rye, wheat, and barley are excellent candidates. Oats, soybeans, and peas work well for vegetable rotations.
- Consider fertility, pH, drainage, moisture, and temperature requirements before selecting cover crops.
- Pay attention to disease potentials associated with unrelated crops in sequence. For instance, avoid following legumes with legumes to reduce disease problems.

WORKING OUT THE ECONOMICS

Concerned about how a shift to organic rotations will affect your cash flow? Good. The agronomics of rotations work out after a while, but you have to keep the economics front and center from the get-go.

Remember that it's the overall economics of the whole rotation that count, not the revenue of any one component alone. Whereas conventional farm subsidy programs and broad-spectrum herbicides reward an ever-decreasing number of crops on a farm, organic farming works best with a wide repertoire of crops. You need to use care in selecting crops that will grow well and yield a high-quality product that you'll be able sell at a profit.

Fortunately, organic markets have tended to reward diversity, making it possible in most parts of the country to plan healthy, long-term crop rotations that improve soil, avoid serious pest problems and offer better financial returns per acre. Good crop rotations let you go into the marketplace with more than one income option, spreading risk as weather and markets fluctuate. As you expand your inventory of crops, you'll probably need to identify new markets as well. We'll discuss marketing issues at greater length in the Marketing chapter.

CHECK YOUR NUMBERS

Use the Crop Conversion Calculator to project what your returns might look like using different cropping sequences. You can obtain current prices from commodity boards, and prevailing organic prices from our Organic Price Report (OPR).

COVER CROPS: ESSENTIAL LINKS IN ORGANIC ROTATIONS

No matter how carefully you sequence your cash crops, there will always be opportunities to supply more fertility, more crop residue, more weed suppression or some other biological boost. That's where cover crops come in. These are crops grown primarily for their benefit to other crops or to the soil, instead of for direct use or sale.

When choosing a cover crop, first consider your needs—to add nitrogen or organic matter, cover bare soil, suppress weeds, etc.—and then compare the windows in your rotation to the planting requirements of the different species suited to your area. Experienced cover-crop farmers use combinations of grasses, legumes, and even brassicas to achieve multiple cropping system objectives.

TAKING COVER

A cover crop can act as a ...

Smother crop or living mulch to suppress or outcompete weeds. Sorghum-Sudangrass, buckwheat, soybeans and cowpeas are all used in this manner.

Nurse crop for other, slower-growing crops. Oats are frequently used as a nurse crop for alfalfa or clover.

Mulch crop to help control weeds, shelter beneficial insects and reduce the spread of splashborne disease. Standing cover crops can be converted to mulch by mowing, chopping or rolling.

Biofumigant crop to rid soils of pathogens. Broccoli and other brassicas have been shown to inhibit root diseases, problem nematodes and even weed germination.

Like the rotations they're a part of, these mixtures can function synergistically, providing more benefits than the individual species grown alone. The most common mixtures include a legume and a cereal grain, such as cereal rye and hairy vetch. The cereal germinates and grows readily through the fall and into the winter, protecting the soil and capturing any nitrogen that might remain at the end of the season. Legumes such as hairy vetch, crimson clover, and Austrian winter peas establish more slowly, putting on most of their growth in the spring. With proper biological inoculation, legumes can fix 70 to 200 pounds of nitrogen per acre, much of it available to crops in the following growing season. Take your time, experiment with different species and see what works best on your farm.

For tables outlining some basic characteristics of frequently used legume, grass-family and other cover crops, click here.

ORGANIC VEGETABLE CROP ROTATIONS

On highly diversified vegetable farms—such as community-supported agriculture (CSA) farms, which often grow as many as 45 or 50 different crops—field plans become so complicated that they are best managed in blocks or groups. Since closely related crops often have similar pest and disease problems, most farmers use vegetable plant family groups as the primary basis of their rotations. As with agronomic crops, other factors to consider include nutrient requirements (heavy feeders vs. moderate feeders), belowground characteristics (shallow-, medium- and deep-rooted crops), and growth season (warm-season vs. cool-season crops).

Photo Credit: Jack Sherman

Picture of field borders

Anne and Eric Nordell of Pennsylvania developed a rotation that captures many benefits on the market farm by balancing crop types, seasonality and over-wintering traits. Each field rotates between a cash crop and cover crops every other year. The cash crops alternate between early and late, while the cover crops rotate between winterkill and winter-hardy. Winterkill cover crops, like oats and peas, precede early cash crops, while overwintering cover crops, such as rye and vetch, precede late cash crops. Click here for details.

A further consideration in crop placement is the need to maintain borders or "buffer" zones between certified fields and adjoining fields where non-organic practices might be used. These areas need to protect your crops against contamination from prohibited substances such as drifting pesticides or wind-borne or insect-borne pollen from genetically modified crops. We'll talk about buffer zone requirements at more length in the Certification chapter.

DISTURBING SOIL—CAREFULLY—CAN BE OKAY

Some people suggest that one pass with a plow destroys the soil's ability to build and retain organic matter. This is not our experience. In our Farming Systems Trial, nearly three decades of organic management with standard tillage have resulted in gains in soil organic matter levels 70% greater than those reported for no-till agriculture as typically practiced.

In ecological terms, farming is a "disturbance" of the landscape, a knocking back of the flora and fauna to an earlier state in its long development toward a stable biological community.

Many ecologists believe that occasional disturbance, such as a wildfire that spurs new growth, is a healthy feature of complex biological communities. Our challenge as farmers is to manage disturbance well so that our farms function as stable, productive agricultural systems.

SOIL FERTILITY THROUGH THE TRANSITION

In a balanced organic farming system, local conditions will determine how best to improve soil fertility and health. Fertility on an organic farm comes from several parts of the cropping system, including rotation, cover crops, manure, and compost.

It's a good idea to have your soil tested when you first start your transition to organic and again at least every two to three years. The test gives you chemical analysis, which is just one tool in determining the health of the soil. Check crop

growth, and perhaps do tissue tests as well, and consult with local experts.

Photo Credit: FarmHack

A no-till roller crimper rolling down cover crop

RESEARCH

Rodale Institute no-till roller-crimper allows farmers to combine the benefits of no-till (saving fuel, time and soil) with the benefits of using a winter cover crop. On fields where weed pressure is under control, the system allows for organic no-till where the rolled cover crop can provide mulch that suppresses weeds and holds moisture. A legume cover crop will also provide nitrogen.

Read more: No-till +

NITROGEN NEEDS

Many farmers considering a shift to organic ask how they can supply enough nitrogen (N) to achieve the kinds of yields they are used to.

It's not that difficult to get all the fertility you need from some combination of cover crops (often termed green manures), manures, compost, and other types of organic soil amendments. In fact, experienced organic farmers tend to focus as much on using cover crops to store excess fertility at the end of the growing season as they do on using cover crops to supply fertility during the growing season.

At Rodale Institute, we use hairy vetch as a cover prior to corn, and rye prior to soybeans. Every five years, we provide about 10 tons of compost to our small grain. Finally, hay does wonders for conserving and even increasing soil fertility.

Legumes vary in the amounts of dry matter and N they contain. A higher percentage of biologically fixed N will accumulate in their top growth than in their roots. That's why it's important to let legumes grow long enough to produce their full potential in biomass. Make sure you get them knocked down before they set seed, however, to prevent your covers from becoming weeds in future seasons. We've found that waiting for full flower stage but before soft seed development is best for producing maximum amounts of nitrogen and building soil organic matter.

Hairy vetch, alfalfa and Austrian winter peas contain 3 to 4% N by dry weight and can contribute up to 200 pounds per acre of N; most other legumes are 2 to 3% nitrogen; cereals and ryegrass possess 1.2 to 2.4% nitrogen. Unlike synthetic fertilizers, which are prone to leaching, the N that's not immediately used by plants can remain available and even contribute to building the soil.

REGIONAL ORGANIC CROP ROTATIONS

Here are some examples of good crop rotations in use by organic farmers in different parts of the country. Remember, every farm's rotation needs are different; these are just ideas for you to consider.

Dryland grains, Washington

See The Wilke Project – An Analysis of Alternative Crop Rotations in the Intermediate Rainfall Area of Eastern Washington

Dryland wheat, Great Plains

On the Great Plains, where soil moisture is a limiting factor, organic farmers have had success replacing the conventional wheat-fallow rotation with wheat-corn-millet-fallow or wheat-corn-sunflower-fallow, achieving better wheat yields

and improved soil organic matter levels.

Fourth-generation farmer Bob Quinn, who converted his 2,400-acre Montana spread to organic in 1989, runs a 4- to 5-year rotation beginning with hard red winter wheat and followed by red lentils, Kamut, or durum wheat in year two. Year three is buckwheat, soft wheat, or barley, undersown with alfalfa. If the alfalfa overwinters, it can be cut for hay for a year before returning to winter wheat in year five. If it winterkills, the field can be used for peas before returning to winter wheat in year four.

Rice-grains, California inland

California's diverse environments have spawned a vareity of organic rotations. This one works well for Ed Sills on good soils in northern California's Sacramento Valley.

- Year 1: rice
- Year 2: dry beans
- Year 3: wheat, followed by hairy vetch cover
- Year 4: corn or popcorn

Litter from free-range turkey farms is available to boost fertility for the rice or corn crops once within the 4-year cycle. Cover crops and crop rotation improve soil fertility and condition, and help to suppress weeds in the rice to a degree comparable to that of conventional systems using herbicides. Rice straw is incorporated into the biologically active soil. A fallow season, and plantings of vetch with a nurse crop of oats, can extend the rotation to nine years in different combinations.

For a 7-year rotation, some farmers in the area use corn, soybeans, wheat, oats, red clover, hay, and adzuki beans.

Intensive vegetables, California coast

Frequent cover cropping creates healthy soils for improved water management and vigorous vegetable crops.

- Year 1: fall-plant perennial rye
- Year 2: mow/plowdown rye; fall-plant onions/garlic on beds
- Year 3: harvest onions/garlic; plant/incorporate summer cover (includes annual buckwheat, sorghum-Sudangrass, and vetch); plant winter cover (includes vetch, bell beans, oats, and peas)
- Year 4: incorporate cover; plant brassicas/greens/carrots; fall-plant winter cover
- Year 5: incorporate cover; plant/harvest potatoes; fall-plant winter cover
- Year 6: incorporate cover; plant/harvest sweet corn or bush beans; fall-plant winter cover
- Year 7: incorporate cover; plant/harvest squash/pumpkins; fall-plant winter cover
- Year 8: incorporate cover; plant miscellaneous crops (includes cucumbers, summer squash, peppers, eggplant, brassicas, basil and other herbs, flowers); fall-plant winter cover

A mechanical spader is usually used in the spring to incorporate winter cover crops. Strawberries and dry-farmed tomatoes can be fit into this rotation as conditions allow.

Mixed crops-livestock, Midwest

Many organic grain farmers in the Midwest also keep livestock, and virtually all organic livestock producers also raise at least some of their own grain. Having crops and livestock together on the same farm adds flexibility to your system and makes it possible to use longer rotations while still bringing in a good income.

A common organic rotation on fertile Midwestern soils looks something like this:

- Year 1: corn
- Year 2: soybeans
- Year 3: corn
- Year 4: oats, underseeded with mixed
- grass-legume hay
- Years 5, 6, 7: mixed grass-legume hay

This system draws residual N from the hay legume and supplemental N from the soybeans while rotating tillage and using perennial plantings to good advantage.

Cotton-hay, New Mexico

See Converted to Organic Cotton, for Health and Profit

Potatoes-hay-covers, Maine

A four-year rotation on a commercial seed potato farm in the short-seasoned Northeast needs to provide fertility and optimal soil conditions for healthy crops.

- Year 1: seed potatoes
- Year 2: spring wheat or oats underplanted with clover and timothy grass
- Year 3: clover sod (cut once for hay, then rotationally grazed through fall, and again in early spring)
- Year 4: plow down clover sod, plant/plow down buckwheat (as a weed suppressant), plant/plow down rapeseed (as a biofumigant)

This rotation uses about one-quarter of the rotated land for the primary cash crop each year, while the remainder contributes to the farm's needs for fertility, soil health, soil tilth, pest suppression (weeds, insects and diseases), and providing habitat and alternate food sources for beneficial insects. The rotation is primarily focused on producing disease-free organic seed potatoes.

Mixed grain-vegetable rotation, Northeast

Here's another example from the Northeast, which includes vegetables as well as agronomic crops:

- Year 1: field corn
- Year 2: soybeans or red kidney beans
- Year 3: spring small grain (oats or barley), underseeded with medium red clover
- Year 4: winter grain (wheat, spelt, triticale, rye, or barley), underseeded with medium red clover
- Year 5: field corn or processing vegetables

In this rotation, the red clover supplies nitrogen for the corn, the small grain straw and red clover add plenty of organic matter, and the alternation between row and sod crops allows for good weed and pest management. In addition, the inclusion of winter small grains helps spread the workload across the year. The rotation is diverse in its ability to provide financial stability, minimizes exposure to pest problems and should improve the health of the soil.

Crop-livestock rotations, Southeast

Farmers in the humid South are experimenting with more intensive organic rotations. This rotation was developed in Virginia:

- Year 1: corn, with winter wheat no-till drilled into the corn stubble
- Year 2: winter wheat grazed by livestock; foxtail millet no-till seeded into the grazed wheat, then grazed or cut for hay; alfalfa no-till drilled in the fall
- Year 3: alfalfa grazed or cut for hay
- Year 4: alfalfa grazed or cut for hay, followed by more intensive grazing in the fall and winter to weaken the alfalfa in preparation for planting corn in the spring

A variation on this sequence is to till the alfalfa under in the fall and seed a cover crop of winter rye and vetch in order to get better weed control in the corn the following year.

A team of researchers in Florida, Georgia and Alabama has demonstrated that standard cotton and peanut rotations can be improved by including bahia grass pasture grazed with beef cattle. The bahia grass is hayed in the first year and rotationally grazed in the second. The grass adds organic matter and helps break up hardpan clay layers. Cotton is planted in the third year and peanuts in the fourth, before returning to bahia grass in the fifth. The cotton and peanuts typically yield 50 to 150% more than standard, non- rotated cotton and peanut yields for the region.

Revenue from the beef cattle in this rotation more than compensates for the reduced cash-crop acreage over the four-year span. This allows good income without greatly expanding farmed areas.

VEGETABLE ROTATIONS SHOULD BE

Planned according to botanical family groupings:

- Nightshade family (Solanaceae): Tomatoes, peppers, eggplant, potatoes
- Cabbage or mustard family (Brassicaceae): Broccoli, cabbage, cauliflower, kale, collards, radishes, Brussels sprouts, arugula

- Beet-spinach family (Chenopodiaceae): Beets, chard, spinach
- Pea family (Fabaceae, also known as Leguminosae): Beans, peas
- Carrot family (Umbelliferae): Carrots, parsnips, celery, parsley
- Squash family (Cucurbitaceae): Cucumbers, winter squash, summer squash, melons, pumpkins
- Composite family (Compositae): Lettuces

...while also considering growing season:

- Warm-season: Cucumbers, eggplant, melons, peppers, pumpkins, snap beans, squash, sweet corn, sweet potatoes, tomatoes
- Cool-season: Asparagus, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, celery, lettuce, onions, parsley, peas, potatoes, spinach

...rooting depth:

- Shallow (18-24 in.): Broccoli, Brussels sprouts, cabbage, cauliflower, celery, Chinese cabbage, corn, endive, garlic, leeks, lettuce, onions, parsley, potatoes, radishes, spinach
- Moderately deep (36-48 in.): Bush beans, pole beans, beets, carrots, chard, cucumbers, eggplant, muskmelons, mustard, peas, peppers, rutabagas, summer squash, turnips
- Deep (>48 in.): Artichokes, asparagus, lima beans, parsnips, pumpkins, winter squash, sweet potatoes, tomatoes, watermelons

...and nutrient demand:

- Heavy feeders: Corn, tomatoes, cabbage family crops
- Light feeders: Root crops, bulbs, herbs

Sample strategy: follow a high-nutrient-demanding, shallow-rooted vegetable crop such as lettuce or spinach with a deeper-rooted crop or cover crop that can utilize the available nutrients left in the soil.

Rotating a perennial sod crop (such as alfalfa) with small grains and corn varies seasonal periods, rooting depth, nutrient cycling and biomass contribution—all elements of a successful rotation to suppress weeds in the mini-pumpkin strip in this mixture (young plants, center).

A ROTATION MIX

This relatively simple vegetable crop rotation mixes families, seasons, root types and nutrient needs:

- Year 1: Sweet corn, followed by a fall-seeded winter rye/hairy vetch cover crop
- Year 2: Pumpkins or winter squash, followed by a fall cover crop of rye or oats
- Year 3: Tomatoes, peppers, or potatoes, followed by a fall rye/vetch cover crop
- Year 4: Mixed vegetables such as brassicas, green beans, carrots, or onions, followed by a fall rye cover crop
- Year 5: Spring-planted oats or summer buckwheat followed by fall-seeded rye/vetch; or, if enough land is available, one to three years of clover or alfalfa

Since most vegetable crops are broad-leaved species (dicotyledons), the use of grass-family (monocotyledon) covers is a good way to break pest cycles. For the most part, pests and diseases of the monocots don't much bother dicots, and vice versa.

Photo Credit: Edwin Remsberg

Buckwheat (top), a summer annual, and hairy vetch (bottom), a winter legume, each have particular uses in rotations.

COVER-CROP DECISIONS

Several factors will influence your cover-crop choices. These factors include climate, soil moisture, field layouts, equipment, labor resources, and the amount of land you have available relative to your production targets.

Determine your primary constraint and use that as a baseline. For instance, cultivation capacity is a major constraint for many farmers. You can determine your cultivation capacity by calculating how many acres a day for a given crop you can cultivate using your existing equipment. Next, compare that number of acres to the length of time and climate conditions for your region to determine your cultivation capacity.

Cover crops can also be classified as either winter (or cool-season) covers and summer (or warm-season) covers. Species sown in fall to serve as winter annual covers include vetches; fava and bell beans; peas; small grains such as oats, barley, wheat, and rye; grasses such as annual and perennial rye grass; and brassicas such as forage radish, oilseed radish, rapeseed, and canola.

Summer annual legumes include lablab bean, cowpeas, crotalaria (sunn hemp), hemp sesbania, and forage soybeans. Warm-season non-legumes include varieties of millet, buckwheat, and sorghum-Sudangrass.

Other more region- or application-specific cover crops include bur clover, lespedeza, lupines, soybeans, velvet beans, ladino clover, sour clover, and field peas.

For a cover crop choices chart, click here.

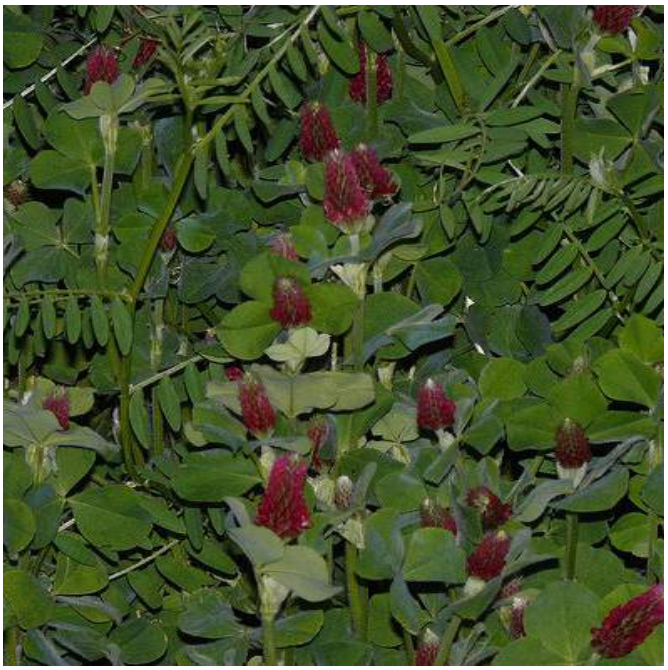

Photo Credit: Kurt Morrow

Vigorous spring growth of crimson clover and vetch in central Pennsylvania.

TROUBLESHOOTING YOUR DRAFT ROTATION

Once you've sketched out a rotation, go back through it step by step. Ask yourself if it includes:

- The right crops. Does my intended rotation feature crops that will perform well and find a reliable, profitable market?
- The right soil impact. Will the rotation control erosion, minimize pest damage and disease, break weed cycles, and improve the quality of my soil?
- The right resources. Will it make effective use of available resources, including labor and equipment?

SUMMARY

As a caretaker of the land, you will find that crop rotations and cover crops are the answer to many organic farm management issues.

Think about your crop rotation plan and the cover crops you will use. Make sure your rotation plan has the right crops that will provide the right soil impact. Think about the economic impact of your crop rotation plan and your resources.

Before we move on to the Seeds and Plants lesson, take a break and update your Organic System Plan.

Complete Part 2: Farm Plan Information. Attach updated field history sheets showing all fields, field numbers, acres, crops planted, projected yields, and inputs applied.

- Indicate whether you have managed all fields for three or more years. If you have not, you must submit signed statements from the previous manager stating the use and all inputs applied during the previous three years on all newly rented or purchased fields.
- Indicate whether all fields requested for certification are located at the main address listed in Part 1. Complete the information for the main farm address and each parcel in a separate location from the main farm.

LESSON 2: SEEDS AND PLANTS

OVERVIEW

Seeds and planting stock are the building blocks of any rotation, and special care must be taken to ensure that your seeds are sourced and your planting stock is propagated in keeping with organic regulations. Another key feature of most vegetable operations is greenhouse production, particularly in northern climates. Quality seed and healthy planting stock grown out in a responsibly managed greenhouse is the best head start you'll get against the challenges that wait out in the field.

GLOSSARY TERMS

Annual seedlings: A plant grown from seed that will complete its life cycle or produce a harvestable yield within the same crop year or season in which it was planted. *(NOP definition)*

Planting stock: Any plant or plant tissue other than annual seedlings but including rhizomes, shoots, leaf or stem cuttings, roots, or tubers, used in plant production or propagation. *(NOP definition)*

WHAT THE STANDARDS SAY ABOUT SEEDS AND PLANTS

Section 205.204 of the NOP Standards states that producers "must use organically grown seeds, annual seedlings, and planting stock." This is the basic goal you should keep in mind. There are, however, a number of exceptions:

1. Untreated, non-organic seeds or planting stock may be used if organic seeds or planting stock of a given or equivalent variety are not commercially available.
2. Non-organic seeds and planting stock treated with a permitted synthetic substance may be used if untreated seeds or planting stock of a given or equivalent variety are not available.
3. Non-organic annual seedlings or transplants can be used with special permission in the case of natural disaster or for research purposes (see §205.290).
4. For perennial crops, non-organic planting stock can be used, but the plants need to be managed organically for at least a year before any organic crop can be sold.
5. Seeds, annual seedlings, and planting stock treated with prohibited materials may be used when such use is required by state or federal phytosanitary regulations.

> **!** Organic seed treated with organic-allowable materials is now available for some crops and varieties.

Note that organic seed must be used for the production of edible sprouts.

Two key phrases in the points listed above

are "commercially available" and "equivalent variety." The standards leave it up to the certifier to determine whether a given variety was commercially available and whether you made a good-faith effort to find organic seeds to fit your cropping plan.

A common rule of thumb is to try three potential sources before resorting to non-organic seed. Keep copies of telephone notes, emails, and other correspondence documenting your efforts to source organic seeds. The organic inspector will want to see this documentation.

GLOSSARY TERMS

Commercially available: The ability to obtain a production input in an appropriate form, quality or quantity to fulfill an essential function in a system of organic production or handling, as determined by the certifying agent in the course of reviewing the organic plan. *(NOP definition)*

SEED QUALITY MATTERS

Certified organic seed does tend to be more expensive than non-organic seed, but don't fall for the temptation of choosing a variety you know is not commercially available in organic form in order to avoid paying the higher price. The organic seed industry is changing rapidly, with more varieties in larger quantities to choose from all the time. Prices will probably come down as supply increases, but supply will increase only in response to increased demand.

As a general rule, you shouldn't be trying to skimp on your seed costs anyway. Seed quality is hugely important in organic systems—the last thing you want to do is introduce weeds or disease with low-quality seed. Some good habits to develop:

- Talk to other organic farmers about their experience with different seed companies
- Double-check seed packages or bags prior to planting to make sure you haven't accidentally received treated, genetically modified, damaged, or contaminated seed
- Source your seed well in advance of when you'll need it to make sure you don't get left short

FARMER-TO-FARMER

"Try to find out the name and reputation of the seed breeder responsible for every variety you grow. Where seeds come from can make a huge difference in performance."

—Richard DeWilde
Viroqua, WI

! Note that "certified seed" is different from "certified organic" seed. Non-organic "certified seed" is a quality standard administered through state departments of agriculture for many conventional agronomic crops. It guarantees specific requirements for germination, cleanliness and genetic purity, but does not address organic compliance.

ON-FARM SEED PRODUCTION

Another option for organic seeds is a traditional one: save your own. Many organic farmers get into the habit of harvesting and saving their own small grain, vegetable, or cover-crop seeds. You can even set up seed-exchange networks with other farmers in your area.

Raising a crop for seed can require even greater attention to crop quality, weed management, harvest techniques, and storage conditions than raising one for feed or food.

A number of organizations, including the Organic Seed Alliance in Washington state and the Carolina Farm Stewardship Association in North and South Carolina, have launched projects to improve organic seed quality and to train more farmers to produce organic seed. If you get good at seed saving, you may want to consider organic seed production as a value-added marketing opportunity.

If you do save your own seed, remember to maintain your field records. You'll need to show that you have the acreage, equipment, and time to do it.

BREEDING FOR ORGANICS

As organically grown seed becomes more widespread, an interesting discussion has sprung up among farmers and researchers about breeding crop varieties and livestock lines specifically for organic systems. Organic crops and livestock face growing conditions distinct from those of non-organic crops and livestock, and so varieties or species that perform well in non- organic systems may not be the same as those that perform well in organic systems.

Organic crops need stronger root systems to forage for soil nutrients and stand up to the physical stress of cultivation, for instance. Organic livestock need to have good grazing abilities to do well on pastures with limited supplemental grain feeding.

Some organic farmers are working with heirloom varieties (nonhybrid varieties introduced prior to 1940) and heritage livestock breeds, reasoning that breeds and varieties developed before agricultural chemicals came into widespread use may have a better chance of performing well in organic systems.

At Rodale Institute, we've compared the performance of existing corn and soybean varieties under organic management and have found that they vary dramatically in their ability to tolerate and suppress weeds. Consider conducting simple side-by-side variety trials on your own farm.

Photo Credit: SARE

Austrian winter peas are an excellent winter annual legume for nitrogen production where winters are mild.

GROWING ORGANIC SEEDLINGS

Most organic vegetable producers grow their own organic seedlings to use as transplants. Organic greenhouse management is governed by the same basic standards that apply to other forms of organic production.

All soil-mix ingredients, fertility products, foliar sprays, and/or pest and disease management materials used in organic greenhouse operations must comply with the National List. Use of treated wood in greenhouse construction is permitted only if it does not come in contact with crops or growing media. It's generally okay for the construction of greenhouse end walls, for example, but not for benches or for raised beds (in the case of in-ground production).

If you maintain both organic and non-organic greenhouses on your farm (parallel production), you'll need to have systems in place to keep these areas separate and to prevent cross-contamination and commingling of organic and non-organic materials and crops. This includes preventing drift of prohibited materials through ventilation systems and runoff from irrigation/fertigation systems.

VEGETATIVE AND PERENNIAL PLANTING STOCK

The same rules apply for vegetative plant propagation materials such as potatoes, sweet potato slips, and onion starts—certified organic material must be used if commercially available.

Perennial planting stock—fruit trees, brambles, grapevines, etc.—may be brought to the farm from non-organic sources but must be managed organically for at least a year before any fully certified organic crop can be sold.

Strawberry plants have been something of a gray area, since in most U.S. growing regions they are perennials treated as annuals. Organic strawberry plants are beginning to be available for purchase. Check with your certifier and other growers in your area.

GREENHOUSES AND HOOPHOUSES

Hoophouse or high-tunnel production is also gaining popularity among organic growers. Hoophouses are economical, unheated greenhouses with flexible ventilation options used for season extension and other objectives. Many hoophouses are designed with roll-up sides to provide maximum airflow as the weather warms up. Some are used in combination with trellising systems to maximize the use of the space under cover.

By sheltering plants from rain and allowing for more intensive management, high tunnels can reduce disease incidence and increase yields. Organic soil management under hoophouses can be more challenging than regular soil production because of the physical constraints and lack of exposure to the elements. Various movable hoophouse designs have been created to address this issue.

GREENHOUSE MANAGEMENT

Many standard commercial potting mixes are not acceptable for organic production because they contain pre-blended synthetic fertilizers. While there are a few organic-approved potting mixes on the market, you may find it more cost-effective to make your own.

The goal is a well-drained, pathogen-free medium with sufficient fertility to give young plants a strong start. Most recipes start with a base of compost, peat moss, sand, perlite, or vermiculite and then add smaller amounts of bone meal, blood meal, alfalfa meal, or greensand. Some growers also use lime or phosphate rock.

Organic growers use a variety of plastic seed trays, pots, or soil blocks in the greenhouse. Seed trays may (and generally should) be reused for several seasons but should be disinfected to prevent the spread of disease. A number of organic-approved oxidizing products are good for this purpose.

Proper watering is essential in the greenhouse. Plants can be stressed by too much or too little water, and stressed plants are more susceptible to insect and disease problems. Watering should be done thoroughly, generally at mid-morning, with a check made mid-afternoon during the hotter months.

Photo Credit: Rodale Institute

The most successful greenhouse mix (center) at the Rodale Institute includes three parts screened on- farm compost (bottom right) and one part each, clockwise from lower left, coir (ground coconut fiber), peat moss, perlite and vermiculite.

Sticky traps can be used in the greenhouse to monitor aphid, whitefly and thrips populations. Releasing beneficial insects can be effective in controlling aphids, thrips, leaf miners, scale, mealybugs, spider mites, and whiteflies. For disease management, the two keys are ventilation and sanitation.

SUMMARY

Remember, annual seedlings must be produced according to organic standards. Non-organic perennial planting stock must be managed organically for at least one year prior to harvest of crop or sale of the plant as certified organic plant stock. Organic seedlings and planting stock must be used if commercially available. If you have both organic and non-organic greenhouse production on your farm, pay close attention to maintaining organic integrity.

Before we move on to the weed management lesson, you may want to take a break and update your Organic System Plan.

LESSON 3: WEEDS

OVERVIEW

Many organic farmers say dealing with weeds is their biggest challenge.

It's easy to understand why; weed management can be tough in organic systems, especially transitioning ones. But the idea that an organic field is a weedy field is outmoded. Skilled organic management can achieve near-total weed control even in challenging crops like soybeans, small grains, carrots, and strawberries.

Another misperception is that organic weed management relies entirely on mechanical cultivation. It's true that you'll be better off if you know your way around a cultivator. But cultural weed-management methods are just as important, if not more so. Crop rotations, adjusted planting dates, mulches, and other preventive methods can all be critical components of a successful organic weed-management plan.

Where weeds are concerned, an ounce of prevention is worth a pound of cure. Using a good mix of organic weed-management practices that work together to lower weed pressure is especially important when weather is uncooperative or other complications arise.

Photo Credit: Rodale Institute

Even in soybeans, our most weed-sensitive crop, we can manage weeds adequately through biological, cultural, and mechanical practices.

WHAT THE STANDARDS SAY ABOUT WEED MANAGEMENT

Section 205.206 of the NOP Standards requires the use of crop rotations, sanitation and cultural practices to prevent weed problems and enhance crop competitiveness. Weeds may also be managed through the use of mulches, mowing, livestock grazing, mechanical cultivation, hand weeding, and thermal or flame weeding.

If—and only if—these methods are insufficient, there is a short list of organic-approved herbicides you can turn to, provided you comply with any restrictions and document where and how you used them in your Organic System Plan. Most of these are cost prohibitive on all but the highest-value crops.

The Organic System Plan forms also ask about your monitoring and evaluation practices with regard to weed management: the effectiveness of your weed management plan, how you evaluate that effectiveness, and whether you're planning any changes.

Any weed management inputs you use should be listed on your Field History Sheet. It's a good idea to keep records of cultivation passes and other mechanical weed-management practices as well. These can be as simple as a field log or working calendar to record tillage, planting, cultivation, and other jobs. The organic inspector will be checking to see that your stated weed-management methods bear a plausible relationship to your observed weed pressure.

ORGANIC WEED MANAGEMENT FUNDAMENTALS

The organic approach to dealing with weeds is best described as ecologically based weed management or integrated weed management (IWM). IWM brings together a wide variety of strategies—from well-designed crop rotations to adjusting planting methods to novel techniques like flame weeding—that together offer an effective weed-management program. Iowa State University weed ecologist Matt Liebman refers to this as the "many little hammers" approach—going after weeds with many small, varied strategies instead of a one-shot approach, as with herbicides.

IWM emphasizes an ecological

understanding of how weeds behave in farming systems. Virtually every field activity you engage in—from soil amendments to crop selection to tillage methods—can have an impact on your weed levels and how they interact with crops.

There are a few basic principles of IWM to keep in mind.

Don't let weed populations get out of hand. This means if you see a patch of weeds developing or if you notice that a certain field has become weedy, you need to increase the intensity of management in that area. This can be as simple as scouting and targeting patches of problem weeds or rotating a field into a weed-suppressive crop.

Don't let weeds get adapted to your operation. This means using multiple and diverse tactics to manage weed populations. Weeds can easily survive and persist if the same management practices are done at the same time of year every year.

The amount of damage weeds can do to a crop can vary. There are many ways to make crop plants more competitive so the negative impact on crop yield from weeds is reduced. Just as every field operation can affect weed levels, weed-crop competition can be affected as well. The key is to manage your system so that the crops are given as much of an advantage as possible over the weeds.

FARMER-TO-FARMER

"Weed control really isn't a battle. It's about learning to understand soil structure and soil health."

—Gary Zimmer
Blue Mounds, WI

FOCUS ON PREVENTION AND ATTENTION

Preventive weed management includes good sanitation and other practices to limit the spread of weed seeds on your farm. Be sure to:

- Use high-quality, weed-free seed. Commercial seed packages should state their weed seed percentage on the label. If you save seed, make sure you clean it well.

Photo Credit: Rodale Institute

Compost piles of manure and other organic matter that reach 60 degrees C will kill many weed seeds.

- Limit weed seed production in field margins and other areas. Some farmers clip weed seedheads over standing soybeans with a high cutter bar. An hour of bean-walking or thistle-stumping can be a good investment.
- Don't spread weed seeds from one field to another via tillage equipment or other tools. Hose down muddy tires and cultivators if necessary.
- Avoid plowing down a fresh crop of weed seeds in the fall. Weeds in the top few inches of soil have a relatively low survival rate, while those deeper down are more likely to germinate when brought to the surface next season.
- Compost manures and plant materials thoroughly. Buy compost only from reputable sources. High-temperature composting with active microorganisms should break down any weed seeds.

High-value vegetable crops require particular vigilance, since acceptable weed thresholds are much lower. Vegetables are not very competitive with weeds, and the hand-harvesting involved makes weed management through cultivation and

cultural practices your number-one priority.

Cultivation is best done every week until you can no longer clear plants. Rows should be marked with a mechanical cultivator if you are planting or seeding by hand. Flameweeding is very useful on slow-germinating vegetable crops such as carrots and beets prior to emergence. Insufficient attention to weed management in the early years of an organic operation can be fatal to the success of your overall enterprise.

USE ROTATIONS TO KEEP WEEDS IN CHECK

Diverse crop rotations are among your best strategies for reducing weed populations. Alternating row crops with solid-seeded crops, including one or more years in hay or pasture, and filling gaps in your rotation with aggressive covers like rye and hairy vetch can all help reduce annual weed pressure and contributions to the weed seed bank in your soil. By limiting and varying the bare-soil periods during which weeds can germinate, rotations increase the likelihood that weed seeds will decompose or be eaten by predators before they have a chance to grow.

Rotations also help with weed management by building soil fertility, tilth, and organic matter, creating conditions in which the crop plants can thrive at the expense of the weeds.

Another way to use rotations for weed management is to take advantage of certain crops' allelopathic, or natural weed-suppressive qualities. Rye and sorghum-Sudangrass are strongly allelopathic; sunflower, sorghum, and many brassicas are less strongly so. Certain varieties of wheat and rice are also thought to inhibit weed seed germination. Plants like these can be used as primary crops or plow-down smother crops to clean up a field with severe weed pressure.

Sod crops, when mowed or grazed regularly, also help manage weeds. Pasture and hay crops can go a long way to suppress weeds while also building organic matter and enhancing soil health.

Paying attention to weed management in the early years of transitioning to organic is critical—a couple of bad seasons can give you serious weed problems for years to come.

PLANTING STRATEGIES TO BEAT WEEDS

Organic farmers use a number of different planting and seeding techniques to meet the challenges of herbicide-free farming. Planting at higher densities, on narrower row spacing, or at higher broadcast rates can increase crops' competitiveness against weeds, compensate for losses during cultivation, and get the canopy closed faster. Seeding rates can be as much as 10% to 20% higher than those recommended for non-organic systems.

If you can, choose crop varieties that canopy rapidly to shade and outcompete weeds. Most modern cultivars of wheat, barley, and oats have been selected for reduced top growth and straw length, but varieties with stronger vegetative growth may work better for organic production.

Organic vegetable growers also shift planting methods to make weed management easier. Transplanted crops are easier to cultivate than direct-seeded crops, for instance, so organic growers typically use transplants as much as possible. For direct-seeded crops, a precision seeder that will limit the need for thinning can be a big advantage. Straight, evenly spaced rows will make cultivation more efficient.

GLOSSARY TERMS

Tilth: An indicator of soil health pertaining to its ability to aggregate, allowing for good drainage and air circulation.

RESEARCH

Iowa State University researchers have found that weed predation by field mice can reduce weed seed populations by 40% in just one night.

Maintaining unmown, biodiverse borders around your fields provides habitat for the mice and provides you with some free weed-control service.
Read more: Free weed-control service: Mice

ADJUST PLANTER, CHECK PLACEMENT

A well-adjusted planter is one of your most valuable weed-control tools. Uniform, proper placement of the crop seed will result in even, vigorous growth. Seed depth is a critical decision based on seed size, soil temperature and moisture, seedling vigor, and where you are on the calendar.

Don't assume that just because a planter is relatively new, it's doing a good job. The planter frame and individual planting units should be regularly inspected for bending or warping.

Older planters with worn seed disks, gauge wheels, closing wheels, or other parts can result in uneven planting. Worn parts should be replaced or repaired. Retrofitting with shoes, firming points, specially designed seed tubes, or "eccentrically bored" gauge-wheel bushings can help achieve more uniform seed placement. Residue-manager wheels in front of the gauge wheels will sweep away clods and stones, making for a level surface and more uniform planting.

Seed placement is important for any crop system, but the weed management constraints of organic farming make it more critical to do quality control as a routine part of planting. New rig or old, what matters is that the seed is placed snugly in the soil at the depth you want. Make sure it is. Get off the tractor regularly and dig up the seed to check planting accuracy and make adjustments if necessary. This should be done not only in good parts of a field but also in uneven or difficult areas. Avoid planting into wet or particularly lumpy soil.

TILLAGE IN WEED MANAGEMENT

After all this crop planning, it's finally time to get on the tractor and stir some soil. Mechanical weed management can be divided into four phases:

1. Field preparation
2. Pre-plant tillage
3. Pre-emergent tillage
4. Post-emergent tillage

All can be very effective, but all come with costs in terms of time, money, and risk. As we've mentioned elsewhere, reduced tillage is a big priority in organic farming right now, with no-till weed-management strategies at the cutting edge of organic farming research. Annual weeds are the pioneer plants of a natural ecological succession. When soil is disturbed by tillage, weed seeds are stimulated to germinate. Reducing soil disturbance greatly reduces the germination of weed seeds, so weed problems are different with no-till than with standard-till farming.

Photo Credit: Jack Sherman

Rotary hoeing is most effective at the "white string" stage, before weeds even emerge from the soil.

PRE-EMERGENT STRATEGIES

Stale, or false, seedbedding is an excellent way to reduce weed populations in a subsequent crop. For best effect, the seedbed should be prepared 10 days before the desired crop planting date. Soil preparation will encourage a crop of weeds to germinate. These tiny seedlings are then killed in the white-string stage by a pass with a harrow, rotary hoe, or other tool.

The second pass should be done as shallowly as possible to avoid bringing new weed seeds to the surface. Multiple passes can be done if conditions permit, but weigh your need to eliminate weeds against the danger of overworking the soil. Best results are achieved when soil temperatures are warm enough to stimulate good

weed germination. In some cases, irrigation is used to enhance the effect of the stale seedbed.

Flameweeding can be used to good effect for everything from blind tillage through mid-season weed control on crops with heat-resistant stems, such as cotton. One of the big advantages of flame weeding is that it doesn't disturb the soil and thereby cause more weeds to germinate.

Flaming works best when the weeds have two true leaves or fewer. Field-scale models are common in the Upper Midwest and the South, while backpack or hand-truck models for vegetables and orchards are popular among market farmers.

A pane of glass can be used to help predict crop emergence and improve timing for flameweeding. The glass is set over a small area of the field, raising the soil temperature and causing the crop seeds underneath to germinate a few days earlier than the rest of the crop.

PRE-EMERGENT CULTIVATION: FLYING BLIND

Blind cultivation is your easiest and best opportunity to destroy weeds that will otherwise grow up within the rows and offer direct competition with the crop. In blind cultivation, the entire field is tilled shallowly at a relatively high speed, paying little attention to where the rows are.

The point of blind cultivation is to stir the top half inch of soil, adding air and causing the millions of tiny germinating weed seeds to dry out and die. The larger crop seeds are below the level of the cultivation and remain undamaged. Weed seedlings are at their most vulnerable at this stage. Effective blind cultivation will give you the biggest possible crop/weed size differential.

Blind cultivation can also break a soil crust, allowing crop seedlings to emerge. Depth control is critical, as is an awareness of crop seedling development to make sure the young shoots are not approaching too close to the soil surface.

The first blind-cultivation pass is usually done right before crop emergence, with a second pass about a week later, depending on conditions. For soybeans, avoid blind cultivation during the sensitive "crook stage," when the seedling is curling upward to become an erect stem.

FARMER-TO-FARMER

"Make the first cultivation the deepest so that new weed seeds aren't brought to the soil surface in later passes."

"Use cultivation equipment with the same number of rows as your planter, so you don't end up taking out the 'guess rows.'"

Source: *Integrated Weed Management: "One Year's Seeding..."* (Michigan State University Extension, 2005)

Blind cultivation is best done when the sun is shining, a light breeze is blowing, and the soil is fairly dry.

Common blind-cultivation implements include coil-tine harrows, rotary hoes, and finger weeders. Some of the most advanced tools are produced in Europe and imported to North America.

POST-EMERGENT CULTIVATION

Once the crop is in the ground, everything you do to manage weeds has to be balanced against the impact on the crop. Mechanical weed controls—from cultivation to flaming to mowing—differ mainly in how they treat the weeds compared to the planted or growing crop.

While cultivation implements are getting better and more varied all the time, there are still three basic ways to kill weeds by cultivation:

- Burying weed seeds and seedlings deep enough so they can't grow
- Uprooting weeds so they dry and die
- Severing or damaging weeds enough so the parts can't regenerate

Weeders and cultivators generally do a combination of all three. It's important to know exactly what your cultivator is doing in order to time the operation correctly and make proper adjustments. Factor in soil conditions, weed pressure, tractor speed, and distance between steel and crop row, as well as crop status. Shallow tillage and no-tillage techniques are recommended for keeping weed seeds in the upper inches of soil, where they're most vulnerable to biological

breakdown and predation.

When the crop rows are clearly visible, it's time for between-row cultivation. This has to be done slowly and carefully to avoid taking out the crop plants.

Many farmers make two passes, one to take out the majority of the weeds and a second to eliminate weeds stimulated to grow by the first. A second cultivation aerates the soil and can be used to hill up soil from between the rows toward the base of the crop plants, helping to limit weeds within the row.

If you do your second cultivation late enough, the crop canopy will prevent further weed germination. With a broadcast seeder, you can apply cover-crop seed at the same time, allowing it to establish in the low-light conditions and then take off after harvest.

Photo Credit: Rodale Institute

S-tine cultivator blades are designed to vibrate side- to-side in response to soil contact to maximize their shattering impact on weed roots. Set in gangs as shown here, they can effectively manage shallow- rooted weeds. Choose shank-style blades to meet goals of slicing, burying or uprooting weeds.

WEEDS, WEATHER, AND TIMING

Weed species vary widely in their susceptibility to being killed by cultivation equipment. Ragweed sends down a taproot very quickly, making it difficult to uproot almost as soon as it comes up. Mustard has very shallow roots at first and is easily plucked out until it is quite large. Summer annual grasses form small seedlings with few reserves that are easily destroyed by burying or uprooting.

Large-seeded weeds like velvetleaf can emerge from deep in the soil and are very resistant to shallow cultivation. Redroot pigweed is difficult to kill by burying or uprooting once it gets a few inches tall because it can re-root and push up out of fairly deep soil. Purslane can also re-root even if pulled all the way out and left lying on top.

In periods of drought, weeds may go into semi-dormancy, leading farmers to stop cultivating or to set cultivators less aggressively. The soil hardens, making it difficult for equipment to penetrate to the proper depth. Deep-rooted weeds are held tightly in the soil, although they may show little aboveground growth. A cultivator run too shallow can bury these weeds without dislodging the roots, creating a field that looks clean but in fact harbors plenty of weeds ready to shoot up at the first sign of moisture.

A rain on freshly cultivated soil, on the other hand, will make it stick together, crusting slightly as it dries. Under these conditions, buried weeds will die quickly and seldom manage to push back out. Any crop plants buried by cultivators just before a rain, however, are usually lost, too.

Weather conditions can play a major role in the effectiveness of tillage operations. If possible, look for a stretch of dry weather before you start your tillage. Wet weather may allow weeds to re-root. Cold, wet conditions can slow weed seed germination, reducing the effectiveness of stale

WHENDOWEEDSWAKEUP?

For problem weeds like quack grass and yellow nutsedge, repeated but ill- timed tillage may cause weed proliferation. Tillage done during hot, dry conditions has the best chance of being effective.

With bindweed and Canada thistle, some organic farmers will take highly infested fields out of production for a fallow period to reduce the population. With perennial weeds, persistent mowing before seed set can be effective.

seedbedding. Choose the time of day that will cause the most stress on disrupted weeds, whether by sun, wind, or overall exposure.

Never work ground that is too wet. You'll cause compaction, which encourages weeds that prefer hard ground and makes later cultivation less effective.

VEGETATIVE AND SYNTHETIC MULCHES

Mulches can be very effective at controlling weeds. Mulch changes the environment around the soil surface, making it difficult for weed seeds to germinate and grow. Vegetative mulches, such as rye straw, can also suppress weeds by allelopathy. Research shows that rye mulch can reduce weed seed germination by 75 to 95% while leaving large-seeded crops such as corn, peas, cucumbers, or beans unaffected.

Natural or non-synthetic mulches such as straw or leaves can have the additional benefit of boosting soil organic matter over time, and even adding fertility. Be careful whenever you import mulch (or compost) materials such as leaves, loose straw, or grass clippings that you avoid potential contaminants or debris. Avoid glossy inks from newspaper inserts and magazine waste.

"Living mulches" are cover crops of clover, grasses, or other species used to suppress weeds in orchards and some other types of cropping systems. These can be mowed regularly or seasonally to maintain the stand.

Synthetic mulches: many organic vegetable growers use plastic mulches to manage weeds in crops like tomatoes, peppers, squash, and cucumbers. Plastic mulches can be laid down with specialized bed-former/mulch-layer implements, or, on a smaller scale, laid by hand after beds have been formed. Drip irrigation tape is usually laid down beneath the plastic. A variety of different-colored plastic mulches (black is standard) can be used to influence soil temperature and other factors.

Natural and synthetic mulches can also be used together, of course, with straw or clover used between raised beds covered in plastic.

Synthetic mulches are classified as a "restricted" input under the National Organic Program Standards, meaning they must be used in compliance with the stated annotations. Regulations require that all synthetic mulches be removed from the field at the end of the growing season.

Photo Credit: Rodale Institute

Natural mulches boost soil organic matter over time, even adding fertility, but they can also add potential contaminants if you're importing them from off-farm.

GLOSSARY TERMS

Mulch: Any nonsynthetic material, such as wood chips, leaves, or straw, or any synthetic material included on the National List for such use, such as newspaper or plastic that serves to suppress weed growth, moderate soil temperature, or conserve soil moisture. *(NOP definition)*

OTHER WAYS TO MANAGE WEEDS

Livestock: Intensive rotational grazing is widely recognized for its effectiveness in limiting perennial weeds in pasture. But in some specialized systems, farmers have developed additional ways to use livestock for weed management. Chickens confined to small pens and rotated through fields have been shown to be effective at eradicating yellow nutsedge. Geese preferentially eat grasses, and so can be used to weed strawberry fields without damaging the

crop. Some tree-crop farmers use sheep to graze the alleys between rows of trees or coffee bushes.

Organic herbicides: Very few input products are available for organic weed management. Corn gluten meal has use as a fertilizer (10% N) as well as an herbicide, but to be permitted in organic farming it must be made from non-GMO corn. It is prohibitively expensive for most crops, although it may have uses in greenhouse or specialty crop systems.

Other organic-approved herbicides on the market are vinegar-based, like Matran, a vinegar-clove product. To be effective, concentrations in the range of 10 to 12% acetic acid are needed, although lower concentrations may work on small annual weeds. For organic use, the acetic acid must be derived from natural fermentation—industrial acetic acid is not permitted. At these concentrations, acetic acid is legally required to be labeled as a pesticide, which limits the number of products available.

Always check the OMRI list and consult with your certifier before investing in a new input material.

Night-time tillage: Some farmers and researchers are experimenting with night tillage using infrared goggles. Weed species such as lambsquarters, ragweed, pigweed, smartweed, mustard, and nightshade require just a fraction of a second of light to trigger germination. The idea of night tillage is to eliminate that trigger. Ascard (1993) reported two studies that illustrated the effectiveness of night-time weed management in managing weeds. In one experiment, harrowing one hour after sunset reduced weed emergence by 40% compared with harrowing during the daytime. In another experiment, a light-proof cover on the harrow in daylight significantly reduced weed emergence compared with conventional harrowing.

SUMMARY

Organic weed management does require a shift in attitude. Striving for 100% weed eradication in organic systems is not essential. The fact is, most crops can tolerate a few weeds without showing any impact on yield or quality.

Research at the Rodale Institute, moreover, has shown that organic crops actually have a greater ability to tolerate weeds than non-organically managed crops do. In almost 30 years of side-by-side trials, our organic plots have consistently yielded as well as our non-organic plots, even though the organic plots usually have heavier weed pressure. It may be that the organic crops suffer less competition from weeds because soil quality is better, making nutrient and water resources more plentiful.

FARMER-TO-FARMER

"[Most farmers] want to see a perfectly clean field. Economically, that's not possible. The costs of making a perfectly clean field are pretty astronomical."

—Dean McIlvane
West Salm, OH

Or, it may be that more complex ecological interactions are taking place. After all, weeds can play a variety of useful roles within your farming system. They can help protect the soil from wind and water erosion. They provide food and habitat for wildlife and beneficial species. They can increase biodiversity, aid nitrogen fixation, add organic matter, and catch excess nutrients. They serve as trap crops for pests and provide grazing for livestock.

My organic weed-management plan features a variety of strategies designed to reduce weed pressure as much as possible. However, my basic goal is just to keep weed pressure below the economic threshold—the point at which it has an impact on the crop.

LESSON 4: PESTS AND DISEASES

OVERVIEW

Dealing with pests probably requires the biggest leap of faith for farmers new to organic management. When you're used to having an arsenal of chemical controls at your disposal, it's scary to think about what might happen when you give them up.

Fortunately, most farmers find that after an

initial "balancing out" period, pest and disease pressures in field crops diminish under organic management. Just as in weed management, effective crop rotation is the primary method of organic insect pest and disease management. In the absence of pesticides, beneficial insect populations return, helping to stabilize pest populations. In organic farming, the early years may be challenging, but things get better over time. Compare this to non-organic farming, in which things can get tougher over time as pests develop resistance and input costs go up.

WHAT THE STANDARDS SAY ABOUT PEST AND DISEASE MANAGEMENT

Section 205.206 of the NOP Standards requires producers to rely first of all on management practices to prevent crop pests and diseases. These practices include:

- Crop rotations and other soil and nutrient management practices
- Sanitation measures to remove disease vectors and habitat for pest organisms
- Cultural practices to enhance crop health, such as selecting plant species and varieties that are resistant to prevalent pests and diseases

In addition, the Standards permit the control of pest problems "through mechanical or physical methods including but not limited to:"

- Releasing beneficial organisms
- Developing habitat for beneficial organisms
- Using lures, traps and repellents
- And disease control via:
- Management practices to suppress the spread of disease organisms
- Application of nonsynthetic biological, botanical, or mineral inputs

After producers have tried or considered all of these strategies, they are allowed to turn to approved pest-management materials.

JEFF MOYER: THE FARMER AS NATURALIST

In my years as an organic farmer, I've learned a lot about what you might call the biological backdrop of the Rodale Institute farm. Insects are an important part of that backdrop. For every corn borer or aphid I find in the field, I know there are dozens of other species—predatory ground beetles and wolf spiders, parasitic flies and wasps, bees that act as pollinators—out there benefiting my crops.

Photo Credit: Rodale Institute

Bean beetle damage on soybeans

I try to keep this in mind as I consider my pest management options, because I know that every time I get out a pest-control material, even one approved for use in organic systems, I risk harming the good insects while I'm trying to eliminate the bad ones.

I also know that vigorous, healthy crops grown in balanced, well-managed soils can stand up to a certain amount of pest pressure. When a pest appears in a crop, I don't automatically decide I have to do something about it—the key is to pay close attention, see if it spreads, and know what level of damage I can tolerate for the markets I'm targeting for that particular crop.

This is the same "economic threshold" concept we talked about with regard to weeds,

and it's why many organic farmers prefer to talk about "pest management" rather than "pest control." The idea is not to eliminate every last pest—usually impossible anyway—but to create stable agro-ecological systems in which pests are naturally held at low levels.

Finally, as with weeds, I try to look at insect pests as indicators of how the whole farm system is working, not just as a problem of the moment. Pest pressure in the fields can be affected by beneficial insect populations, rotation decisions, tillage methods and many other factors, such as how we manage our windbreaks and field edges. Checking to see if the bluebird boxes are occupied is a lot more enjoyable than getting out the spray rig—and ultimately, I've come to realize, it's more effective, too, because it teaches me something instead of just being a chore I cross off my list.

EMPHASIZE CROP HEALTH

Most organic farmers use cultural methods for pest management, such as:

- Delaying planting to avoid critical pest life-cycle stages
- Planting small "trap crop" areas to attract pests away from the primary crop
- Choosing several varieties instead of a single crop variety in order to create a less uniform landscape for pests to move across

Biological or physical methods include using row covers to exclude flea beetles and applying beneficial nematodes to control undesirable nematodes. Biological or physical methods are usually practical only in high-value, intensive crops such as fruits and vegetables.

Choosing crops that grow well in your area and providing optimum conditions for crop growth should be your number-one pest-management strategy. Even the huge vegetable farms in California's Salinas Valley, which have gone organic with over 12% of their production and which have all the latest pest-management tools at their disposal, use this "grow crops in their best place" strategy as their first line of defense against pests on their organic acreage. Plants are like people; if they're eating right and enjoying good living conditions, they can fight off most infections and heal cuts and bruises quickly.

Organic farmers have long maintained that synthetic fertilizers and pesticides make pest problems worse. Recent research has begun to support those observations. Plant susceptibility to insect feeding has been linked to high plant nitrogen levels, which in turn are related to the high soluble fertilizer inputs typical of non-organic agriculture. Free amino acids, again associated with high N applications, have also been reported to increase pest attacks. Compost-fed plants have lower soluble N levels and are thus less attractive to pests.

Other good farming practices also help reduce pest pressures. Good field preparation, skillful seed placement, timing planting to take advantage of optimum soil temperatures, and wise use of irrigation (if applicable) will give you strong young plants that are better able to withstand pests.

VARIETIES DIFFER IN PEST-RESISTANT TRAITS

Another part of good crop selection is good variety selection. There are many pest-resistant and pest-tolerant varieties available, with more being developed all the time. Although they

Photo Credit: Rodale Institute

Scab-resistant varieties of apples improve skin condition at harvest in the Rodale Institute orchard

sometimes lack the yield numbers or commercial recognition of less-resistant varieties, you may find that they work better for you overall in your new organic system.

In Hawaii, for example, organic ginger growers have discovered that yellow ginger is more insect-tolerant than the more commonly grown white ginger, and that while it has lower yields, it also has a stronger flavor and (according to homeopaths) more powerful medicinal qualities, making it better suited for premium organic markets.

Here at the Rodale farm, we've done a lot of work trialing scab-resistant apple varieties over the past 30 years, and have found that most of them have terrific flavor, good appearance and acceptable storage qualities. What they lack is a familiar name that customers can identify, so selling them takes a bit more marketing effort. Having a combination of scab-resistant (but less familiar) and popular (but scab-susceptible) trees in the orchards gives us the best of both worlds: it limits our need to spray sulfur to prevent scab and gives us a mix of varieties to market.

Systemic acquired resistance: Do plants have immune systems? The ability of plants to respond to pests and diseases by acquiring systemic resistance when exposed to those pests and diseases has been widely studied (Casal, 2012; Slaughter et al., 2012). The term "systemic acquired resistance" refers to physiological changes that occur in plants in response to initial insect feeding or disease infection. These changes can help the plants stop the infection or slow insect reproduction rates. There's even evidence that crop plants under insect attack emit volatile scent signals to protect themselves or to communicate with insect enemies of the attackers.

Plant immune responses may also increase crops' nutritional value. Researchers in California have found that unsprayed organic fruits produce higher levels of antioxidants—prized by health-conscious consumers—in response to insect and pathogen attacks.

FARMER-TO-FARMER

You know a revolution in pest management is happening when the pest-management specialist of a big Salinas Valley produce company shows a photo of a young, aphid- infested romaine lettuce plant and says, 'I don't worry about this anymore because I know the beneficial insects will catch up and eat them all.'"

—Ramy Colfer
Salinas, CA

BUILDING BIODIVERSITY

After choosing appropriate varieties and giving your crops the best growing conditions you can, the most effective way to minimize pest problems is by making your farm as biologically rich as possible. There are lots of ways to do this, from growing a wide range of crops to planting diverse hedgerows.

It may seem hard to believe that your field edges can have that big an effect on what insects show up in your field, but they do. When Bob and Ardie Rodale bought what's now the Rodale Institute farm back in 1971, it had been farmed pretty hard. Most of the trees and shrubs had been taken out, and the fields were plowed to within a few feet of the farm buildings. Since then, we've planted hundreds of trees, put in two ponds, established permanent grass waterways, and done substantial landscaping around the buildings. Not only do we have more beneficial insects and birds and other animals, it's also a more pleasant place to live and work.

Transitioning to an organic crop rotation, including three to five primary crops and two or more cover crops, will by itself do a lot to increase the biological diversity of your farm. As we discussed earlier, you can add diversity to your rotation by mixing varieties of a given crop within a single field, by undersowing a cover crop or a hay crop into vegetables or small grains, or by strip cropping and intercropping.

Some organic grain and livestock farmers have revived the old practice of growing "succotash" mixes of oats, barley, wheat, and/or field peas, reducing pest pressures and boosting yields while also producing better feed values. Studies (such as Barkley and Peterson (2008) in Kansas) have shown that mixed-variety wheat fields can outperform single-variety stands. The

general rule seems to be the more, the merrier.

DEALING WITH LARGER PESTS

Larger pests such as birds and mammals can be as troublesome on organic farms as on non-organic farms. Problems with mammals—from rats to bears—are common; deer, in particular, can be devastating where pressure is high. There are no special organic solutions, except to note that many products are not approved for use.

In areas with intense deer pressure where hunting or special deer-control shooting permits are not an option, the best remedy is a 10-foot box-wire or plastic mesh fence, although some farmers, like Bob Muth in southern New Jersey, report success with a single strand of electrified wire with bundles of human hair (from a local barber shop) tied to it at intervals.

Many organic farmers use live traps to remove groundhogs. For bird damage to growing crops, a variety of "scare" products can be purchased, including plastic owls, scary-eye balloons, shiny streamers, and noisemakers that emit hawk calls. These need to be moved regularly for best effect.

Photo Credit: Cornell University

Deer damage can be severe even in commodity crops.

TIMING CROPS, DIVERTING PESTS

Once you understand the life cycles of your most serious pests, you may be able to adjust your planting schedule to avoid their seasons of peak activity. For example, early-season sweet corn can escape corn earworms; late-season potatoes are often less susceptible to Colorado potato beetles. Aphid problems can also sometimes be avoided by early-season planting. Other pest problems, like wireworms in root crops, can be minimized by early harvesting.

For vegetable growers, pests such as flea beetles and cucumber beetles can be effectively managed by using row covers to protect plants early in the season, when they're small and vulnerable. Once the plants are well established (or have reached pollination stage), the covers are removed.

Trap cropping: An alternative strategy is to devote a small part of a field specifically to a crop that attracts pests as a way of enticing them away from your primary crop. Entomologist Forrest Mitchell in Texas has shown that using squash plants as a trap crop can almost completely eliminate squash bug damage in watermelon and cantaloupes. Potato plants can be used as trap crops for Colorado potato beetles in tomato and eggplant fields.

Trap crops are usually planted along field margins so that pests moving into fields encounter them first. For crops like alfalfa hay, a trap is created by leaving an unharvested strip when each field is cut, so that pests such as leafhoppers have a place to go instead of moving on to subsequent plantings.

A refinement on the trap cropping strategy is to destroy the "trapped" pests once you've attracted them. In California, some organic growers experimented with using vacuum machines to suck up lygus bugs from strawberries. Then researchers discovered that planting alfalfa as a trap crop every 16th row is so attractive to the lygus bug that vacuuming just the alfalfa rows gave better control of the lygus than entire-field vacuuming—and reduced vacuuming time by 75%. Infested trap crops can also be destroyed by flaming. Modification of trap crops can attract predators that can prey upon the pests potentially

eliminating the need for vacuuming. Zinati G. and Smith A. (2017) at Rodale Institute demonstrated that insectary strips, consisting of alfalfa as a base plant and oats as a nurse crop, mixed with a suite of herbs such as dill, basil, calendula, and lemon balm can provide a habitat for—and increase the populations of—beneficial insects such as ground beetles, wolf spiders, soldier beetles, lady bugs, bumble bees, cucumber beetle parasitoids, and braconid wasps. These beneficial insects have demonstrated a strong potential to control cucumber beetles—not only pests in cucumbers by themselves, but also vectors for a bacterium pathogen.

"FARMSCAPING" TO ATTRACT BENEFICIALS

Diversity shouldn't stop at the field margin—it should just be getting started there. The term "farmscaping" refers to the idea of looking at the entire farm landscape as a semi-wild ecological system that can be managed for overall farm productivity and health. Examples of good farmscaping strategies include:

- Leaving some standing dead trees and brush piles for wildlife habitat
- Eliminating plants that serve as overwintering habitat for specific pests (one example is blackberry, which is a host of the consperse stinkbug)
- Planting "living snow fences" to catch winter moisture and provide shelter for livestock
- Designing multistoried cropping systems, such as orchards with annual crops grown in between the rows, or tree nuts with grazing
- Establishing "beetle banks," permanent grass strips that serve as habitat for beneficial ground beetles
- Sowing rows of flowering plants to provide food resources for beneficial insects
- Delaying field work to protect ground-nesting bird species

RESEARCH

Researchers at Montana State University report that farmers can protect crops from wheat stem sawfly by setting their cutter bars higher when they combine. Two parasitoids of the sawfly overwinter in standing wheat stems, but they can't do so if the stubble is left too short. The scientists recommend leaving at least one-third of the wheat stem standing at harvest and cutting even higher along field margins. Given sufficient habitat, the parasitoids can all but eliminate sawfly damage.

Read more: A wealth of ways to manage pests without pesticides

- Preserving or reestablishing native vegetation (prairie, woods, wetlands) on some portion of the farm
- Reducing and rotating tillage

Not all of these strategies will be possible on every farm. There can be a fine line between leaving undisturbed areas for wildlife habitat and keeping weeds from going to seed. In some cases, pest habitat will overlap with habitat for beneficials. You'll need to experiment to figure out what's practical for your conditions. When in doubt about a new management idea, start by managing a small area first.

ATTRACT BENEFICIALS WITH THE BASICS

Anybody who's kept bees—or worried about adequate crop pollination—knows the importance of having something in flower in the landscape all season long. Beneficial insect species like honeybees, lady beetles, and hoverflies rely on nectar and pollen resources for food at critical points in their life cycles. Because wild and weed species may not provide sufficient floral resources, many organic growers cultivate "insectary" plants to attract and retain beneficial insects.

Insectary plants work by supporting the adult, nectar-feeding stages of beneficial wasps and flies. The adults lay eggs on neighboring plants, and when the larvae emerge, they feed voraciously on aphids and other pests. For insectary plantings to be successful, specific

plant species that support predatory insects of your particular pests need to be included in the system, and the insectary plantings need to be close enough to the crop areas to have an effect. Depending on their size and how well they fly, beneficial insects may travel from a few yards to several miles to lay their eggs in crop fields. Insect specialists recommend you figure 50 to 400 yards in planning these beneficial interactions.

When choosing insectary plants, consider these criteria:

- Select plants for their attractiveness to beneficial insects
- Choose plants with an early and long bloom period
- Select plants with low potential to host crop viruses or attract pest species
- Choose plants with low potential to become weeds
- Consider low seed cost and easy establishment

This bee, Osmia ribifloris (on a barberry flower), is an effective pollinator of commercial blueberries.

Many members of the Umbelliferae (coriander, dill, Queen Anne's lace), Compositae (goldenrod, yarrow, sunflower), Brassicaceae (sweet alyssum, wild mustard), and Leguminosae (sweet clover, alfalfa) plant families offer good floral resources for beneficial insects.

Among California vegetable growers, a popular insectary plant mixture is sweet alyssum, coriander, buckwheat and a cereal grain. The cereal acts as a windbreak and as a host for alternate prey of the beneficials.

KEEP YOUR EYES OPEN

Walk your fields regularly at different times of the day and night and see how many insects you can identify. Look on the undersides of leaves, on the ground, and underneath the mulch. Try to familiarize yourself with the important beneficial species as well as the pests. Study field guides to learn about their life cycles and feeding habits.

Advanced scouting and monitoring involves being able to identify eggs, larvae, exoskeletons, and adults of pest species. Local and regional workshops, consultants, and websites are all good resources for this type of training. The insect world is vast, so don't get discouraged. Even professional entomologists often find bugs they can't identify right away.

Many larger organic growers hire consultants to monitor pests, since the initial stages of an outbreak can be easy to miss for untrained eyes. Local organic and integrated pest management (IPM) specialists sometimes establish thresholds and tolerance levels for different types of pest activity. Thresholds are generally lower if the pest is feeding on the marketable part of the crop.

Pheromone traps or sticky traps can detect insect population cycles and predict potential outbreaks. We use these in the Rodale Institute orchards, as do most fruit growers and some vegetable growers. Steve Groff, who grows no-till

FARMER-TO-FARMER

"Pest management in organic farming is all about paying attention to cycles—when a pest emerges, how much humidity or warmth it requires to hatch out, where it feeds and how quickly it reproduces. Once you understand the cycles, you can try to figure out ways to disrupt them."

—Eric Strandberg
Tonasket, Wasthington

tomatoes in eastern Pennsylvania and sometimes has problems with slugs, puts a few boards or buckets out in the field to serve as slug monitoring stations.

Biological and physical controls can be essential in high-value crops. Use of Bt (Bacillus thuringiensis) in brassica crops, SurroundWP (kaolin clay) in cucurbit crops, and row covers for salad greens is standard practice among many organic growers. Many vegetables and fruits do require timely and judicious use of permitted insecticides, fungicides, and physical barriers.

Careful scouting to anticipate problems is critical. Time your first spraying with the initial emergence of pests. If the first population is controlled and not allowed to breed, the need for subsequent spraying declines dramatically.

MAKING USE OF APPROVED INPUTS

After all of the methods discussed so far have been tried or considered without success—crop rotations, planting adjustments, resistant varieties, encouragement of beneficials, sanitation, and exclusion, the organic rules permit you to resort to approved inputs.

A word of caution regarding pest management inputs: first, they tend to be expensive, so you want to use them sparingly. second, the weaker ones don't work all that well, and the strong ones work almost too well—which may result in harmful effects to beneficials and the possibility of developing resistance.

The best organic farmers try to use fewer pest-management materials every year. If you find yourself using more and more each year, you should probably step back and have a look at your whole system to see what else you can do to make things work better.

A short guide to organic pest-management materials: The major classes of organic pesticides are microbials, botanicals, synthetics, and minerals. For more detailed recommendations for specific crops and pests, consult the resources listed at the end of this chapter.

Microbial Insecticides

Microbial insecticides are derived from naturally occurring bacteria, fungi, algae, viruses, or protozoans. They suppress pests by producing a toxin specific to the pest, causing a disease, preventing establishment of other microorganisms through competition, or other modes of action. The most commonly used microbial pesticide is Bacillus thuringiensis, or Bt.

As originally discovered, Bt is toxic to the caterpillars (larvae) of moths and butterflies. Several strains of Bt have been developed that control fly larvae and are used against mosquitoes and blackflies. Other major types of Bt are the Kurstaki strain for caterpillar pests (Dipel, Javelin, Thuricide, MVP and other brands) and the san diego or tenebrionis strain for potato beetle larvae (M-One, M-Trak, Beetle Beater, Novodor and others).

Other microbials are available that work as fungicides, such as Mycostop, a soil drench derived from Streptomyces fungus, and Gliogard, derived from Gliocladium fungus. Both these products are labeled to control root-rotting organisms that cause damping off and similar problems in young seedlings.

A new class of microbial-derived pesticides in organic farming are the spinosads, developed by Dow Chemical under the brand name Entrust. Organic fruit growers have rapidly adopted spinosads for control of pests such as codling moths.

Botanicals

Botanicals are plant-derived materials such as rotenone, pyrethrum, sabadilla, and ryania. Nicotine products, although natural, are not permitted in organic systems due to their high toxicity to animals. Botanicals are generally short-lived in the environment, breaking down rapidly in the presence of light and air. Thus, they provide pest control for only a day or two. Ryania and sabadilla may have some additional residual activity. Botanicals are generally broad-spectrum, so they kill beneficial insects as well.

Garlic and hot pepper extracts—used as repellents, not pesticides—are other botanicals commonly used for organic pest management.

Newer botanical insecticides include products made from extracts of the seeds of the neem tree, native to India. Neem has been used by Indian farmers for centuries. Azadirachtin, the active ingredient of neem extracts, has a very

low mammalian toxicity. It works by inhibiting development of immature stages of many insects and by deterring feeding by adults. Azatin and Align are labeled for many vegetable crops.

Another new botanical that's beginning to see some use in organic farming is orange peel extract.

Synthetics

Synthetic compounds for organic production include soaps and horticultural oil. Soaps are made from potassium salts formulated to act as either insecticides (M-Pede, Safer's Soap) or herbicides (Sharpshooter). Soaps and oils work by dissolving insects' cuticle of protective wax and by smothering soft-bodied insects like aphids and thrips. Application directly onto exposed insects is important. The soap-based insecticides and herbicides are not allowed by all certification groups, so be sure to check with your certifier. Soaps can be toxic to some crops and harmful to some beneficials.

Horticultural and other dormant oils can be petroleum-based but are permitted in organic systems for smothering scale and other insects. There is good evidence that horticultural oils in combination with bicarbonate salts (such as baking soda) can prevent powdery mildew on crops like cucurbits. Stylet oil is one of these. It is good for controlling virus transmissions and many insects.

Some of the best-performing cucurbit powdery mildew controls in our research have been milk sprays. Using milk hand washes is effective in preventing hand transmission of tobacco mosaic virus in tomatoes.

Insect pheromones are a synthetic biochemical product used in organic pest management. However, they are not a pesticide (they don't kill or weaken the insect). Pheromones are naturally occurring chemicals that insects use to locate mates. Synthetic pheromones are used to disrupt insect mating by creating false signals or by luring insects into traps. Pheromone-laced traps are also used to monitor insect populations.

Although disinfectants are not typically considered pesticides, they are important to horticultural production. The synthetic materials chlorine (bleach) and hydrogen peroxide are allowed in organic systems as dilute solutions to disinfect greenhouse surfaces and tools. Iodine in a phosphoric acid solution can also be effective for bacteria control. This material is not caustic to human skin and is used as a disinfectant in organic dairy operations and in the organic ginger industry in Hawaii.

Minerals

Minerals such as sulfur and copper have long been organic mainstays against fungal and bacterial diseases. Some available formulations are Bordeaux mixture, tri-basic copper, copper hydroxide (Kocide), cupric oxide, copper sulfate, elemental sulfur, calcium polysulfide (lime sulfur), and copper-zinc mixtures. Use these products with caution because of potential phytotoxicity, especially at temperatures over 80°F. Copper is being phased out in European organic regulations, and this may be a harbinger for the United States.

Diatomaceous earth (DE) is made from tiny, single-celled organisms called diatoms, the "shells" of which act as a mineral dust that dries out certain soft-bodied insects. It is more widely used in post-harvest applications than in the field. DE can be effective for slug control, and when combined with Bt and applied to corn silk, gives good control of corn earworms.

So-called particle film products for coating plant foliage have been growing in popularity among organic farmers, especially fruit growers. Kaolin clays are the main particle film used in organics. These have been found effective in managing both insect pests and fungal disease. Surround WP is one common brand.

Again, keep in mind that organic standards require that preventive pest-management measures be used before resorting to inputs. And always check with your certifier—before you buy and apply—if you are uncertain about the permissibility of a particular input.

PLANT DISEASE BASICS

Broadly speaking, diseases are a minor problem for most organic grain farmers, a small to medium-size problem for organic vegetable growers and a medium to large problem for organic fruit growers. Organic farmers ranked pest and disease management fourth on a list

of research priorities in the Organic Farming Research Foundation's most recent national survey (2017). Farmers listed weed control, building soil health and fertility, and coping with water management during drought and flooding as major research priorities for US organic farmers.

The prevalence of plant diseases is determined by three factors, sometimes referred to as the "plant disease triangle:"

1. Plant susceptibility
2. Presence of pathogens
3. Environmental conditions favorable to disease development

As farmers, we can minimize disease by paying attention to all of these. We can provide good growing conditions to raise healthy plants that will be less susceptible to disease organisms in the environment. We can choose resistant varieties. We can implement crop rotations, remove diseased plant materials and practice other sanitation controls to limit pathogen populations. And we can alter environmental conditions to reduce disease transmission by using drip irrigation instead of sprinklers, for instance, adjusting planting dates or increasing crop row spacing to allow for better airflow.

Most infectious plant diseases are caused by fungi, bacteria, viruses, or nematodes. As with weeds and insects, not all of these kinds of microbes are bad—there are many species of beneficial nematodes, bacteria, and fungi that attack pest insects, and dozens if not hundreds of microorganisms that help break down plant materials in the soil and make nutrients available to crop plants.

RECOGNIZING DISEASE SYMPTOMS

Plant-disease symptoms include root rots, blights, rusts, smuts, wilting, leaf spots, mottling, and other types of necrosis or dying of plant tissue. Keep in mind that some "sick" plant conditions commonly referred to as diseases are in fact physiological responses to environmental factors such as nutrient deficiencies, waterlogging, or air pollution. An example is blossom-end rot in tomatoes and other crops, which is caused by calcium deficiency.

Again, as with weed and insect management, disease management in organic systems emphasizes prevention over rescue treatments. Choosing crops well-suited to your growing conditions, fostering balanced soil fertility, and scheduling planting to meet optimum soil temperatures for germination can all go a long way toward promoting crop health and avoiding disease. Some disease pathogens, including Fusarium, Pythium, and Phytophthora, benefit from excessive N, which can result from over-application of composts just as readily as from synthetic N sources.

Watch for Drift

Disease-like symptoms can also be caused by herbicide drift, which obviously can be a serious issue for organic growers. Drift of the herbicide 2,4-D can cause symptoms even at very low concentrations on sensitive crops such as grapes and soybeans. If you suspect that your crops have suffered from herbicide drift from a neighboring property, document what you've found by noting the date, taking photos and collecting leaf samples. Talk to your neighbor about what you see and to your certifier. If you're very concerned about drift potential, you should probably re-examine your buffer zones.

ROTATIONS, ROTATIONS, ROTATIONS

We have already talked a lot about the importance of diverse crop rotations in organic farming systems. Disease management is one of the major reasons why. For field crops especially, there's a large group of diseases often called "rotational diseases" because they overwinter in the soil and can readily infect subsequent crops if the rotations aren't long or diverse enough.

In general, rotations can be very effective in limiting diseases harbored in the soil or in crop residues, but are less effective in managing aerial and seedborne diseases. Depending on your local topography and what other types of farms are in your area, you may be able to use some fields as "isolation areas" for crops susceptible to windborne disease.

CHOOSE RESISTANT VARIETIES

Using resistant varieties is more important for disease management than for insect pest management, and more important in organic than in non-organic farming.

Study seed catalogs carefully to identify the traits most important to you. Talk to your fellow growers and make notes on your own experience with disease problems with different varieties. Plant pathologists make a distinction between "tolerance" (the ability of some plants to maintain yields in the presence of a pest or disease) and true "resistance" (the ability to successfully fight off a pest or disease, for instance through the production of special chemical compounds).

Both of these plant defenses work and should be a major consideration as you select the varieties you want to plant from year to year. Together, these kinds of inherited resistance are also referred to as "constitutive" resistance, as opposed to "acquired" or "induced" resistance, another set of mechanisms by which plants can fight off pests and pathogens. We talked about "systemic acquired resistance" briefly in the previous section of this chapter.

RESEARCH

Plant breeders talk about two types of resistance exhibited by plants: vertical and horizontal. Vertical resistance is relatively easy for breeders to work with because it usually involves a small number of genes. The downside is that because it relies on just a few genes, it can be overcome fairly easily by evolutionary change on the part of the pathogen. This is why breeders are constantly developing and releasing new crop varieties.

Horizontal resistance is conferred by multiple genes and is thus much more stable. It's also more challenging to work with and has been largely ignored by mainstream breeding programs. (It's also difficult to patent, making it much less commercially attractive.) Advocates of horizontal resistance consider that it is particularly well suited to organic farming systems.

KEEP IT CLEAN

The next major element of a successful organic disease-management program is sanitation. Sanitation can take many forms and is applicable to nearly every stage of the growing cycle, from seed to harvest. Organic farmers must be particularly careful to avoid disease-infested seed and seedlings, since organic seed and plant producers cannot use the standard chemicals to sanitize their stock. Check out your potential seed and transplant sources carefully, and consider using hot-water treatments to sanitize seed yourself. (Note: Follow specific directions for this practice, since hot water can damage seed viability.)

Sanitation is fundamentally a preventive strategy, although it can be part of rescue treatments as well. Other examples of good sanitation practices include:

- Pruning and destroying diseased plant parts
- Prevention and elimination of disease-hosting weeds
- Prevention of volunteers from previous crops that can carry diseases into subsequent seasons
- Cleaning and disinfecting tools and equipment, including seedling flats and tomato stakes
- Avoiding movement of soil or tools from diseased areas to disease-free areas on the farm
- Asking visitors to the farm to disinfect their boots or shoes
- Isolating new livestock downwind for a period of time before introducing them to the remainder of the farm
- Deep tillage to bury diseased crop residue (although this should be balanced against the value of leaving residues on the surface to protect soils from erosion)

GET AN IDENTIFICATION

When you do encounter a disease problem, obtaining a good diagnosis is the first step toward figuring out how to correct it. Keep in mind that

the symptoms of many diseases can look similar, so expert analysis is sometimes needed.

Once you have an identification, you can start to understand the pathogen's life cycle and then think about how to interrupt that cycle so as to minimize its impact on your crops. Organic disease management can come down to small, simple things like cutting broccoli heads off at an angle so that water won't collect on the stalk surface left behind or creating a place for brassica head rot bacteria to collect and reproduce. It is also essential to have well-trained employees who will follow good harvesting and other sanitation practices and who will keep an eye out for emerging symptoms while they are in the fields.

CULTURAL DISEASE MANAGEMENT

For fruit and vegetable crops, and to a lesser extent, field crops, managing your plant spacings and "crop architecture" to promote good airflow can go a long way toward minimizing disease. Growing soybeans in rows instead of a solid stand is a good example. It can also help to plant crop rows parallel to the direction of prevailing winds. Grapes and fruit trees that are well pruned and trained are usually less susceptible to diseases. Although it is labor-intensive, staking tomatoes and even eggplants and peppers can pay off in terms of reduced disease levels and harvesting efficiency.

Irrigation methods also play a major role in disease development and severity. Using drip irrigation instead of overhead sprinklers, or irrigating at night so foliage can dry off in the daytime will make your crops a less inviting environment for many diseases. Harvesting tomatoes later in the day, after the dew has dried off the foliage, is critical to preventing spread of diseases.

The effectiveness of straw mulches in reducing splash-borne diseases in potatoes and strawberries has been demonstrated by researchers. Many vegetable crop diseases thrive in wet conditions and can be minimized by planting on raised beds to improve drainage. Row covers can also be effective for limiting diseases, especially those spread by insect vectors, like cucumber beetle-induced bacterial wilt in cucurbits.

Another positive development is the interaction taking place between organic farmers, researchers and integrated pest management. Although most IPM programs include occasional use of synthetic inputs off limits to organic producers, many extension services and consultants now offer recommendations specifically tailored to organic systems.

Tree fruit growers who have transitioned to organic are applying their knowledge of IPM monitoring techniques to organic systems, making organic materials more effective, for instance, by timing applications to the most vulnerable stages of pest and disease life cycles.

Photo Credit: Greg Endres

Planting soybeans in rows rather than a solid stand is one good way to minimize disease.

THE ROLE OF COMPOST

One reason why crop diseases seem to be less of a problem for organic farmers than for non-organic farmers has to do with the influence of compost. As discussed in the Soils chapter, compost is a living biological substance containing tens of thousands of microbes all feeding on one another and contributing to the complex soil food web. Because most organic farmers make regular use of composts of one type or another (along with other good soil-management practices like

crop rotations and green manures), organically managed soils are more likely to host a range of beneficial microorganisms that can help keep pathogens in check.

These effects are well documented by scientific studies. Soilborne root diseases, for example, have been shown to be less severe in organically grown crops than in non-organic ones. Composts have also been shown to promote "induced resistance" in crops to certain pathogens. In one experiment, composts applied to soils induced resistance to a fungal disease in plant foliage as well as root resistance to the soilborne disease Pythium.

There are a few diseases and pests, such as Rhizoctonia and symphylans, which enjoy the high soil organic matter levels promoted by organic management and can be difficult to manage. On the whole, though, organic farming will put you ahead on the disease front. Sometimes you just have to take the bad with the good.

Given the strong evidence that composts can keep some diseases at bay, it is not surprising that compost teas have attracted a lot of attention as a potential disease-management material. Compost teas are "brewed" by soaking compost in water, often in special aerated tanks and with additional ingredients such as dried molasses or fish oil.

RESEARCH

Rodale Institute conducted a two- year study of compost tea's effectiveness in suppressing disease in grapes, pumpkins and potatoes. Results were mixed. The tea showed some ability to limit powdery mildew in grapes, but had no effect against diseases in pumpkins. The tea had a positive impact on plant health and yields in potatoes in one year, but not the other. Overall, we concluded that while compost teas alone do not make for an effective plant health program, they can complement other measures.

WEATHER MONITORING

Weather monitoring can be a critical part of an integrated pest-management program. New technologies make it possible to use small, computerized weather stations at different points on your farm to help anticipate pest and disease pressures. By collecting temperature, humidity, wind, and leaf wetness data and then analyzing them with special software, such weather stations can project apple scab and fire-blight potential, for instance.

Doing your own weather monitoring is important because disease conditions in your orchard or on your farm can be different from those predicted by the local extension agent's weather data.

SUMMARY

You, too, will gain entomology experience as you identify pests on your farm. Pay close attention to signs of pest activity in crops. Watch to see if they spread. Take action before the level of damage exceeds what you can tolerate for the markets you're targeting.

Look for pest-resistant varieties. Focus on prevention and the use of cultural pest-management methods. If all else fails, consider the use of approved inputs.

Disease management begins with understanding plant disease basics. Remember, the prevalence of plant diseases is determined by the plant disease triangle: plant susceptibility, the presence of pathogens, and environmental conditions favorable to disease development. Learn to pay attention to all these factors. Select

Photo Credit: Scott Bauer

Potato beetle

disease-tolerant or resistant plant varieties when possible. Observe good sanitation practices.

Last but certainly not least, don't forget to fill out the pest and disease management sections of your Organic System Plan.

LESSON 5: WILDCRAFTING

OVERVIEW

Although it may seem logical to assume that any crop harvested in the wild should qualify as organic, in practice "wild" areas are highly variable and may be subject to contamination. For example, roadsides can be contaminated with heavy metals and soot from vehicle exhaust. Many railroad embankments and power line rights-of-way are sprayed with herbicides periodically. As a result, wildcrafted crops must meet organic regulations if they are to be sold as organic.

The list of crops for potential wildcrafting is long and varied. Some of the more common are mushrooms, tree nuts, and wild rice. Certain types of algae used in organic food processing are harvested from natural lakes in southern Oregon. Non-food crops like prairie plant seed can also be wildcrafted.

Strong markets exist for a wide variety of wildcrafted, native annual and perennial herbs.

WHAT THE STANDARDS SAY ABOUT WILDCRAFTING

The "Wild crop harvesting practice standard" (§205.207) is among the shortest sections in the federal organic regulation. It includes two key requirements. Crops must be harvested:

- "from a designated area that has had no prohibited substance ... applied to it for a period of three years immediately preceding the harvest of the wild crop;"
- "in a manner that ensures that such harvesting or gathering will not be destructive to the environment and will sustain the growth and production of the wild crop."

Organic crops harvested in the wild can thus come from land that is not itself technically certified, although it must meet the same basic requirements as certified acreage. Certifiers may ask for harvest locations, field management histories, descriptions of buffer zones, and/or affidavits of adjoining land use. They will want to know about your harvesting methods and crop handling practices.

If the land you are harvesting from is not your own, it is a good idea to obtain written permission from the landowner. Depending on the crop and the location, you may need to obtain other forms of documentation as well. For example, in some states, a permit is required to collect wild ginseng. Regulations like these exist to protect wild plant resources from over-harvesting.

RESEARCH YOUR MARKETS FIRST

Wildcrafting can be a terrific way to diversify your farm income. Think of it as a bonus for managing your farm in a way that protects and nurtures wild species. Or as an excuse to go for a

GLOSSARY TERMS

Prohibited substance: A substance the use of which in any aspect of organic production or handling is prohibited or not provided for in the Act or the regulations of this part. *(NOP definition)*

TO CERTIFY?

A key question for wildcrafters is whether organic status is necessary for a given market. In Missouri, for instance, a group called the Missouri Northern Pecan Growers obtained organic certification for its members' sustainably managed wild pecan groves. Ranging in size from two to 500 acres, the groves are self-sown but actively managed through thinning and pruning.

For these growers, certification has been key to market development—sales quadrupled in two years, and they've begun selling overseas. Some Native American wild rice harvesters in northern Minnesota, on the other hand, have chosen not to seek organic certification, focusing instead on fair trade and other types of authentication.

walk in the woods on a beautiful spring morning. Or as a way to share with your customers some of the best things about farming as a way of life, from finding mushrooms to making dandelion wine. Wild-harvesting can also play a role in neighborhood bartering networks.

But before you go gathering more than you and your family can immediately use, research your markets. Here on the East Coast, the company Herbalist & Alchemist purchases organically grown and ethically gathered plants for the production of whole plant extracts and other herbal products. The following is a short list of herb companies to contact for potential marketing of wildcrafted or homegrown herbs. Many other good companies exist as well.

AmeriHerb, Inc.: Bulk herbs and spices, 500+ organic and wildcrafted herbs. Phone: 800-267-6141, http://www.ameriherb.com/

Herbalist & Alchemist: Compound herbal formulas, single herb extracts, tea blends and bulk herbs, oils and ointments, educational materials. Phone: 908-689-9020, http://www.Herbalist-alchemist.com

Jean's Greens: Organic and wildcrafted herbs, herbal teas, tinctures, and bulk essential oils. Phone: 888-845-TEAS (8327), http://www.jeansgreens.com

Mountain Rose Herbs: Bulk herbs, herbal oils, herbal extracts, and teas. Phone: 800-879-3337, http://www.mountainroseherbs.com

San Francisco Herb Co.: Quality herbs and green teas. http://www.sfherb.com

FARMER-TO-FARMER

"We have elderberry trees on our farm entirely by accident. Seeing the boughs loaded made me wonder how I might sell the berries. I've taken them to the farmers market in San Francisco, where the purple berries add a dash of novelty to our stall, and some chefs have purchased them to jazz up their menus. For me, the most fun has been inviting customers out to the farm to pick their own."

—Andy Griffin
Watsonville, CA

KNOW YOUR NATIVE ZONE

One reason there's a strong market for wild-harvested herbs is that many people believe wild herbs are purer and more potent than cultivated varieties. Rodale Institute wildcrafts many of the following species in the native woodlands that form part of our Pennsylvania farm. Use the resources listed at the end of this chapter to create a similar list for your area.

- Barberry (Berberis vulgaris)
- Bayberry (Morella cerifera)
- Blackberry (Rubus fruticosus)
- Black cohosh (Cimicifuga racemosa)
- Black haw (Viburnum prunifolium)
- Black walnut (Juglans nigra)
- Blue cohosh (Caulophyllum thalictroides)
- Blue vervain (Verbena hastata)
- Boneset (Eupatorium perfoliatum)
- Burdock root (Arctium lappa)
- Butternut (Juglans cinerea)
- Chickweed (Stellaria media)
- Dandelion (Taraxacum officinale)
- Elderberry, elderflower (Sambucus nigra subsp. canadensis)
- Ginkgo (Ginkgo biloba)
- Goldenseal (Hydrastis canadensis)
- Hawthorn (Crataegus spp.)
- Horsetail (Equisetum arvense)
- Juniper berry (Juniperus communis)
- Lobelia (Lobelia inflata)
- Mullein (Verbascum thapsus)
- Peppermint (Mentha x piperita)
- Raspberry (Rubus idaeus)
- Solomon's seal (Polygonatum biflorum)
- St. John's wort (Hypericum perforatum)
- Stinging nettle (Urtica dioica)

TEN RULES FOR WILDCRAFTING

1. Prepare by taking an herb (or mushroom or tree) identification course, studying guidebooks, or crafting with an

experienced wildcrafter to become familiar with wild plants.

2. Keep a journal to record plants identified, the condition of the population, and precise locations, dates and amounts harvested. This is critical for certification and will also help you find the plants more easily the following year.
3. Become familiar with the poisonous plants that grow in your area and be aware of look-alikes.
4. Seek permission for collecting at a site. You may need a permit to harvest on public lands.
5. Do not harvest endangered, protected, or sensitive-to-disturbance species. Check with the U.S. Fish and Wildlife Service, the Department of Agriculture, and/or the Native Plant Society to determine plants that are federally protected. When in doubt, leave the plants alone.
6. A wildcrafter should never damage or deplete a plant community. Guidelines for sustainable harvesting recommend taking at most one in three or one in four individuals in a stand. Many crafters take only one in 10 in order to maintain the ecological and aesthetic balance of the site.
7. Never harvest more than you can process promptly.
8. Harvest only healthy specimens that are not contaminated in any way.
9. Consider your impact on the land before you harvest. Fill in any holes and clean up any debris—the area should be left in pristine condition. Minimize disturbance to insects, animals, and plant pollinators.
10. Process harvested plants as soon as possible after they have been gathered. Plant material must be fresh and unspoiled for the best-quality medicine or product.

THEWILDCRAFTER'SETHIC

The second part of the NOP wild- harvesting standard—the part about harvesting so as not to damage the wild population—is obviously open to interpretation. Fortunately, the wildcrafting community has developed its own set of guidelines congruent with the NOP Standards, and the ethics of wildcrafting are more or less commonsense once you start thinking along ecological lines. Mushroomers use mesh bags to bring their "crops" in from the fields, for example, so that spores from the mushrooms can disperse through the woods.

SUMMARY

In the process of wildcrafting, be mindful of the fact that wild areas are highly variable and may be subject to significant potential contamination. If you harvest crops in the wild, make sure they meet organic regulations if you want to sell them as organic. Be aware that roadsides can be contaminated with herbicides, heavy metals, and soot from vehicle exhaust.

If you intend to seek organic certification for any wild-harvested crops, take some time now to fill out the relevant question in Section 5 of your Organic System Plan.

CONCLUSION

This concludes the Crops chapter. Plan your crop rotations carefully, making sure your rotation plan has the right crops that will give the right soil impact. Think about the economic viability of your crop rotation plan and your resources. Try to use rotations that suppress weeds. Think about delaying tillage to give seed predators more time to feast on weed seeds.

When you source seed, research and double-check seed packages or bags before purchasing. Make sure you source seed and planting stock in accordance with NOP regulations.

Brush up on your entomology skills as you identify pests on your farm. Give beneficials a chance to bring pests into balance, but take action before the level of damage exceeds what you can tolerate for the markets you are targeting for that crop.

Select pest-tolerant and disease-tolerant or resistant plant varieties when possible. Observe sanitation rules, and focus on prevention. Emphasize cultural pest- management methods. If

all else fails, consider the use of approved inputs.

You can use what you've been learning in this chapter to work on sections 2, 3, 4 and 6 of your Organic System Plan.

RESOURCES

Resources are free online unless otherwise noted.

GENERAL

The New Organic Grower
By Eliot Coleman
(Chelsea Green Publishing, 1989)
The new generation market gardener's bible. Although some details have been improved upon by others, this sets the standard for meticulous, well-planned small-scale organic vegetable production.
$24.95, 352 pp.

COVER CROPS AND CROP ROTATIONS

Managing Cover Crops Profitably
Edited by Greg Bowman
(Sustainable Agriculture Network, 1998)
Called "the most comprehensive book ever published on the use of cover crops to sustain cropping systems and build soil." Provides detailed information on top regional species, performance statistics, cultural traits, planting specifics, pros and cons of 18 different leguminous and non-legume cover crops. $19.00, 212 pp.

Guide to the Expert Farmers' DACUM Chart for Managing Crop Rotation Systems
(Northeast Organic Network, 2002)
The NEON project gathered 12 experienced organic vegetable farmers, put them in a room and produced this stunning chart outlining real-life, practical 4- and 5-year crop rotation sequences with multiple variations. A real head-scratcher, in the best possible way. (free download, 4 pp. PDF format)

SEEDS & PLANTS RESOURCES

High Tunnels: Using Low-Cost Technology to Increase Yields, Improve Quality and Extend the Season
By Ted Blomgren and Tracy Frisch
(University of Vermont Center for Sustainable Agriculture, 2007)
Includes sections on site selection, construction, environmental management, soil and crop management, pest management and marketing. Also features case studies of six different farmers using high tunnels. Free download, 75 pp.

Four-Season Harvest
By Eliot Coleman
(Chelsea Green Publishing, 1992)
A guide to raising winter vegetables at the 44th parallel, in tunnel greenhouses and cold-frames without supplementary heat.
($24.95, 236 pp.)

WEED MANAGEMENT

Integrated Weed Management: "One Year's Seeding..."
Edited by Adam Davis
(Michigan State University Extension Bulletin E-2931, 2005)
Probably the best extension publication on the topic. Combines farmer tips, cutting-edge research results and helpful illustrations. Also includes herbicide guidelines for organic and reduced input management and species profiles for a dozen problem weeds. $13.75, 120 pp.

"Principles of Sustainable Weed Management for Croplands"
By Preston Sullivan
(NCAT/ATTRA, 2003)
A bulletin discussing the basics of weed ecology, cropping system design to minimize weed pressure and alternative weed management methods such as flameweeding and weeder geese.
(Free download,15 pp. PDF format)

Vegetable Farmers and Their Weed Control Machines
(University of Vermont Extension, n.d.)
A 75-minute video on cultivation and

flameweeding equipment as used by nine farmers in three Northeast states.
($15 DVD, $5 VHS)

PEST AND DISEASE MANAGEMENT

ATTRA's Pest Management Resources Page
Includes many valuable short publications on specific disease management issues, including "Organic Control of White Mold on Soybeans," "Notes on Compost Teas," "Use of Baking Soda as a Fungicide," "Downy Mildew Control in Cucurbits," and "Organic Alternatives for Late Blight Control on Potatoes." A longer, more general ATTRA publication is their resource on Biointensive Integrated Pest Management. (free downloads, PDF format)

Manage Insects on Your Farm: A Guide to Ecological Strategies
By Miguel A. Altieri and Clara I. Nicholls with Marlene A. Fritz
(Sustainable Agriculture Network, 2005)
Contains a number of strategies for controlling pest insect populations through the management of beneficial predator populations, and stresses increasing above- and below-ground diversity, enhancing plants' natural defenses, and managing soil as means to this end. $15.95, 128 pp., also available for free download, PDF format

WILD-CRAFTING

The EchoHerbalists Fieldbook: Wild-crafting in the Mountain West.
By Gregory Tilford
(Mountain Weed Publishers, 1993) $24.50, 295 pp.

The Encyclopedia of Edible Plants of North America
By Francis Couplan
(Keats Publishing, 1998)
Details over 4,000 edible wild plant species, their distribution and general edibility; a truly encyclopedic resource in one handy volume.
$19.95, 570 pp.

Identifying and Harvesting Edible and Medicinal Plants in Wild (and Not So Wild) Places
By Steve Brill
(HarperCollins, 2002)
Features information on finding and using more than 500 different wild plants medicinally and for general health, and includes more than 260 detailed line drawings and over 30 different recipes. $23.00, 336 pp.

Medicinal Wild Plants of the Prairie: An Ethnobotanical Guide
By Kelly Kindscher
(University Press of Kansas, 1992)

Planting the Future: Saving Our Medicinal Herbs
By Rosemary Gladstar and Pamela Hirsch
(Healing Arts Press, 2000)

CHAPTER 4

LIVESTOCK

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Photo Credit: Jack Sherman

CHAPTER 4

LIVESTOCK

INTRODUCTION

OVERVIEW

Organic animal husbandry represents one of the strongest growth areas in agriculture today. Consumer demand for organic meat, milk and eggs continues to increase, and as a result, organic commodity buyers are actively recruiting farmers in many parts of the country.

Having animals on an organic farm fosters integrated farming systems in which nutrients are cycled through animals, and manures (composted or uncomposted) are returned to pastures and fields to maintain soil fertility. Grazing or browsing livestock can make use of marginal land not suitable for row crop production, can assist with weed management and can help distribute income and workload throughout the year. Livestock can also add flexibility to your operation, enabling you to sell crops directly or feed them through animals as market conditions or other factors shift.

This chapter explains the National Organic Program Standards as they apply to livestock production. We'll discuss the transition process, feed requirements, living conditions, health care practices and basic processing rules. At the end of this chapter, you'll have the opportunity to complete your Organic Livestock Plan using our customized online tool.

Even if you don't have livestock now, I encourage you to read through this chapter. You may choose to acquire livestock later, you may wish to sell organic livestock feed or you may rent pasture to another organic farmer. In any case, it's important to understand organic livestock regulations.

Photo Credit: Jack Sherman

LESSON 1: BASICS

OVERVIEW

The challenges involved in transitioning to organic livestock management will depend a lot on how your current system is set up. Generally speaking, organic standards favor pasture-based systems, as they tend to be less input-intensive and place a strong emphasis on honoring the animals' natural behaviors. In fact, access to pasture is required for organic ruminants. The following steps can guide your transition to organic livestock production.

1. Study the NOP Standards as they relate to livestock. Talk to your certifier about specific requirements.
2. Research organic livestock systems for the species you're interested in. Talk to other organic producers in your area or attend field days and conferences.
3. Assess your resources, including buildings, fences, pasture and cropland, labor, expertise and breed genetics. What changes will you need to make?
4. Design your organic livestock plan. Work it out on paper first. Make low-cost alterations first, saving more-significant investments for later, after you've gained more experience.
5. Make sure you have a reliable source of organic feed. A good diet is critical to livestock health. Whether you raise your own feed or not, it's a good idea to have backup sources in case of an emergency.
6. Establish an appropriate recordkeeping system. You should be able to track each animal or flock from birth to slaughter (or sale), account for all feed produced or purchased, and document all health treatments.
7. Discontinue prohibited practices. For many farmers, transitioning involves culling animals that seem to be susceptible to health problems such as lice or parasites. But giving up conventional veterinary medicines also means figuring out how to improve living and feeding conditions to foster good health among the herd or flock.
8. Take another look at your whole system to identify possible improvements, from breeding to manure management.

GLOSSARY TERMS

Ruminant: An even-toed ungulate mammal that chews the cud regurgitated from its rumen. The ruminants comprise the cattle, sheep, antelopes, deer, giraffes, and their relatives.

WHAT THE STANDARDS SAY ABOUT THE ORIGINS OF LIVESTOCK

Section 205.236 of the NOP Standards states that, to be sold as organic, an animal must be managed organically for its entire life plus a third of its time in the womb. Special circumstances apply for poultry, breeder stock, and dairy animals, as follows:

- Poultry must be managed organically from the second day of life.
- Breeder stock "may be brought from a non-organic operation onto an organic operation at any time" (§205.236(a)(3)). Bulls, rams, billy goats, etc., do not need to be managed organically. Of course, if you buy a non-organic pregnant ewe and you want to sell its offspring as organic, you must bring the ewe to the farm prior to the last third of gestation, and you must manage it organically from then on.
- Dairy animals must be managed organically for a full year prior to the sale of any milk or milk products as organic. Once a farm's entire herd has been converted to organic, all dairy animals on the farm must be managed organically from the last third of gestation. In other words, it's not okay to move your organic heifer calves to non-organic feed for the first part of their young lives, then shift them back to organic feed one year prior to their first lactation.

Once they've transitioned, some organic farmers seek to keep a closed herd in order to minimize the possibility of introducing disease organisms with new stock. Note that artificial insemination (AI) is allowed under organic standards, but the use of hormones to regulate breeding cycles is not.

WHAT THE STANDARDS SAY ABOUT FEED

The "Livestock feed" standard (Section 205.237) of the NOP Standards states that organic livestock managers must provide 100% organically produced feed, including pasture and forage.

Organic feed is expensive, so for the highest profitability, you'll want to raise as much as possible yourself. Many organic livestock producers move toward a more forage-based system as they improve the nutrient quality of their forages and find forage-based systems more economically profitable. Obviously, some species, such as hogs and poultry, require a more grain-intensive diet than others.

NOP Standards also specifically prohibit the following feeding practices:

- Use of drugs or hormones as growth promoters
- Use of feed supplements or additives in excess of animals' nutritional requirements
- Feeding plastic pellets for roughage
- Feeding formulas containing urea or manure
- Feeding mammalian or poultry slaughter byproducts to mammals or poultry
- Use of any feed, feed additive, or feed supplement in violation of the Federal Food, Drug and Cosmetic Act.

GLOSSARY TERMS

Breeder Stock: Female livestock whose offspring may be incorporated into an organic operation at the time of their birth. *(NOP definition)*

Feed: An even-toed ungulate mammal that chews the cud regurgitated from its rumen. The ruminants comprise the cattle, sheep, antelopes, deer, giraffes, and their relatives.

Forage: An even-toed ungulate mammal that chews the cud regurgitated from its rumen. The ruminants comprise the cattle, sheep, antelopes, deer, giraffes, and their relatives.

Manure: An even-toed ungulate mammal that chews the cud regurgitated from its rumen. The ruminants comprise the cattle, sheep, antelopes, deer, giraffes, and their relatives.

FEED ADDITIVES AND SUPPLEMENTS

Section 205.603 of the Standards lists "synthetic substances allowed for use in organic livestock production." Permitted feed additives include copper sulfate and magnesium sulfate used as trace minerals, and FDA-approved vitamins "for enrichment and fortification." Vitamins and minerals approved by the Association of American Feed Control Officials (AAFCO) are also allowed in organic livestock production.

> **!** Allowed synthetic substances for organic crop and livestock production are subject to change. It's essential to keep in touch with your certifier and other organic news sources to stay informed of these new developments.

A notable permitted synthetic feed additive in poultry production is methionine, an essential amino acid that is typically lacking in standard poultry rations and is currently unavailable in a usable natural form. Researchers at the Michael Fields Institute are working to breed a high-methionine corn to help address this problem.

The use of milk replacers of any kind is disallowed for organic production. Commercial, synthetic silage preservatives are also prohibited. Only silage inoculants containing naturally occurring beneficial microbes are allowed.

FEEDING DAIRY HERDS THROUGH THE TRANSITION

A lot of debate has surrounded the question of how the NOP Standards' requirement for 100% organic feed intersects with the transition process for dairy farmers. This has been settled: they must be fed organic forage and grain throughout the transition period. This means that feed and forage cannot come from fields that are in the process of transitioning and must come from sources that are already fully organic.

FEED QUALITY IS PARAMOUNT

To be successful as an organic livestock producer, you need to do a lot more than just

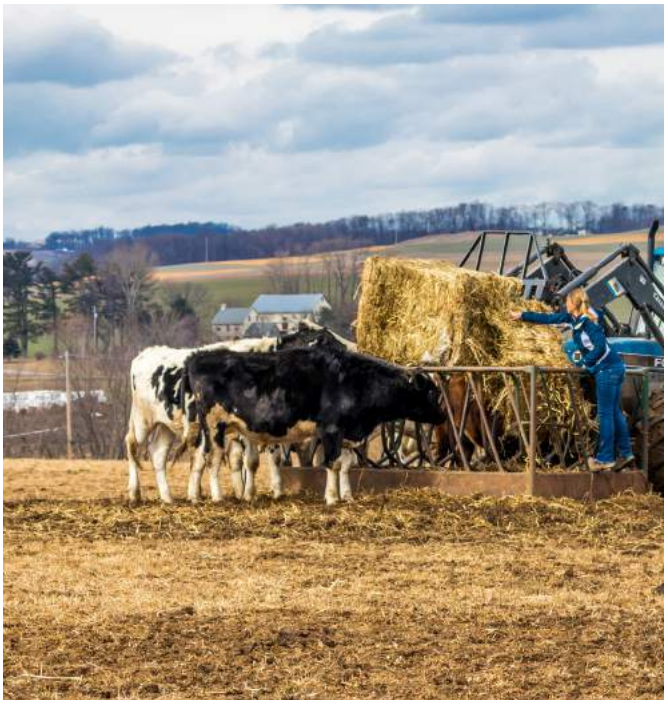

Photo Credit: Jack Sherman

provide 100% organic feed. It has to be top-quality organic feed, rich in nutrients, not just feed produced without chemicals.

Sure, you may be able to save money in the short term by feeding a cheaper, low-quality feed. However, if the feed fails to give the animals what they need nutritionally and physiologically, you'll end up paying in the long run through poor animal performance.

For stored feeds, quality depends not just on what you grow but also on how you handle and store it. Do everything you can to become a good haymaker so that you harvest the crop at its highest nutrient levels. It's worthwhile to obtain protein analyses of your different hay cuttings so you can accurately calculate rations.

It's also important to consider how your animals' nutritional needs change through different life stages. A growing calf will obviously need different feed quality and quantity than a milking cow, dry cow, or steer. We'll talk more about feed considerations for different types of livestock at the end of this chapter.

Your Organic Livestock Plan should outline backup strategies for sourcing organic feed in case of a crop failure or other emergency. For recordkeeping purposes, you must file and save all feed labels, receipts and other documentation.

WATER

Clean, plentiful water is also essential for successful organic livestock management. In most situations, this means providing access to fresh water for all animals at all times. NOP Standards stipulate free access to clean, fresh water as an aspect of humane living conditions. However, water tests are not specifically required. Tests may be required for water that's used for cleaning, however.

Watering systems should be sanitized regularly with an organic-approved sanitizer to prevent the spread of disease. Annual water testing is required for any on-farm processing and handling operations. Experienced organic dairy veterinarians say you shouldn't be offering your animals any water you wouldn't drink yourself.

The Organic Livestock Plan forms contain a number of questions related to your livestock's water resources, including:

- Sources of water for livestock use
- Contamination threats to your water source(s), e.g., pesticide or fertilizer runoff, industrial pollution, etc.
- Water testing for coliform bacteria and nitrates
- Any water additives, if you use them, such as hydrogen peroxide
- Livestock access to surface water, and, if applicable, how you prevent bank erosion and degradation of water quality

SUMMARY

Shifting to organic livestock production requires careful planning. You may need to make changes to your infrastructure, marketing strategies and recordkeeping systems as well as to your crop and livestock management methods. Talk to other producers, sustainable agriculture education groups and certification agencies before beginning your transition.

Poultry must be managed organically from day two of life to be sold as organic. Larger livestock must be managed organically from the last third of gestation. Existing dairy herds may be converted with the farm on a one-time-only basis, with a full year of organic management elapsing prior to the sale of any organic dairy products. Male breeder stock (bulls, rams, etc.) do not need to be managed organically and/or can be transitioned at any time. Be sure to obtain necessary documentation of organic status for any organic animals you purchase.

NOP Standards require that organic livestock be fed 100% organic feed. Have a backup plan for alternate organic feed sources in case of a crop failure or other emergency. Any feed additives used must be in compliance with the Standards. Milk replacers, synthetic silage preservatives and growth- promoting hormones are all prohibited.

If you're planning on seeking certification for an organic livestock operation, now would be a great time for you to start filling out your Organic Livestock Plan using our electronic Organic System Plan tool. Some certifiers combine organic crop and livestock information into a single set of forms, but many ask you to complete both forms if you intend to sell both crops and livestock products as organic.

LESSON 2: HEALTH CARE

OVERVIEW

Prevention is the key to a healthy livestock operation. I encourage you to be observant and to recognize the signs of illness and stress in animals. I think it is important to monitor each animal at least once a day. Remember, it's really important to promote health through high-quality feed, healthy pastures and low-stress living situations. Medical treatment must be utilized when needed.

Just as successful organic crops start with healthy soil, a successful organic livestock operation starts with healthy animals. This requires close and careful attention to animal condition by someone who recognizes the signs of vigor as well as the signs of stress, infection,

GLOSSARY TERMS

Pesticide: Any substance which alone, in chemical combination, or in any formulation with one or more substances is defined as a pesticide in section 2(u) of the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136(u) et seq). *(NOP definition)*

nutritional deficiencies and other problems.

Your system should be set up so that you or someone you trust sees every animal on a regular basis—usually daily, if not more often. The key to organic animal husbandry is preventive health care, and the key to preventive health care is well-informed monitoring of livestock that has been provided a supportive, healthful environment.

Animals are like people—sometimes we get a little stressed out or rundown, and that's when we're most susceptible to illness. If we can get some rest, relax and eat properly, usually we can fight off serious illness before it takes hold. You have to be a good enough manager to notice when an animal isn't quite right. In organic farming, there's no substitute for observation. Due to their many differences, each species on your farm will require a different level and type of observation.

WHAT THE STANDARDS SAY ABOUT LIVESTOCK HEALTH CARE

In keeping with the fundamental principles of organic agriculture, the NOP Standards require that livestock producers rely first and foremost on preventive methods for livestock health care, as outlined in (§205.238):

9. Selection of suitable species and breeds with strong natural resistance to common disorders
10. Offering a well-balanced ration to meet all nutritional requirements
11. Provision of appropriate housing and high-quality pasture to allow necessary exercise and relaxation
12. Good sanitation
13. Judicious and humane use of physical alteration practices
14. Use of vaccines and biologics

We'll talk more about these methods in a moment.

When preventive practices are not enough, synthetic medications may be used, provided they are allowed under §205.603. Use of hormones for growth promotion is prohibited, as is the routine use of synthetic parasiticides or any animal drug in the absence of illness.

Antibiotics are also prohibited in organic livestock production—any animal treated with antibiotics must be permanently removed from the organic herd. Necessary medical treatment should never be withheld from a sick animal in order to preserve its organic status, however.

SELECT WELL-ADAPTED SPECIES AND BREEDS

Many organic farmers report switching breeds in conjunction with transitioning to organic. Older dairy breeds such as the Dexter, Dutch Belted and Ayrshire are gaining renewed interest among organic dairy people looking for traits like longevity, hardiness, thriftiness and willingness to graze. Organic pig farmers favor breeds that show good mothering characteristics, and often choose colored breeds for pasture-based systems (since white breeds can suffer from sunburn).

Crossbreeding is also popular with organic producers, taking advantage of hybrid vigor. Many an organic herd is made up of a colorful mixture of crossbred Jersey, Brown Swiss, Guernsey and others. Some organic farmers report success importing Holstein semen from New Zealand,

GLOSSARY TERMS

Livestock: Any cattle, sheep, goat, swine, poultry, or equine animals used for food or in the production of food, fiber, feed, or other agricultural-based consumer products; wild or domesticated game; or other nonplant life, except such term shall not include aquatic animals or bees for the production of food, fiber, feed, or other agricultural-based consumer products. *(NOP definition)*

Biologics: All viruses, serums, toxins, and analogous products of natural or synthetic origin, such as diagnostics, antitoxins, vaccines, live microorganisms, killed microorganisms, and the antigenic or immunizing components of microorganisms intended for use in the diagnosis, treatment, or prevention of diseases of animals. *(NOP definition)*

Parasiticide: A substance used in medicine and veterinary medicine to kill parasites (especially those other than bacteria or fungi).

where virtually all dairies are grass-based and animals are selected for success on a grass diet.

Within most breeds, there will be individuals with the characteristics necessary for sound organic livestock production. The challenge lies in knowing what phenotypic traits to look for. Animal frame size, eating preferences and reproductive traits can all be favored through breed selection. Culling individuals with recurrent problems and selecting individuals that thrive under the conditions you wish to establish will gradually build up the genetics you need.

MINIMIZE STRESS

One of the best ways to keep your animals healthy is to keep them happy. Contented, well-cared-for animals don't get sick as often. For the most part, the organic standards' requirement to "provide living conditions in keeping with the natural behaviors of the animal and appropriate for its stage of life" implies the provision of low-stress conditions.

Reducing stress also means being aware of animals' social needs and paying attention to the dynamics of your livestock group. Most domesticated livestock species are social animals and need to establish rank and alliances within the herd. For most species, isolation of individuals can cause stress.

Stress can also come from negative interactions with people. Make sure everyone employed on your farm knows how to work with the types of animals in your operation and treats them well. Different species demand different treatment. Protecting your animals from heat and flies will also reduce stress.

For help, check out livestock specialist Dr. Temple Grandin's website for tips on low-stress animal handling and facility design.

PROVIDE PASTURE FOR RUMINANTS

The NOP Standards require that ruminants be on pasture in order to be certified. Many farmers find that pasture-based systems are well-suited to organic production, for a number of reasons. Click here to read the NOSB's recommendations on the subject.

Pasture-based systems emphasize lowering inputs, increasing efficiency and basing the health of the whole system on the health of the soil. High organic matter and balanced soil mineral levels make for healthy pasture and, in turn, for healthy animals.

Many—although not all—organic livestock farmers practice some form of rotational or management-intensive grazing (MIG). In MIG systems, pastures are divided into several small paddocks, often using temporary electric fencing. The animals are grazed at high densities for short periods of time before being moved on to a fresh paddock. Grazed paddocks are allowed to regrow with no animal pressure until ready to be harvested by animals again.

Short-term, high-density grazing can help keep weeds from taking hold (although mowing is sometimes called for). It allows grasses and other pasture species time to regenerate between grazing events, and it gives livestock a steady supply of fresh pasture to graze. It can also be used to reduce the spread of parasites, since most parasites will die over a period of time in the absence of an animal host.

Grazing periods in MIG systems typically range from twelve hours to five or six days; rest periods can range from ten days to a year or even longer, depending on climatic conditions.

HEALTH CARE WITHOUT ANTIBIOTICS

The ban on antibiotics as a health-care tool in organic livestock production is one of the issues perceived to be most challenging by transitioning livestock farmers.

Just as in organic crop systems, where pest pressures diminish as organic systems mature, experienced organic livestock farmers have found that herd health improves once they implement organic practices. Herd health is based on building immune-system function and allowing the

GLOSSARY TERMS

Phenotypic: The expressed traits of an individual plant, animal or other organism; the net result of its genetics and its environment.

Paddock: A small field or enclosure where pasture animals are kept or exercised.

animals' own bodies do the healing. Successful organic farmers base their health management on the prevention of problems, rather than on treatments. Many find that health situations traditionally treated with antibiotics in a non-organic system rarely occur once the organic system has stabilized.

We will discuss here several treatment alternatives. As you successfully transition to organic, your herd health will improve and you'll see lower demand for health intervention.

It is essential that the restriction on antibiotic use not interfere with humane management. If you need to use an antibiotic to save an animal's life, do so, document the use, and remove the animal from your organic herd. Try to figure out what led to the problem so you can keep it from happening again.

SANITATION

Sanitation and good hygiene practices are a centerpiece of organic livestock health care. Sanitation encompasses a wide range of practices, from quarantining new animals brought onto the farm and requesting that visitors wear disposable boot covers or sanitize their shoes, to keeping barns clean, rotating pastures and dealing with manure promptly. Clean, dry, comfortable animals will have stronger immune systems and be more resilient.

Sanitation is particularly important for pig and poultry operations. Many organic pig farmers advocate an "all-in/all-out" rule for raising groups of pigs, to prevent the transfer of pathogens from one group to the next. Facilities are cleaned out and allowed to "rest" in between groups, almost the way a fallow period can break disease cycles in a crop rotation. Of course, it's not possible to prevent all exposure to disease organisms—and many producers argue that animals need some exposure in order to develop strong immune systems. The goal is to protect vulnerable animals (such as newborns) and then control their exposure as much as possible later on.

Trucks and other equipment can bring disease organisms onto a farm just like dirty boots can. Be aware of where your boots and clothing go off-farm as well. Hose down sows before transferring them into farrowing facilities. Know where your bedding materials come from. If possible, consider prevailing winds and neighboring livestock operations when locating your facilities. These and other measures can help you prevent diseases, so you won't have to treat them later on.

> "THE SUN IS YOUR FRIEND"
>
> —*Managing for Herd Health in Alternative Swine Systems*
> (Practical Farmers of Iowa, 2007)

ALTERNATIVE TREATMENTS

In the absence of antibiotics and other "standard" veterinary treatments, organic farmers and vets have developed a growing list of traditional and alternative remedies useful for treating common livestock ailments. Examples include:

- Tincture of garlic (used in place of antibiotics)
- A drench of vinegar, kelp, dolomite, molasses and garlic
- Arnica (good for bruising, and also used after difficult births)
- Comfrey (used topically to accelerate healing of bone fractures and other hard tissue injuries)
- A mixture of copper sulfate and gentle iodine (used topically for foot and hoof problems and minor infections; also effective for early intervention against pinkeye)
- Goldenseal, St. John's wort and aloe vera

Currently, the only non-synthetic (or "natural") substance prohibited for organic livestock production is strychnine. The list of allowed synthetic substances (§205.603) is considerably longer. Some of the more commonly used items include:

- Ethanol and isopropanol as disinfectants
- Aspirin as an anti-inflammatory

- Glucose and electrolytes (without antibiotics) for energy boost and hydration

Be sure that any synthetic substance used does not contain prohibited additives such as preservatives. Check with your certification agency if you have any questions about a particular product.

HOMEOPATHY

Homeopathy is a health tool that many new organic farmers find easy to use with good success. Homeopathy "kits" are available from various sources. These kits offer a diverse array of homeopathic treatments that are generally labeled by the problem they are most effective in solving, making them easy to reach for when a health problem is discovered.

The basis of homeopathy is that a plant or other material is formulated so that the "energy" of that item is extracted and put into tiny pills. Extracts are made from materials as diverse as nettle leaves and bee venom.

Homeopathic remedies are based on the concept of "like curing like." It has been found that an application of something that causes swelling, such as bee venom, will help to reduce swelling from any cause. Thus an "Apis mel" homeopathic treatment is indicated for the treatment of swelling associated with mastitis in dairy animals.

Homeopathic remedies typically come in the form of small pills or tablets. Depending on the size of the animal being treated, several to many of these small pills are inserted where they will have good contact with mucus membranes. Acute conditions are often treated several times a day for one to several days. Homeopathic kits come with recommendations on dosage and which remedy is indicated for which application. When treating a very sick animal, the remedy indicated for the most extreme condition should be given first. Generally remedies are not used in combination, although they are frequently used in combination with other types of treatments, such as tinctures or herbs.

As with almost all natural treatments, patience is required. Homeopathy has been found to be very effective in treating many health situations, but will take time as the animal regains its natural resistance and its system strengthens. For more information, contact one of the numerous homeopathy books available, such as Edgar Sheaffer's Homeopathy for the Herd (Acres USA, 2003).

INTERNAL PARASITES

Keeping internal parasites below damaging levels without the use of commercial parasiticides can be a challenge in organic livestock production. For dairy and breeder stock, the NOP Standards allow use of the parasiticide Ivermectin in emergency situations only; its use is prohibited entirely for organic slaughter stock. Milk and milk products from treated animals may not be sold as organic for 90 days after the use of Ivermectin, and the parasiticide cannot be used on organic breeder stock during lactation or in the last third of gestation if the offspring are to qualify as organic.

A variety of natural, plant-based vermicides and vermifuges have been investigated for use in organic systems, with varying success. For sheep and goats, parasite-load monitoring methodologies such as FAMACHA are recommended.

As mentioned earlier, management-intensive grazing systems can minimize potential problems with intestinal parasites. To manage parasites effectively, one must learn the life cycles of common parasite pests and rotate animals accordingly. Rotational grazing of several species of livestock, either together (e.g. beef and poultry) or in a leader-follower system (e.g. sheep and beef) can further minimize parasite populations.

EXTERNAL PARASITES

External parasites such as lice and ticks can be managed by external applications of diatomaceous earth, and by providing dust baths for chickens. Flies and mosquitoes can be reduced

GLOSSARY TERMS

Slaughter Stock: Any animal that is intended to be slaughtered for consumption by humans or other animals. *(NOP definition)*

with the use of fans, sticky tape, bug zappers and screens, and by encouraging beneficial predators like purple martins and bats.

Cleanliness and prompt removal of manure in and around lots and buildings is essential to controlling fly populations. Prompt removal of standing water helps reduce mosquito populations. Many organic farmers follow grazing cattle with poultry groups to scratch up manure piles and eat fly eggs; another strategy is to drag pastures after grazing to distribute manure.

Preventive measures and the use of various approved treatments for parasite control are the subject of lively dialogue among organic farmers, veterinarians and researchers. Final decisions should always be made in consultation with your certifier.

Photo Credit: Jack Sherman

Follow grazing ruminants with chickens to reduce fly larvae.

PREDATOR MANAGEMENT

Predator management is another, occasionally critical, aspect of herd and flock health. Most animal operations will have predator issues of one kind or another, especially when young stock are on the farm.

Guard animals such as dogs, llamas and donkeys occupy an important place within organic systems. Any of these are most effective if introduced to the flock or herd at a young age and left to live amongst the animals for the majority of their lives.

Other acceptable ways of limiting predation include shutting up animals at night; hunting (in keeping with state and local regulations); mechanical traps, protective fencing, noisemakers or visual deterrents; and properly disposing of dead animals and processing waste. Keep in mind that some predator animals are protected from harm by law—check with your local department of natural resources before attempting any predator eradication program.

Alternatively, you may be able to develop your predator management strategies into an additional selling point for your products. A growing number of farmers and ranchers throughout the United States participate in voluntary "predator-friendly" certification programs designed to protect livestock while also safeguarding wild creatures. These programs should be compatible with organic certification.

PHYSICAL ALTERATIONS

The NOP Standards allow physical alterations (docking, castration, etc.) "as needed to promote the animal's welfare" and "in a manner that minimizes pain and stress" (§205.238). This is pretty open-ended, and there's been considerable debate among organic producers and animal-welfare advocates as to what it should mean.

Photo Credit: Julie Anne Workman

Tail docking of sheep is usually allowed under organic certification, but you should always check with your certifier before planning any such physical alterations.

Individual certifiers may vary somewhat in their interpretation of this rule, based on regional practices and conditions. Ear notching or tagging is generally allowed for most species. Tail docking of cows and pigs is generally prohibited, but tail docking of sheep is usually allowed. Castration and dehorning are usually allowed but should be done as early in the animal's life as possible.

Check with your certifier regarding what physical alterations you plan to make, and be sure you specify in your Organic Livestock Plan when, why and how you plan to make them.

All medical treatments or procedures, including physical alterations—whether administered by you or by the vet—are considered "health events" that must be recorded. Treatments to poultry may be recorded by group; each animal does not have to be individually identified.

SUMMARY

The NOP Standards for health care practices cause concern among many producers as they first consider the organic transition. Organic standards require antibiotics to be used if necessary, but stipulate that any animal so treated be permanently removed from the organic herd or flock. Many other conventional veterinary treatments are also prohibited under organic rules. Synthetic medications must be used in compliance with §205.603 of the Standards.

Organic health care practices focus on promoting animal health, rather than on treating disease. Choosing well-adapted breeds and individuals, practicing good sanitation, offering high-quality feed and forage, and providing clean and appropriate housing are all required elements of an organic livestock health care plan. Use of vaccines and other immune-building practices (such as feeding colostrum to calves) are also invaluable.

Limiting internal and external parasites is a key challenge of organic livestock management. Careful pasture rotations, diatomaceous earth, permitted dewormers and close observation are all important methods.

You may wish to do some more work on your Organic Livestock Plan while the health care standards are fresh in your mind. In the next lesson, we'll talk about organic requirements for livestock living conditions.

LESSON 3: LIVING CONDITIONS

OVERVIEW

As we saw in the previous lesson, provision of appropriate living conditions is an essential part of a successful organic health care plan. What's appropriate will depend on the type of animals in question, their stage of life and the local climatic conditions. NOP Standards set rules for outdoor access by livestock and poultry as well as for buildings and other facilities.

Livestock facilities can represent a major financial investment for many farms, so you should carefully consider how your existing setup matches the Standards as you begin to plan your transition to organic. You may need to make major changes, or you may be able to make a few inexpensive modifications. Whether you're planning new construction or purchasing used equipment from another producer, consult your certifier to make sure materials are in compliance and that the new facilities will offer you the flexibility you need to meet organic requirements.

The organic living conditions standard also covers responsible manure management to protect crops, soils and water resources from contamination with nutrients, heavy metals and pathogenic organisms.

A final question to consider is whether your shift to organic suggests an alteration in the number of animals you plan to manage or raise each year. The higher price premiums often available for organic products may mean you can scale back or diversify your operation while achieving greater profitability and quality of life.

WHAT THE STANDARDS SAY ABOUT LIVING CONDITIONS

NOP Standards require producers to "establish and maintain livestock living conditions which accommodate the health and natural behavior of the animals" (§205.239). Specific requirements stipulate that:

- All animals must have "access to the outdoors, shade, shelter, exercise

areas, fresh air, and direct sunlight" as appropriate for "the species, its stage of production, the climate and the environment." Confinement of animals is allowed only on a temporary basis based on weather conditions, health or the animal's stage of production.

- Ruminants must have access to pasture.
- Bedding must be kept clean and dry. If livestock typically eat the bedding, it must be organically produced, like any other part of their feed.

Livestock housing or shelter must be designed to give animals:

- Room for exercise and other natural behaviors such as grooming and lying down
- Protection from extreme temperatures
- Ventilation and fresh air
- Protection from injury

DEFINING "ACCESS TO PASTURE"

The National Organic Standards Board issued official guidance language for the access-to-pasture requirement, stating that "ruminant livestock should graze pasture during the months of the year when pasture can provide edible forage" except during climatic events such as drought or flood, and that "the Organic System Plan should have the goal of providing a significant portion of the total feed requirements as grazed feed...not less than 30% dry matter intake on an average daily basis during the growing season [and] not less than 120 days per year."

The NOSB guidance document suggests that the following information be included in the Organic Livestock Plan to verify compliance with the pasture requirement:

- Amount of pasture provided per animal
- Average amount of time animals are grazed on a daily basis
- Portion of total feed requirement provided from pasture
- Circumstances under which animals will be temporarily confined
- Records maintained to demonstrate compliance with pasture requirements
- Outline of plans to improve and optimize pasture access over time

ACCESS TO PASTURE IN PRACTICE

The ability of organic producers to offer pasture to ruminants obviously varies greatly depending on the local climate. In the humid East and grass-generous Midwest, pasture can be provided almost year-round, even in more northerly areas, where producers are getting more and more skilled at "stockpiling" grass for grazing after the growing season is over. Weather protection mechanisms such as shelterbelts allow cattle to be comfortable outdoors even in the winter.

In the dry parts of the West, pasture is naturally limited by rainfall and irrigation. The "Regional Natural Resources Conservation Service Conservation Practice Standards for Prescribed Grazing" (Code 528)" can be used to help farmers and certifiers agree on appropriate pasture conditions for a given number of animals in a given area. Contact your certifier for the latest protocols.

GRAZING SUCCESS

Farmers' investment in pasture-based livestock management has been significant in the past two decades. Their work and collaboration has created an active body of regionally adapted resources and many farmer-based organizations, such as the American Pastured Poultry Producers Association (APPPA). "Grazing networks"—groups of farmers or ranchers who come together to exchange ideas about pasture management and

GLOSSARY TERMS

Records: Any information in written, visual, or electronic form that documents the activities undertaken by a producer, handler, or certifying agent to comply with the Act and regulations in this part. *(NOP definition)*

Shelterbelt: A line of trees or shrubs planted to protect an area, especially a farm field, from strong winds and the erosion they cause.

other aspects of grass-based production systems—are another innovation pioneered in New Zealand that has become increasingly popular in the United States.

Successful grazing involves making regular management decisions. Many farmers realize they can best learn how to manage pastures from other successful graziers. Experienced organic farmers must consider not only the mix of species in the pasture, or the height of the green growth, but also the nutritional analysis of the forage, including the protein-to-energy ratios, and relative levels of macronutrients and trace minerals. Working with a nutritionist and studying your soil tests can offer insight into the connections between your soil profile and the health of your herd or flocks.

SHELTER AND HOUSING

The state of your existing livestock housing facilities can have a big impact on the feasibility and ease of your transition to organic. If you've recently made a major investment in an expensive confinement facility, you may find it more difficult financially to justify the move to an organic system. Older dairy barns and other facilities can also sometimes be more of a liability than an asset. Some experienced "grass farmers" argue that the fewer buildings you have on a farm, the better—buildings require maintenance, and they by no means always improve the health of the animals.

Low-cost hoophouse systems combined with rotational grazing are becoming popular for all types of livestock. These newer types of structures are cost- effective and make it easier to maintain temperature level, ventilation, air circulation, comfort behaviors, opportunity to exercise and protection from injury for many species.

Livestock housing and pasture systems need to be constructed in such a way as to prevent any contact with prohibited materials. This includes arsenate-treated wood and lead paint. For existing setups being transitioned, it's sometimes possible to grandfather in treated wood if the inspector and certifier agree that the risk of contamination is small. For new construction, treated wood will generally be allowed only in areas where animals will not come in direct contact with it. Using naturally rot-resistant woods like Osage orange, black locust or red cedar is preferable. Fiberglass or plastic posts are another option. Again, check with your certifier before you make an investment.

Photo Credit: Jack Sherman

Hoophouses offer a low-cost, low-maintenance option for rotationally grazed livestock.

HOW MUCH SPACE?

Although the NOP Standards don't provide specific space requirements for different types of livestock, other groups have issued guidelines that may help you in designing your system. The Certified Organic Associations of British Columbia offer the following minimum space requirements, for example:

In pens

Livestock	*Space requirements*
Calves under 400 lbs.	80 feet^2 per head
Farrowing sows	50 feet^2 per head
Layers	2.5 feet^2 per head
Broilers	.36 feet^2 per pound of bird

In paddocks

Livestock	*Space requirements*
Cattle	800 feet^2 per head
Sheep	400 feet^2 per head
Sows with litters	10 head per acre
Sows without litters	15 head per acre
Layers	1,000 birds per acre

DEFINING "TEMPORARY CONFINEMENT"

NOP Standards allow for temporary confinement of livestock, based on the following specific conditions (quoting from §205.239):

- Inclement weather
- The animal's stage of production
- Conditions under which the health, safety or well-being of the animal could be jeopardized
- Risk to soil or water quality

As you might expect, defining some of these terms and interpreting their application across a variety of regions and production systems has been a challenge. In its guidance document on access to pasture for ruminants, the NOSB suggests that confinement in the case of severe weather should be limited to periods of a few days during each grazing season and states that "in no case should temporary confinement be allowed as a continuous production system."

It's best to learn about the appropriate use of temporary confinement by consulting with established certified producers in your area, particularly those who use the same certifier you have chosen. To make sure the housing and management system you have in mind will conform to organic regulations, talk over your plan with your certifier as you begin your application and before you invest money in new facilities.

As always, your certifier is your best link to possible changes in interpretation of the Standards on this point.

MANURE HANDLING

A final clause of the living-conditions standard relates to responsible manure management: "The producer of an organic livestock operation must manage manure in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, heavy metals, or pathogenic organisms and optimizes recycling of nutrients" (§205.239c).

The use of manure in the production of human food crops is very closely regulated by the NOP. Be sure to understand the rules before you spread manure on any crops grown for human consumption.

On-farm composting is an effective way to manage livestock wastes while promoting soil health. Manures can be mixed with carbon-rich materials and allowed to heat and decay. Farm-based carbon sources might include bedding or waste hay; off-farm carbon sources could be municipal leaves or wood chips. For more details on compost production and use, see the Composts lesson within the Soils chapter.

Photo Credit: Rodale Institute

On-farm composting of manure is a cost-effective way to keep valuable nutrients on your farm.

PEST MANAGEMENT

Improperly managed manure can increase the risk of E. coli, other pathogenic bacteria, intestinal worms and insect pests.

Keeping flies' numbers reduced is an important part of providing comfortable living conditions for your animals. Flies will congregate when manure is present. Fly-control strategies approved for organic management include releasing natural enemies like hister beetles and predatory wasps, keeping barns clean and dry, and using various non-synthetic traps. Many dairy farmers use sticky tape to catch flies in the milking parlor or install walk-through flytraps for the cows to move through on their way into the

barn. Bug zappers and jar traps are also permitted, although some farmers (and entomologists) disapprove of bug zappers, since they tend to kill many beneficial insects along with troublesome ones.

There are also some organically approved fly sprays on the market, for example Ecto-phyte by Agri-Dynamics and No Fly by Crystal Creek.

SUMMARY

Providing appropriate, healthy indoor and outdoor living conditions is required by National Organic Program Standards and is fundamental to maintaining a profitable, thriving livestock operation. Organic rules require access to the outdoors for all livestock and access to pasture for ruminants. If you have cows, sheep or goats, developing expert pasture-management skills will be critical to your organic success.

Organic poultry and pig management are dynamic sectors with many recent innovations based on new and appropriate technology, such as hoophouses, lightweight electric fencing and movable hutches or creepers. Consult the resources at the end of this chapter or contact other growers in your area for more details on building or modifying these systems.

If you're ready, take some time now to visit your Organic Livestock Plan and fill out the sections relating to livestock living conditions. In the last lesson of this chapter, we'll cover basic organic handling and processing regulations as they apply to animal products.

LESSON 4: PROCESSING

OVERVIEW

So far in this chapter, we've discussed origin-of-livestock requirements, feed rules, living conditions, and health care practices for organic livestock production. In this lesson, we'll discuss options for on-farm and off-farm processing and packaging of meat, milk, eggs, and other livestock products.

You have an opportunity to enhance farm income by choosing to process your animal products yourself, or you may contract with local processing facilities for slaughtering, butchering and other services. This decision will depend on your markets as well as on your farm facilities and labor resources. Many organic farmers find that marketing processed products versus live animals can greatly enhance their total income without requiring expansion of their production capacity.

Most organic livestock producers make use of USDA or state-inspected processing facilities for slaughtering and packing. A growing number of meat processors have experience with organic handling in accordance with NOP Standards. Contact your state department of agriculture, extension offices, and producers' organizations to locate facilities in your area.

For the direct marketing of livestock products, some level of processing is almost essential. For the purposes of organic certification, processing generally entails additional recordkeeping requirements, the creation of an Organic Handling Plan, and additional certification fees. You will also have to abide by any applicable local, state, and federal regulations for food safety, waste management, public health, etc. The markets you sell to (e.g. farmers markets, retail stores, wholesale, home delivery) will dictate the kind of processing facility you must use. Check with the marketer or your state department of agriculture to find out any specifications.

WHAT THE STANDARDS SAY ABOUT LIVESTOCK PROCESSING

Organic processing and handling requirements are discussed at more length in the Certification chapter of this course. Basically, to be certified as an organic processor or handler, you need to:

- Make sure any and all ingredients and processing aids meet the appropriate organic label definitions (i.e. "100% organic," "organic," or "made with organic ingredients")
- Establish a good recordkeeping system, including the maintenance of an audit trail to track saleable products back to the fields, locations or groups of origin

- Show that facilities are cleaned with approved cleaning materials with no risk of contamination to the organic food item
- Maintain a facility pest-management plan in keeping with organic regulations (§205.271)
- Ensure separation of organic and non-organic ingredients and final products

Before launching a processing enterprise, do lots of research—talk to your public health officials, your local extension service and any other farmers you can find who are engaged in similar projects. Rules governing processing vary widely by state and municipality.

ON-FARM MEAT PROCESSING

Small to medium-size organic poultry producers may want to consider on- farm slaughtering and butchering as part of a direct-marketing effort. Poultry processors are often eligible for small-scale exemptions not available for other types of meat processing. Most states set their own limits for on-farm poultry processing. Check with your state department of agriculture to find out about the regulations for your state.

A number of community agricultural development centers and other groups have designed and built self-contained, mobile poultry-processing facilities that can be driven or towed to individual farms for occasional use. Systems like these can reduce costs for small-scale producers, facilitate adherence to regulations and let you test specific types of equipment before making a major investment of your own.

You'll also want to consider your marketing strategies and how they might affect your processing choices. Some farmers encounter problems obtaining permission to sell fresh meat or even eggs at farmers markets, for instance. Talk to market managers well ahead of time to find out what the requirements are in your area. ATTRA (the National Sustainable Agriculture Information Service) has a detailed guide, "Small-Scale Poultry Processing," describing several different systems.

Remember, if you process livestock on your property, you still need to comply with state and local food-safety regulations as well as federal inspection requirements if you sell across state lines. This includes mail order and Internet sales.

GLOSSARY TERMS

Split operation: An operation that produces or handles both organic and nonorganic agricultural products. *(NOP definition)*

OFF-FARM MEAT PROCESSING

Like other kinds of organic processing, certified organic slaughtering and butchering require that systems be in place to prevent commingling and contamination. If a facility is used for both non-organic and organic processing, organic animals have to be kept separate from other incoming animals, in a clearly designated area protected from contamination with prohibited materials.

If you maintain a split operation with both organic and non-organic production and/or processing on the same farm or in the same off-farm facility, additional procedures and greater vigilance will be required to make sure that organic and non-organic products stay separate and readily identifiable at all times.

Usually, the organic animals are processed at the beginning of the day or shift, following a complete cleanup of the facility, to prevent contamination from non-organic animals or meat. Carcasses should be labeled as organic.

LOW-STRESS ANIMAL HANDLING METHODS

Whether you're slaughtering on-farm or delivering your animals to a certified processing facility, remember that low-stress animal handling methods are an important element of humane livestock management. Animals that are visited regularly during rearing will be easier to handle and transport when the time comes for processing.

Working animals intelligently, gently and with respect reduces the risk of injuries for everyone involved. Humane handling also contributes to improved meat quality and, ultimately, better sale prices. Trucks and trailers should be kept in good repair, have non-slip floors, be suitable for the animals being transported, and be driven cautiously to avoid falls and bruising. Be

aware of temperature and weather conditions, and never overload a livestock transport unit. Gates, fences and chutes should have smooth edges to prevent cuts and bruises.

Low-stress animal handling is appropriate for all livestock production systems and is implied by the NOP Standards' emphasis on animal welfare. It's also well suited to high-value, high-quality organic marketing.

HACCP

Slaughterhouses inspected by the USDA are required to have Hazard Analysis Critical Control Points (HACCP, pronounced "HASS-ip") plans. HACCP is a methodology for assessing the whole manufacturing or processing facility, identifying the points at which contamination or other hazards can occur and then instituting monitoring procedures at those points.

HACCP is a useful analytical tool and can be an excellent starting point for creating an Organic Handling Plan, even if your facility is not federally inspected and thus not required to use HACCP. Recordkeeping should be sufficient to allow tracking of each individual animal through the facility.

Organic inspectors are trained to use HACCP as a way to identify potential threats to organic integrity. With a little background, you too can use it to troubleshoot your on-farm facility, evaluate a processor's facility and better understand the certification process. The USDA's Food Safety and Inspection Service has more information about HACCP and its application to different types of situations.

DAIRY PROCESSING

For dairy products, as with other organic foods, maintaining quality is of foremost importance. This is true whether you're selling your organic milk in bulk or processing it into yogurt or cheese on-farm. Most organic milk buyers require lower somatic cell count thresholds than conventional milk buyers do. It's always important to guard against the contamination of milk with off flavors from garlic or other pasture weeds, but this will be even more critical if you're direct-marketing your milk.

As with poultry processing, different states have widely varying regulations and licensing requirements for on-farm dairy processing. Check with your state department of agriculture for regulations relevant to your location. The necessary infrastructure investment required for small-scale on-farm cheese making, for instance, is minimal in some states and cost-prohibitive in others.

Labor resources are another key factor to consider when exploring on-farm dairy processing options. Jack Lazor, who with his wife, Anne, has been making and selling Butterworks Farm organic yogurt on their Vermont farm since the late 1970s, cautions that "milk processing is [a] serious, time-consuming business" that is often challenging to balance with regular farm chores. Other points to consider:

- Experiment extensively in the kitchen before investing in commercial- scale equipment. Attend field days and workshops. Visit other dairies and small-scale processors.
- Think about facility requirements when choosing your product. Raw-milk cheeses are simplest because they don't require pasteurization, but they're subject to additional regulation and can require more aging-room space.
- Yogurt provides good returns but requires a large initial investment due to the cost of cup-filler machines.
- Now that the organic market is so large, you'll be competing with national brand competitors. How are you going to distinguish yourself? What will be your niche-within-a-niche?

GLOSSARY TERMS

Somatic cell count: A measure of milk quality based on the level of white blood cells present in the milk. A high SCC (generally expressed in 100,000s of cells per milliliter) can indicate mastitis.

EGG HANDLING AND PACKING

The NOP Standards do not spell out specific rules for the washing and packing of organic eggs. In keeping with general processing standards, however, organic eggs must be kept clearly separated from non-organic eggs and protected from contamination with prohibited substances. Consult the Resources section at the end of this chapter for more information.

The best way to keep eggs clean is to provide plenty of clean, fresh bedding for laying boxes, collect eggs regularly and make sure you have enough boxes for the number of hens. Egg washing practices are essentially the same for organic and non-organic handlers, with the important caveat that any washing or defoaming agents must be approved for organic use. Contact your certifier for allowed products and brands.

Be aware, too, that most states have regulations pertaining to the sale and handling of eggs. Check with your local authorities to make sure you're in compliance.

ANIMAL FIBERS

Although the NOP has no published standards for organic wool production, the Organic Trade Association (OTA) and other industry leaders got together in 2004 to publish their own set of organic fiber standards. These cover wool, cashmere and other exotic animal fibers as well as crop-based fibers. OTA's Fiber Standards may be viewed online free of charge after registering with the site.

In principle, organic wool must come from certified organic animals grazing on organically managed land. Wool storage, washing and other processing should be done without use of prohibited materials for cleaning, dyeing or the prevention of pest damage. Some organic wool producers use all-natural, plant-based dyes as more in keeping with organic principles. Markets for organic wool are increasing at both the retail (home spinners and knitters) and wholesale (blankets and clothing) levels.

GLOSSARY TERMS

Prohibited substances: A substance the use of which in any aspect of organic production or handling is prohibited or not provided for in the Act or the regulations of this part. *(NOP definition)*

DOCUMENTATION AND LABELING

NOP Standards require that all animals be individually identified and traceable through every phase of on-farm production. For poultry, records may be kept by flock; for bees, by hive. Recordkeeping requirements for organic livestock operations are discussed in more detail in the Certification chapter of this course.

As with crops, NOP Standards allow the use of other, so-called complementary label claims so long as they are truthful and accurate. Some of these have their own certification and authentication systems, such as kosher and certified humane. Others, like "local" or "natural," currently do not.

Meat labels must meet state requirements. Organic labeling must meet NOP requirements. See the Certification chapter for details on organic labeling.

SUMMARY

Organic processing and handling regulations for livestock products are identical to those governing non-livestock organic products. In most cases, how you set up your on-farm processing facilities will depend more on local, state and federal food-safety and other regulations than on organic requirements. Organic products must be kept separate from non-organic products and protected from contact with prohibited materials. Cleaning products, additives and all ingredients must be use in accordance with the NOP Standards.

If your livestock products are to be sold as certified organic, any off-farm processing must likewise conform to organic standards for processing, handling and labeling. Small and medium-size livestock processors are sometimes able to accommodate organic producers by running the organic animals first thing in the morning, on a clean line, to prevent contamination or commingling with non-organic product.

Standards for organic recordkeeping, facility pest management and processing are covered in

more detail in the Certification chapter.

Take a moment now to complete more of your Organic Livestock Plan. Coming up next is a special section covering more specifics about organic management of dairy cows, beef cattle, sheep and goats, hogs, poultry and honeybees.

LESSON 5: SPECIES INFO

DAIRY COWS

Organic dairying is challenging but highly rewarding. Organic milk is among the strongest and fastest-growing sectors of the organic marketplace, attracting many farmers with a diversity of operations. Keep in mind that it is a dynamic marketplace and the balancing of organic supply and demand is expected to continue in the years ahead. In this environment, it's important to consider all your marketing options before signing on with a particular group.

If you have the facilities, you may want to consider marketing directly to the public. This option will require a large investment in infrastructure, but if well managed, can also bring high returns. If you're farther from a consumer population or you're not interested in the marketing end of things, talk to other organic dairy farmers about their experiences before committing to a buyer. Having a positive marketing relationship is probably more important in the long run than securing a few more pennies per hundredweight of milk.

Successful organic dairy farmers recommend rotational grazing, high-forage diets and open housing to keep dairy cows healthy and comfortable without the use of veterinary interventions. Many also change their genetics, moving from purebred to mixed-breed herds, sometimes importing semen from countries such as New Zealand, where grazing has remained a priority. These producers focus on managing for lifetime per-cow milk production or milk production per pound of body weight rather than milk production per lactation.

As you make the change to organic, you may also find that your balance of cows to acres and of farm-raised grains to farm-raised forages changes.

Photo Credit: Thinkstock

A cow in a milking facility

DAIRY NUTRITION

As discussed above in the section on feed, providing a high-quality, appropriate diet is the cornerstone of organic dairy management. The best base for that diet is well-managed pasture. Many organic farmers work with a nutritionist to help evaluate and balance the ration they offer their cows.

Gary Zimmer, of Midwestern Bio-Ag, suggests that a good target for a milking cow is a 16 to 18% protein ration made up of 60 to 75% forages on a dry-matter basis. Usually, this includes a combination of hay, haylage, corn silage, dry corn and roasted soybeans. Some farmers don't like corn silage; others find it's useful in small amounts. The components of your ration will depend on many factors, including your available land, equipment and expertise. But remember: make your cows' health your first priority. Productivity and profitability follow from there.

Organic dairy nutritionists and veterinarians place a great deal of emphasis on mineral balancing and how cows' mineral needs change through different stages of production. Offering free-choice minerals is a good insurance policy in case your nutritional analysis and ration planning

fall short. But your underlying goal should be to achieve the right mineral balance in the ration itself. Healthy soils are better able to produce forage and grain crops that provide the right balance of minerals in the first place.

DAIRY HEALTH CARE

Not being able to use antibiotics for dry-cow treatment causes a good deal of concern for dairy farmers transitioning to organic. Most experienced organic dairy people find those fears understandable but largely unfounded once an effective organic herd health plan is working.

For dry-cow management, Dr. Paul Dettloff recommends bringing the potassium-to-calcium ratio as close to 1:1 as possible and being sensitive to two natural dips in the strength of the cow's immune system. The first dip is about a week long, right after dry-off; the second is a 4- to 6-week period around calving.

During these two periods, avoid activities that challenge a cow's immune system, such as administering vaccines. Instead, take steps to boost immune-system functioning by feeding aloe vera pellets and/or kelp.

Read more: The fundamentals of dry-cow management

Subject to revisions. A number of materials included on the original 2001 National List of approved and prohibited materials were subject to a 5-year "sunset" provision unless re-approved. In March of 2006, the NOSB issued final recommendations to allow continued emergency use of oxytocin and Ivermectin. Use of Ivermectin is allowed in dairy animals and breeder animals only, not slaughter stock, and subject to specific restrictions. For example, milk from treated animals must be withheld for 90 days.

CALF MANAGEMENT

For standard calf management off the mother, experts like Dan Leiterman, of Crystal Creek, a Wisconsin-based organic dairy nutritional consultancy, emphasize the importance of providing a dry, comfortable environment and being aware of calves' changing nutritional requirements. "Ask yourself, would you put your children in the calf pens? ... Get on your hands and knees and take three deep breaths," Leiterman advises. If your knees get wet and you're choking on ammonia, you need to make some changes.

Calves should get a gallon of first-milk colostrum within their first 8 to 12 hours of life. For calves less than three weeks old, consider feeding more than the standard one to two quarts of milk twice a day. "Calf weight gain directly correlates to calf survival and disease resistance," Leiterman points out. Calves eating lots of calf feed or hay when they're less than 21 days old are trying to tell you they're not getting enough milk.

Some organic dairy farmers advocate letting the calves stay with their mothers until weaning or putting them with an older nurse cow. These practices produce stronger, bigger calves, save an hour or so a day of calf chores, and (some people feel) lower the stress levels of the entire herd. On the other hand, the calves will consume milk you could otherwise sell, and there is some risk of disease transfer from cow to calf via suckling.

Photo Credit: Jay Bohnsack

Calves on grass

BEEF CATTLE

Raising organic beef cattle is generally less management-intensive than organic dairying. Here, the main challenge frequently lies in the marketing end of things. To get the best price, you need to market directly to the consumer, but this takes work—advertising, communicating with customers, figuring out what to charge, predicting demand, and balancing what your customers want with what you can reasonably produce. In many areas, it's hard to find federally inspected slaughtering facilities willing to handle small numbers of animals, not to mention being ready to get certified for organic handling.

The development of markets for organic meat is several years behind organic produce and grain markets because of the lag in labeling for organic meats. This allowed other alternative labels to gain market share, including "natural," "antibiotic- and hormone-free," "grass-fed" and "humanely raised." But organic beef is a fast-growing industry.

In 2016, the USDA Agricultural Marketing Service withdrew its grass-fed standard and stated that it would no longer be verifying applicants to the Standard.

The other challenge with organic beef is deciding whether to go entirely grass-fed or to select a combination of pasturing and grain finishing. Cattle don't need grain—they can get everything they need from well-managed pasture, supplemented with a few minerals—but for marketing reasons, you may decide that some grain feeding is valuable. Not only are most customers used to the way grain-fed beef looks and tastes, but the USDA grading scale was designed to favor the fat marbling characteristics of grain-fed meat. Without exceptional grass-based genetics, pasture and management, it's difficult to produce beef that will grade as "choice" without feeding some grain.

GRAZING FOR BEEF

Grass-fed beef takes longer to finish than grain-fed beef. You must consider production time and costs carefully when projecting your cash flow. Average daily gain on good-quality pasture can reach 2 to 2.4 pounds. Most graziers recommend keeping cattle on pasture until they reach at least 800 to 900 pounds. After that, they might get 8 to 10 pounds of grain per day, gradually increasing to 12 to 14 pounds per day for finishing.

As with dairy cattle, moving to organic beef production may cause you to rethink your breed choices. Organic farmers report that smaller breeds with good mothering traits, such as Red Angus, work best in pasture systems. For calves, the rule of thumb is "castrate early, wean late" to put minimal stress on the animals.

FARMER-TO-FARMER

"The organic graziers in New Zealand have a theory that it takes five days for the worm eggs to hatch and become strongly infective, so if you keep your cattle moving every five days or less, you can reduce the impact of parasites."

—Dan Specht
Clayton County, IA

Herd health management strategies for organic beef are similar to those for organic dairy, although generally simpler. Many organic producers use diatomaceous earth (DE) for internal as well as external parasites, although its internal effectiveness is a matter of debate. DE can be offered free-choice two or three times a year, on its own or mixed with ground corn, minerals, kelp, or salt. Another reported treatment for external parasites is a mixture of Vaseline and sulfur applied to posts or stationary brushes for cattle to rub against.

Kelp is also used as a mineral supplement to treat conditions such as hoof-rot and pinkeye. Calves can be given Lactobacillus acidophilus as a probiotic, particularly if they have trouble with scours.

Among the best strategies for solving herd health issues is to cull and select rigorously, getting rid of animals that seem to be most susceptible to problems and retaining the offspring of those that do best.

SHEEP AND GOATS

The biggest challenge in organic management of sheep and goats is dealing with internal parasites. The goal is not total elimination of parasites, but keeping their populations to low levels. Factors affecting parasite buildup include animal nutrition, stress, pasture rotations, genetic resistance, the lambing calendar, and the use of natural vermicides made from plant-based materials such as conifers, lamb's-quarter, wormwood, and trefoil.

Some organic sheep producers advocate shifting the breeding calendar in order to lamb on pasture in late spring instead of in the barns in winter. As with other livestock, getting young on pasture in warmer weather lowers disease pressures, gives the mothers access to high-quality fresh grass, and can reduce the need for expensive infrastructure construction and maintenance. With sheep, added benefits of spring lambing include the increased fertility of ewes around the shortest days of winter, reduced winter feed costs, and the fact that ewes can be shorn before lambing without depriving them of their winter coats.

SHEEP AND PASTURE

Sheep are well suited to mixed-species livestock rotational grazing systems, which can help extend the grazing season while limiting parasite populations. Some people advocate following sheep with cattle because, in tall grass, sheep are less likely to graze low to the ground, where they can ingest parasite larvae. Others prefer to graze cattle first, since sheep are better grazers of short grass.

Ideally, sheep should not graze an individual paddock more than once a year. Some organic sheep farmers alternate grazing ground with haying ground in a two-year rotation to further limit the possibility of infection. Grazing sheep on turnips as part of a crop rotation is another option to extend grazing land.

A good deal of research has been done in New Zealand on breeding for parasite resistance. Using resistant rams can produce lambs with dramatically lower fecal egg counts. Even just a percentage of resistant lambs in a flock can improve performance of all flock members by reducing the total number of parasite eggs present in the pasture.

Photo Credit: Rodale Institute

Goats browsing

In most areas, sheep need shade and clean water available at all times and five- or six-strand electrified fencing to keep sheep in and predators out. Some producers use dogs, llamas or donkeys as guard animals.

GOATS AND BROWSE

Goats prefer browsing to grazing and have higher mineral requirements than sheep or cows. They are also highly social. To respect these natural behaviors, organic goat management should include access to woody plants, shrubs and/or rough grazing, and plenty of room for running and jumping.

Goats can play a useful role on a diversified farm, keeping brush down or reclaiming pastures that have been let go. In some parts of the country, goat rental agencies are used as chemical-free shrub control for parks and other open areas. If grazing areas don't include rocks or boulders, the goats' hooves will require regular trimming to prevent foot rot and other infections.

Raising meat goats is an increasingly popular niche market opportunity, particularly in locations with access to ethnic populations that prize goat

meat for everyday eating or for specific holidays. Offering kosher or halal slaughtering options can be a good idea.

Rules for organic goat meat production are the same as those for organic beef production; requirements for organic goat milk production are the same as those for organic cow dairy management.

HOGS

Successful methods of raising hogs organically are being worked out by a handful of experienced hog farmers across the country. Researchers at institutions like Iowa State University and the University of Minnesota have begun to examine the production and economic profiles of these systems.

Alternative swine production methods such as the Swedish deep-bedding system were developed and gained popularity prior to implementation of the NOP Standards. Now, we know methods to raise good quality pork, but the meat processors have been slow to transition. Until more slaughterhouses transition to using organic methods, it will be difficult to market certified organic pork on a larger scale. Certifiers and the NOP are figuring out what's optimal and reasonable for organic management of sows and pigs.

There are two aspects of pig nature that make it difficult to develop ideal systems. The first is the need to balance the benefits of pasture and the pigs' need for exercise with the need to protect the animals from extreme heat and cold.

The second challenge is the need to balance pigs' highly social nature with the sows' desire to be separated from the group during farrowing and the little pigs' need for protection from being crushed by their mothers in their first few days of life.

HOGS ON PASTURE

There are two basic alternatives to the non-organic industry standard of total farrow-to-finish confinement for hogs: pastured systems with individual farrowing huts, or hoophouse systems with deep bedding.

Pastured systems work great in milder climates or in the warmer parts of the year. Pigs vary by age and breed in their ability to utilize forages and will usually require additional grain and mineral supplements. Experienced producers have developed ways to integrate sows and pigs into their crop rotations, running them not just on pasture but also on turnips, brassicas, field peas, soybeans or standing corn.

Hogs' natural rooting behavior can be used to "till" ground or to renovate pasture (spreading seed a couple of weeks before hogs are taken off allows them to tread it in), although they can also destroy pasture if not managed correctly. Well-drained, high-legume pastures work best. Producers recommend placing huts at least 50 feet apart. Care should also be taken to eliminate plants like jimsonweed and nightshade, which are poisonous to hogs.

Photo Credit: Rodale Institute

Hogs on pasture

DEEP-BEDDED HOOPHOUSES

Deep-bedded hoophouse systems were pioneered in Sweden following a ban on antibiotic use for livestock in 1986 and gained popularity among small-scale producers in the U.S. Midwest in the 1990s. Typically, they involve an inexpensive hoop structure, perhaps 35 by 80 feet, covered with reinforced plastic tarp material

and open at both ends. Up to a third of the area underneath is given a concrete floor and outfitted with feeders and waterers. The rear two-thirds has a dirt floor covered thickly with straw or other bedding material.

Big, round bales of straw, cornstalks, or waste hay are added periodically, which the pigs tear apart and distribute, building nests to stay warm. The pigs' rooting helps compost the manure pack, generating additional heat. The building is cleaned out between groups; the accumulated bedding and manure can be composted further in windrows before being spread on the fields.

The advantages of hoophouse systems are that they are relatively inexpensive, versatile, and effective. They can be used for gestating sows or young pigs. Some producers modify them for farrowing purposes as well.

Hoophouse systems can generally meet production requirements for premium pork markets like Niman Ranch or other buyers adhering to Animal Welfare Institute or American Humane Association standards. Talk to your organic certification agency about whether the system you're planning to use will meet organic standards for winter production.

Remember, too, that organic standards prohibit the use of arsenate-treated lumber where animals can come in direct contact with it.

FARMER-TO-FARMER

"For 13 years, I struggled with countless animal health problems associated with slat floors. Early one September morning, I opened the door of my grower barn, and one of the pens was covered with fresh blood. The pigs' level of stress was so high they had become violently aggressive.

"Plans were set to build three hoophouses where straw-bedded pens replace metal crates and slatted floors. One hundred and sixty pigs were released into their new home. The next morning, as I walked up to the door, it was quiet, very quiet. I peeked into the hoophouse to see 160 pigs in one massive straw nest, snoring with great content! I laughed until I cried. Their stress was gone, and so was mine."

—Tom Frantzen
New Hampton, IA

LET PIGS BE PIGS

The key to keeping pigs healthy is to keep their stress levels low, which means accommodating their natural behaviors as much as possible. For pigs, this means rooting, nesting, wallowing, and foraging.

Studies show that if left to their own devices, pigs will spend about half their time rooting. If they can't root, destructive behaviors are likely to appear. Wallowing is important for temperature regulation in the summer and to eliminate external parasites. Some producers offer on-demand showers or timed sprinklers instead of muddy areas to minimize the risk of disease transfer between groups. Most producers use feeders with flaps or other devices to keep the pigs occupied and to limit the rate at which they can feed.

Photo Credit: Jack Sherman

The most important traits to select for in your hogs are good mothering characteristics.

Pigs are highly social, and good managers will take note of dominance relationships within groups. Groups of 8 to 12 sows are thought to be the most stable. Try to avoid mixing strange groups of pigs. Visit your animals daily, and never run or shout when moving and handling them.

As with cattle, castrate as early and wean as late as possible. Some organic farmers prefer to

provide an iron boost to winter litters by cutting squares of sod before the ground freezes and giving them, dirt side up, to the young pigs.

Other health-management strategies for organic pork production were touched on in the health care section above. Most organic pig farmers regard vaccination and rigorous attention to sanitation procedures as absolutely essential. Pastured pigs are generally healthier, although internal parasites may become a problem. Rotating pastures and feeding diatomaceous earth are the two most common remedies.

Colored breeds generally do better outdoors than white breeds because they're less sensitive to sunburn. Medium-framed breeds with good lung capacity are best suited to organic management overall. Perhaps the most important genetic traits to select for are good mothering characteristics.

ORGANIC EGG PRODUCTION

Many organic egg producers raise their own pullets, since organic standards require organic management—including 100% organic feed—from day one of the birds' life. Conceivably, specialized organic pullet growing operations may appear eventually.

Birds given access to forage from a young age will make better foragers as adults. Foraging can also be encouraged by letting feed run out for a few hours each day before replenishing. Lazier meat birds can be encouraged to go outside by using outdoor feeders and providing shade.

The Organic Livestock Handbook (published by Canadian Organic Growers) offers the following sample ration for a large-scale organic layer operation growing most of its own feed and milling and mixing on-farm (quantities are converted from kilograms):

- 661 to 881 lb. corn
- 440 to 660 lb. mixed small grains
- 440 to 551 lb. soy meal
- 110 to 331 lb. peas
- 220 to 331 lb. mineral mix, alfalfa, flax, and kelp

This provides a 16% protein ration. In winter, it can be adjusted to provide more calories and less protein by substituting roasted soybeans for soy meal and more corn for some of the small grains.

Some producers say it's better to offer minerals, oyster shell and grit free-choice, separately, so birds don't overeat while trying to satisfy specific deficiencies.

POULTRY HEALTH ISSUES

There are many breeds of laying hens suitable for organic systems, with smaller-scale producers especially favoring the more colorful heritage breeds.

The identification and development of better chicken breeds for organic meat production is an ongoing challenge, since the dominant commercial hybrids have been bred for confinement and tend to develop weak legs. This problem can be reduced by limiting feed somewhat in the first three weeks of life, and being sure that rations are well-balanced with necessary minerals.

Health management practices for poultry include the provision of dust baths to limit external parasites and keep feathers healthy. Following an all-in/all-out system and thoroughly cleaning facilities in between groups can help limit the spread of disease.

Photo Credit: Jack Sherman

Chickens

Alternatives to antibiotics for chicks include apple cider vinegar and/or probiotics in drinking water to combat coccidiosis. Vaccines for coccidiosis are used by larger organic producers. Producers may also use homeopathic remedies.

In its "Draft Recommendation on Access to the Outdoors for Poultry," dated December 2001, the NOSB observed that "The requirement for access to outdoors is not based on the nutritional needs of poultry but rather on humane consideration[s] and consumer perception."

In other words, poultry are not really designed to eat a lot of forage—they're designed to eat insects, seeds and some green stuff. They generally enjoy being outside in the sunshine, where they can forage. There is currently debate as to the exact extent or quality parameters that "outdoor access" for poultry must follow. Grain feeding is imperative for production, whether for meat or eggs, and care must be taken that birds get all the essential amino acids.

Photo Credit: Jack Sherman

Rodale Institute's tractor-pulled chicken house

STRUCTURES FOR ORGANIC POULTRY

Structures for organic poultry production can be divided into two categories: mobile and stationary. A variety of designs for mobile chicken houses have been popularized, from Andy Lee's "chicken tractor" to Joel Salatin's "pastured poultry profits" system. Houses can be built on two- or four-wheeled trailers or on skids; the smaller and lighter they are, obviously, the easier they are to move.

In milder climates, wheeled chicken houses can be built with screened floors so litter falls through to the ground, making cleanout easier, but in colder climates this may not offer enough winter protection. Houses not placed directly on the ground can be used in conjunction with portable electrified chicken netting to provide protection from predators.

Stationary houses are typically designed with separate access to two or more outdoor runs that can be rotated to manage pests and disease organisms and to allow for regrowth of vegetation. Runs should be seeded to a legume/grass mix, and if possible grazed before vegetation gets too tall, since chickens will graze shorter pasture more efficiently.

It's a good idea to put down straw or other bedding material in heavily trafficked areas immediately outside the house, so litter can be removed and composted to reduce the reproduction of pest organisms. Flocks should be rotated before they completely denude the vegetation.

Whichever housing style you choose, chickens should be given a minimum of eight linear inches of roosting space per bird, with one nesting box for every four to six laying hens. Clean, fresh water is essential. A covered porch area is also a good idea.

ORGANIC BROILERS

Chickens raised for meat require slightly different management than those raised for eggs. Meat chickens are generally only seven to nine weeks of age when butchered. Most producers use the same genetics for organic production as the conventional confinement industry does, a Cornish-cross bird that has been bred to grow very quickly while consuming large amounts of food. Some producers have been experimenting with heritage breeds or new genetic crosses of birds that have been bred to grow slower, developing a

richer taste, or those that have been bred to thrive on pasture.

Some basic management guidelines:

- All-organic feed and management is required from day-old chicks. Chicks need not be purchased from organic stock. Feed ration should be 19% protein for the entire growth cycle.
- Raise in brooders with heat for three weeks. The best bedding is wood chips or sphagnum moss (low dust). Cleanliness is key to organic success.
- Organic poultry must have access to the outdoors as seasonally appropriate. The outdoor area need not have green vegetation; however, grass-fed poultry can be a selling factor in some markets and is claimed by some to produce healthier birds and better-tasting poultry products. Any land the birds have access to must be certified organic.
- Either a day-range or outdoor pen system may be used. Day-range provides birds with a shelter they can access, but also a free-range area that they can run around in, with food and water. Free-range areas are protected by electric net fencing and may be moved weekly or less often to keep pasture fresh. A pen system has birds in a variety of movable pen styles with food and water. Pens are moved daily to access fresh pasture.
- Health care is the same as for pullets.
- Processing can be on-farm or at an organic plant; state laws stipulate maximums for on- or off-farm sales.

ORGANIC TURKEYS

There is a strong demand in many parts of the country for pasture-raised, organic turkeys for holiday meals. Turkey production is much the same as organic broiler production, but with a few significant differences.

As with broilers, turkey poults can be purchased from any source but must be managed organically from the first day of life. Turkey poults will also be started in a brooder, but should stay in this more regulated environment longer (four to five weeks). Turkeys also require more protein than broilers, with 24 to 28% protein for the first five to six weeks. After this, they can be moved to a lower-protein ration, such as the 19% protein that the broilers eat. Turkeys generally take four to five months to reach market weight.

Turkeys are strong foragers and appreciate room to move around. However, it can be challenging to train them to respect fences. Most organic producers will raise turkeys outside in pens after the first month, taking advantage of the benefits foraged greens and insects add to the birds' diet and the health benefits of fresh air and sunshine.

Many organic producers raise traditional white or bronze turkeys, using the same genetic strains conventional farmers rely on. A new market trend has started to support production of heirloom turkey varieties, such as Bourbon Red and Narragansett. These heirloom varieties will produce smaller finished birds over a longer period. Being strong foragers with lighter body weights, these birds can be more difficult to manage, as they tend to fly over fences and so on, but they're reported to produce extremely fine-tasting meat that can garner a significant price premium in specialized markets.

ORGANIC BEEKEEPING

When the U.S. National Organic Program Standards were finalized in 2002, they lacked specific guidelines for organic apiculture. Draft organic apiculture standards were put forward by an NOSB Apiculture Task Force in September 2001, but have yet to be officially approved. Instead, the NOP issued a policy statement in May 2002 saying that honey could be certified under the existing standards. Essentially, this has left it up to individual certifying agencies to decide what's reasonable for organic beekeeping practices and organic honey production.

The draft standards propose a 270-day transition period, creation of an Organic Apiculture Plan (along the lines of the Organic System Plan, and including a forage map) and a four-mile radius from the hives within which no prohibited materials are in use. Hives should be

made of natural materials and painted with non-lead-based paints. Plastic foundation is permitted if dipped in organic wax and mounted in a wooden frame. Any supplemental honey or sugar syrup fed to the bees should be from organic sources.

Use of genetic modification technologies is considered an "excluded practice" in organics—all organic producers are required to take steps to prevent contamination of their products with GM traits. Bees are generally believed to travel as far as three miles from the hive, so, ideally, hives should be placed at the center of a circle at least six miles across with no GM crops within the circle.

Photo Credit: Jack Sherman

Paul, a beekeeper at Rodale Institute

HIVE MANAGEMENT

Hive management should emphasize preventive health care, with a goal of building strong colonies naturally resistant to disease and pest organisms. To suppress tracheal mites, organic beekeepers use vegetable shortening, lactic acid, and essential oils such as menthol, cinnamon, eucalyptus, spearmint, wintergreen, thyme and camphor. Some progress has been reported in selecting queens for resistance to varroa and tracheal mites.

Other organic management practices include basic good beekeeping strategies, such as maintaining hives in good order with no cracks or holes, placing hives so they have access to plentiful forage through the seasons and being careful not to let hives become overcrowded. Individual hives in a bee yard should be three to four feet apart. Providing good protection from the cold in winter also helps colonies stay healthy.

For organic honey production, beekeepers must follow organic handling and processing regulations as outlined in the NOP Standards. They should keep bees and provide bee forage on organically managed land, and they should adhere to the materials restrictions contained in the National List of approved and prohibited materials.

In terms of using bees for pollination, the decline in honeybee populations resulting from disease and other pressures has led agronomists and entomologists to think about ways to protect and promote native bee populations as alternate pollinators. Such recommendations fit well with organic farming, which seeks to encourage beneficial insects for a wide range of ecosystem services.

CONCLUSION

This concludes the Livestock chapter. We've covered a lot of information about why livestock can be advantageous in organic farming systems and how organic livestock management differs from non-organic management. It's important to select healthy animals to begin with and have a knowledgeable person to care for them and keep them healthy. Animals need the correct nutrition, fresh water and healthy living conditions and pastures. Most producers find that once they have their systems set up right, major health problems generally don't arise, making the NOP restrictions on synthetic medicines relatively easy to follow.

The Resources section at the end of this chapter can point you toward more information specific to your particular needs. Many certifiers and organic producers' groups maintain lists of approved materials and practices for organic dairy management and other systems.

If you're planning on transitioning to organic

livestock production, make sure your Organic Livestock Plan is complete using our interactive online tool.

In the next chapter, we'll talk about marketing strategies, farm business management and the many opportunities that exist in today's organic sector. See you there!

RESOURCES

Resources are free online unless otherwise noted.

GENERAL

NCAT's Organic Livestock Workbook
(ATTRA, 2004)
A step-by-step guide to meeting NOP Standards. 92 pp.

PASTURE

Eat Wild—Grass-fed Food and Facts

Grazing Networks for Livestock Producers
Paul Williams and Alice Beetz
(ATTRA, 2002)
How to begin, join or maintain a grazing network.
12 pp.

Pastures: Going Organic
George Kuepper and Alice Beetz
(ATTRA, 2006) 20 pp.
University of Wisconsin Extension Forage Resources

DAIRY

Northeast Organic Dairy Producers Alliance
A rich website including news, classifieds, policy discussions and links to additional resources for transitioning.

Organic Dairy Farming: A Resource for Farmers
Jody Padgham, ed.
(Community Conservation, 2006)
An up-to-date resource collecting expertise from nutritionists, veterinarians, farmers, certifiers and researchers. $19, 192 pp.

SHEEP AND GOATS

Dairy Sheep
Margo Hale and Linda Coffey
(ATTRA, 2006)
Covers marketing, breed selection and management. 15 pp.

Managing Internal Parasites in Sheep and Goats
Margo Hale
(ATTRA, 2006)
Overview and guidelines for organic and sustainable production. 8 pp.

National Goat Handbook
(University of Maryland)
A comprehensive resource, although not specific to organics. 412 pp.

Sheep and Goat Marketing Info

PIGS

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16 pp.

CHAPTER 5

MARKETING

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Photo Credit: Jack Sherman

CHAPTER 5

MARKETING

INTRODUCTION

So far in this course, we've looked at how to produce crops and livestock organically to give you a certifiably different product. To capture the value of your investments in going organic—and the environmental benefits that will result—you need to be able to maintain that difference when you take your products to market. To do that, you'll want to have a business plan that includes a marketing plan and a thorough understanding of costs and pricing.

This chapter will introduce you to overall organic market trends and the opportunities they provide for you, given your capacity to produce, your location and your desired level of "adding value" to what you grow. Whether you produce field-run soybeans or farm-processed yogurt in a private-label container, a good plan will help you become a successful enterprise by connecting to a solid market for your products.

We will suggest strategies and tactics to help you manage and market your business

in your part of the country. The emphasis is on providing value by optimizing the marketing mix (product, place, price, and promotion).

By the end of this chapter, you will be better able to understand general organic marketing trends and opportunities; identify regional marketing options for what you wish to market; use the Crop Conversion Calculator (this course's crop enterprise budgeting tool); and determine why business and marketing plans are important for your business, and how they can help you decide if organic farming is right for you at this time.

LESSON 1: BUSINESS BASICS

OVERVIEW

In the first few chapters of this course, we presented information about managing soils, crops, and livestock. Now it's time to look at managing and marketing your organic farm business. If you already run a successful business, stay tuned for some new ideas from successful owners and reports from the field on improving your business.

This lesson is about selling value by developing your marketing mix including product, place, price, and promotion. We'll give you details about what goes into a basic marketing plan, and then how to create an overall business plan.

To do this, we'll introduce farm planning, describe the organic marketplace, talk about why consumers want organic products, and explain how you can provide value to your customers through positive relationships and effective branding.

WHAT IS MARKETING?

Marketing is more than the process of promoting, selling, and distributing a product or service. It's about giving value. It's about identifying what customers want and selling it to them at the right price when they want it.

The word marketing is used in a variety of ways in agriculture and business: to some, it means just finding a buyer; others think of it mostly in terms of advertising. In this course, marketing means something much broader and, we think, more exciting.

Marketing is the process of:

1. Identifying what makes your products, services and farm unique;
2. Determining who your customers are and understanding their motivations and needs;
3. Finding the best way to connect your products and your customers; and then
4. Creatively communicating all of this in as many ways as you can.

You can be effective at marketing no matter what you produce or how big your farm. It all comes down to how well you know what makes your product valuable and how well you communicate that value to others through your actions, information, image, relationships, and products themselves.

A good business plan is built on a solid understanding of your product and what it takes to produce it (your Organic System Plan); the market, which includes the market environment, competition, customers and communication (your marketing plan); and your cost to produce and market successfully (your financial plan).

By combining these, you have the basic ingredients of a solid business plan. You will also have a strong grasp of what you are doing in your business that you can adapt and revise as you go.

FARMER-TO-FARMER

"Marketing is everything you do to promote your business, from the moment you conceive of it to the point at which customers buy your product or service and begin to patronize your business on a regular basis."

—Jay Levinson
Guerrilla Marketing (2007)

THE VALUE OF PLANNING

This may sound like a lot of "thinking and planning" just to do something you already know: farming. Think of it this way: No one knows your farm as well as you do, and this is just getting what you know and what you'd like to do with it down in writing.

Developing these plans will help you

organize your farm activities, add important new information, and have something to refer to as you face various decisions about your farm. It will also allow you to present your farm operation to those who don't know it as well as you do, such as bankers or potential customers.

Think about these questions:

- What makes your products unique and attractive to customers?
- How can crop storage and processing add value?
- Who are your competitors?
- Do you already have a business plan or a marketing plan?
- How will you get your products to market?
- How will you identify and communicate with potential customers?
- Do you have an updated Plan B to respond to changing market conditions?

Think of these plans as maps to guide you in managing your business. Refer back to the plans often as you fine-tune your business and marketing strategies.

FARMER-TO-FARMER

"In my experience, the difference between a successful and a failing farm operation usually comes down to the farmer's marketing skills."

—Rosie Koenig
Gainesville, FL

A GROWTH SECTOR

Organic farming is one of the fastest growing segments of U.S. agriculture. As consumer interest continues to gather momentum, many U.S. producers, manufacturers, distributors, and retailers are specializing in growing, processing, and marketing an ever-widening array of organic agricultural and food products.

There are many reasons to convert to organic farming. All farmers, organic or otherwise, share one goal: remaining profitable in order to stay in business. This means you have to make enough money from the sale of your products to cover your costs, pay yourself, and support your business plans for growth and innovation. Going organic gives you new ways to pursue production and marketing that can create new areas of profit.

THE ORGANIC MARKETPLACE

Organic producers are penetrating virtually every market sector where health, environmental and food-quality attributes are valued. These range from neighborhood farmer's markets selling fresh produce to contracts for railcars of organic small grains for pasta and bread; from semi-trailers of #2 yellow corn for livestock feed to pricey ounces of dried mushrooms.

Photo Credit: Rodale Institute

From farmers markets to grocery store shelves, organic products are a hot commodity.

ORGANIC PREMIUMS VARY BY REGION, PRODUCT

With organic products, you are usually able to command a premium—a price higher than that of the same product of the same grade raised non-organically. While the percentage may vary from crop to crop or region to region, organic products virtually always have extra value in the marketplace.

Some industry professionals say price

premiums need to come down if we are to see the organic sector gain a bigger share of the marketplace. However, the reality is that these premiums are holding strong in some areas, fluctuating in others and dropping in still other areas. These mixed results combine the economic impacts of consumer preferences that relate to perceived organic benefits, shifting global supply, and changes in the conventional commodity markets.

GRAINS

Demand has been strong for organic grains. Prices and the size of organic premiums (relative to non-organic prices) vary by the type of grain, geographic region and time of year. Choosing varieties with distinct marketable traits—including superior quality—is one key to success in the organic marketplace.

PRODUCE

Produce is marketed on a wide range of scales, from a handful of red beets at an on-farm stand to a pallet of boxes going into wholesale trade. Produce prices at the wholesale level can be speculative and more volatile than in organic grains or livestock, and vegetable prices depend significantly on quality.

Vegetable production and fruit production are the entry points for many beginning organic farmers. These enterprises provide a way for a commodity- based farm to try the new management needed for higher-value crops, and also give farmers with access to only a few acres in metro areas the chance to try management-intensive cropping and marketing. Growing organic food by the basket for the people who eat it gives you very different marketing opportunities compared with selling non-organic commodities by the ton to a regional elevator.

FARMER-TO-FARMER

"My business plan is modeled after a three-legged stool to afford me stability in the rough, uneven world that is farming. Today my farm has three distinct streams of income: subscription sales to our CSA members, a restaurant delivery route and one farmers market stall.

"The CSA is by far the most important part of my business, because these folks are my underwriters. They're essentially fronting me the money we need to farm."

—Andy Griffing
Watsonville, CA

DAIRY

While one organic label might pay the farmer a little less than another, this may be offset by other aspects of doing business with the buyer. Variations include the stability and duration of contracts, financial counseling, animal health training in your area, a solid reputation within the marketplace, a say in the business (if you are part of a co-op), quick payments, other intangibles and even veterinary services.

Many organic dairy farmers are finding success in alternative markets by developing on-farm- or custom-processed products that add value to bulk milk, including butter, yogurt and cheese. Selling raw milk—in states where it is legal and when done with careful safeguards—is another option for producers with excellent milk quality that may attract a loyal customer following.

MEAT

Beef lagged behind the produce and grain sectors of the organic industry in being labeled organic until a federal organic beef definition was accepted in 1999. In the years since, other production and quality claims—including "grass-fed," "natural" and "antibiotic- and hormone-free"—have gained market share.

With poultry, the descriptive but legally undefined terms "free-range" and "cage-free" with regard to poultry are used with some success to indicate a production value that consumers may find important in their purchases.

The "USDA Organic" meat label guarantees that animals were raised hormone- and antibiotic-free on an organic diet. However, the label does not guarantee that diet was grass-based (the natural habit of ruminant animals). As consumers become more knowledgeable about how livestock

may be raised, they may want to consider more than one aspect. The "stacked values" of "organic," "grass-fed" and even "local" become their personal standard.

Photo Credit: Rodale Institute

Rod Weider sells grass-fed American buffalo to customers in Pennsylvania.

FARMERS HELPING FARMERS

Here's one of the more pleasant aspects of organic farming: it's not business as usual if you become involved with the network of farmers building organics in your geographical area. The strongest organic farmer groups are regional and state-based, concentrating on the people and places they know best.

Organic farmers typically realize there's room for everyone in the expanding universe of health and sustainability, and you'll generally find they'll help you in any way they can. Especially where organics is still a new idea, those who have been pioneers want to pass on their hard-earned insights to those who will strengthen the area's organic community. Organic infrastructure for distribution and logistics is relatively undeveloped in many regions, so sharing freight costs and buying in greater volume are practical reasons to work together.

You'll help yourself and the farmers you work with by producing the best possible product you can, and by distinguishing yourself in other positive ways. Organic innovators who plan carefully, execute well and welcome others to join can be a tremendous influence for good. Farmers market managers seek out vendors with complementary products. This can mean adding cheese to a produce-only market, or bringing new types of cheese to a market where cheeses are already popular.

WHAT CONSUMERS VALUE

Now that you have an overview of the opportunities in the organic market, and you are beginning to look at specific crops and regions, let's take a look at who is behind this market demand: consumers.

"The largest quantity for the cheapest price" is a common advertising message conveyed in grocery store circulars. Committed consumers of organic food, however, tend to be motivated by factors in addition to price. They give greater consideration to the environmental and health costs of non-organic farming, the insecurity of a food system dependent on foreign oil, and the loss of farming communities across the country where farms are trying to produce for the "cheap food" market.

Photo Credit: Wholtone

Customers in a farmers' market

A 2003 study by the Hartman Group identified health as the number one reason consumers choose organic. For occasional organic buyers, price was the main barrier to making the organic choice.

Many consumers are happy to make their organic purchases in a health-food store or a conventional grocery store. A growing number of organic shoppers are becoming even more discerning. Where their food is grown has become important to them, leading to the rise of locally and regionally sourced organic foods.

These shoppers demand the "local connection" of fresh food from farms in a specific area that keeps their food dollars circulating more times in their own communities. This segment of consumers is largely responsible for the continued growth in farmers markets and CSA (Community Supported Agriculture) farms. A CSA is a model whereby customers pay up front for a box or "subscription" of fresh vegetables received each week of the growing season.

CROPP'S SUCCESS

A cornerstone of CROPP/Organic Valley's success is its relationship with customers. According to Steve Brandl, the company's national food service sales manager, the primary interests of customers buying Organic Valley products are:

- supporting sustainable agriculture
- supporting small family farmers
- voting with their dollars for a food system they want to be part of

WHY PEOPLE CHOOSE ORGANIC

Consumers are looking for food they can trust. The more effectively you can educate them about how your products are different, the better you will succeed in the marketplace. Even if you don't sell direct, you can capitalize on this trend by finding companies that cater to this growing market of "conscious eaters." Almost 24% of Americans find USDA organic labeling helpful in providing an additional assurance of quality and peace of mind when making choices to purchase "good foods" to serve their families, according to a survey commissioned by a ConAgra brand.

Consumers of organic products are willing to pay a premium for many reasons, including better health, flavor, nutrition, environmental considerations and the good of the community. One way to study changes within overall consumer demand for organics is to identify subgroups and how each views their purchases as part of their life. The Hartman Group uses three segments:

- Periphery buyers, who are just beginning to use organic foods, buying single items for specific reasons until they develop greater interest
- Midlevel buyers, who are adding organic products to their life in a gradual evolution
- Core buyers, who try to buy organic whenever they can and who look for additional ways to support what they believe "organic" means.

Get to know your customers well. It's important to identify the interest profile of each person you market to. Their interests may be quite different from those you are used to, or what you are interested in when it comes to food and farming. Getting a handle on these issues will be critical to your business's success and your overall profitability.

Your customers and potential customers are key ingredients in your marketing plan. Once you know where you're going—who your customers are—it's much easier to draw a solid marketing map to get you there.

To succeed in business, you need to attract and retain satisfied customers. This takes careful planning and marketing efforts that convince people to try or continue to use your products or services.

INPUT FROM RODALE

You don't have to sell direct to get to know your customers. If you're going wholesale, it still pays to understand what the end customer is looking for as well as what your buyer wants to see.

—Jeff Moyer

UNDERSTANDING BRANDING

"Value-added" means doing something extra with your basic crop or livestock product through preserving, processing or packaging that improves the utility, interest or information to garner a higher price. Sun-dried tomatoes, cleaned grain, delivered hay, garlic vinegar and strawberry jam are all examples. To explore this approach:

- Become familiar with your state's health and business codes and how they are being enforced
- Become familiar with the NOP Standards regarding the labeling and protocol for handling of processed foods
- Talk to other organic farmers working in similar areas
- Talk with your certifier

Connecting the farm story adds value, and organic itself is a marketable attribute. Research tells us "local" has become a powerful way to add a deeper dimension of value to your organic premium. The experience of visiting your farm's stand or field day offers an additional layer of interest as do the recipes and information pamphlets you pass along to your customers.

The question of "values" (worth based on how a product was produced or what it represents) and "value" (the benefit a consumer experiences relative to the cost) is central to organic production. Many interested consumers remain price-sensitive in their food purchases for a variety of reasons, including having to live on low incomes.

Photo Credit: Rodale Institute

Artisan bread made with local grain is one value-added trend gaining popularity.

Chart a course for your operation that factors in which market segment you wish to target. High premiums usually come with stiff competition, shifting tastes and the need to reach a small percentage of the market. It's easier to sell lower-cost products, but you'll need volume to reach a profitable level. Larger-scale operations may be able to underprice you unless your product has unique features valued highly by specific customers. Good presentation, attractive labels, and attaching the "farmer's story" can add value at any level.

BRANDING BUILDS RELATIONSHIPS

The concept of "branding" crystallizes what makes your farm and products distinctive in the marketplace. Successful brands all start with identifying a core idea: what do you stand for, what do you do that is unique, what do you want people to think of when they hear your name or see your logo?

These elements all go into making up your brand identity. Your logo, packaging, promotions, community events, and the way you treat your customers are all ways of building and communicating your brand. Everything you do, no matter who your target customer is, can enhance or detract from your brand.

The Quaker Oats guy, the Land O' Lakes Indian maiden and the Jolly Green Giant all represent successful brands. Organic farmers and companies are building their brand reputations, as well. Martin and Atina Diffley have been farming organically outside the Twin Cities in Minnesota since 1973. They've been running a farm stand on the same acre of land since 1977, selling produce from 100 certified-organic acres.

Their close relationship with food co-ops—and with customers of those co-ops—is unprecedented. It's built on their "Gardens of Eagan" brand, with a label that shows the farmers out working their fields. Customers connect this

label not only to superior quality and taste, but also to a commitment to a valuable way of life. When the Diffleys were forced to fight an oil pipeline proposed to run through their farm, their customers rallied to help.

The Diffleys built this loyalty by nurturing human relationships and promoting brand recognition, two sides of the same coin. Each year, Martin and Atina visit each of the eight stores they do business with. Their faces and their brand are recognizable on store displays and on product labels. All of this is underscored by the Diffleys' commitment to educating customers about their farm and about the importance of the food choices we each make every day. One longtime co-op they serve has agreed to purchase the farm to ensure its agriculturally productive future.

SUMMARY

Too many farm businesses fail because their effort and hard work aren't matched by careful planning. Take the information in this lesson and build a strong business plan that allows you to take advantage of the opportunities in the organic market today.

The organic difference—in quality and price—can become the competitive edge for your organic business. Your job is to decide how you can best build value and values into your farm enterprises.

Be sure to visit the Resources section at the end of this chapter for information on learning more about the various parts of your operation that will shape your marketing strategy.

Even if it's not part of your Organic System Plan, understanding the organic marketplace and the opportunities it offers is essential to your success with organics.

LESSON 2: MARKETING PLAN

OVERVIEW

The essence of marketing is identifying what makes your product unique and valuable, positioning your products to take advantage of those unique benefits, and communicating all of that to your prospective customers. In this lesson, you'll learn how you can use this information to assist you in defining your competitive advantage. We'll explain the classic four P's of marketing: product, place, price, and promotion—as well as what could be called the fifth P, people.

Price overlaps so much with financial planning that it is talked about it in depth in Lesson 3, even though it's a key element in your marketing strategy. First, we'll focus on product, place, promotion, and people.

PRODUCT, PLACE, PRICE, AND PROMOTION

A useful way to think about marketing focuses on the four P's: product, place, price, and promotion. The key is to use these four P's to create value.

1. Product: remember, your product needs to satisfy the wants and needs of your potential and current customers. Think about what makes your product distinctive or better than other products, and your customers' perceptions of your service, image, brand and quality. Product can also include processing and packaging.
2. Place is where and how the product meets the customer: a roadside stand, farmer's markets, online or telephone sales, on-farm sales, and so forth. Place can mean selling directly to the consumer or to a chef, retailer, wholesaler, or broker. Your decision about the best place to market your product will have a big impact on your other strategies, including price and promotion, so it's important to consider early in the development of your

FARMER-TO-FARMER

"Based on my experience, marketing had better be an important part of your business plan, because it will take around 30 percent of your time each week. This is different from how most farmers perceive themselves. This means more than just working in the fields. It means putting orders together, talking with customers, packaging, invoicing and delivery."

—Brian Moyer
Fleetwood, PA

marketing plan. A mix of different places or market channels can often be a good strategy.

3. Price is the cost to the customer, the amount of money exchanged for the benefits of the product or service. Before you set a price, consider costs, margins or markups, and competition. Your goal should be to deliver value to your customers while earning enough for yourself to stay in business.
4. Promotion: there are many creative ways to reach potential customers and promote your products. Promotion may include referrals, free samples, incentives, radio advertisements, or an Internet presence. Try to find ways to track the impact of your various promotional strategies. The key is to develop the necessary contacts, maintain relationships with your customers, and budget for these expenses. Too often, people think of marketing and promotion as the same thing. In fact, promotion is the final piece of the marketing puzzle, best tackled only after you have a good handle on the other three aspects.

IDENTIFY YOUR MARKET STRATEGY

Consumers used to be confused by numerous agencies and a wide range of standards certifying organic products. It wasn't easy or quick, but by 2002 the organic community had worked to create a set of rules that are administered by the USDA. This means consumers—your customers—now know there is a defined and documented process used when they buy items bearing the "USDA Certified Organic" label.

This is especially important in instances where there is a middleman, such as a grocer or a produce wholesaler, between you and the customer. To be sold as "organic," your product must carry the USDA organic label. An exemption exists for farmers doing less than $5,000 in sales a year, but these farmers must still adhere to the National Organic Program Standards.

For some farmer's market and CSA customers, buying directly from the farmer is more important than whether or not the farmer is certified organic. It's up to you to decide who your customers are, what their expectations are, and how to fulfill those expectations. Generally speaking, though, unless you are selling 100% direct to customer, you will want to seriously consider certification. With the expansion of interest in organics, more and more new shoppers will be getting their first exposure to organic food far from the farm. Here, the combination of certified organic strengthened by a local or regional label could make your product stand out.

As you consider each element of your marketing strategy, you'll probably go back and forth and revise to reflect new ideas and information—the marketing plan is not a step-by-step process so much as a process of each element influencing the whole. For example, if, after researching your options, you decide your best placement strategy is to market to retail stores rather than direct to consumers, you may have to go back and look at your product again to consider packaging and pricing suitable to that market. When you figure out the price point you need to reach to be competitive, that may send you back to reconsider the product, process or packaging again; and so forth, until you come up with the mix that is right for your farm.

FARMER-TO-FARMER

Tim Stark moves up to two tons of heirloom tomatoes a day in high season from his farm in southeastern Pennsylvania. When his 10,000 plants are at peak production, he has to get creative.

"I could never sell medium-size heirloom tomatoes," says Stark. So he started offering quart-size "variety packs" of different sizes and types. The result? "We sell tons of them right off the table." Stark also wholesales the mixed packs to Whole Foods and to restaurants.

—Brian Moyer
Fleetwood, PA

PLACE AND TARGET MARKETS

Place is where the product or service will be available to the customer. The place may be a food co-op, CSA, storefront, farmer's market or farm website with online ordering. Or it may be a mill, cannery or processing plant that is manufacturing a product for which you provide raw material.

Placement of your product, and your place of business, should efficiently serve your customers and consider each of the steps involved in the distribution of the product. Place considerations depend on whether you are selling to a wholesaler, the public or a retailer. In addition, place includes logistical considerations such as shipping products that customers order by phone, by mail or via the Internet.

Your marketing strategy may include any or several of these markets:

Direct to consumer:

- Farmer's markets
- CSAs
- Farm stand
- Internet sales
- Pick-your-own

Retail or wholesale:

- Retail outlets
- Restaurants
- Cooperatives
- Contracted sales
- Sales to a food distributor
- Farmer-to-farmer sales
- Broker sales
- Institutions such as schools and hospitals

STORAGE AND HANDLING TO ADD VALUE

The special storage and handling needed for organic crops adds both expense to your operation and value to your product. In organic production, quality must be first and foremost, as this is why you receive a premium price. You need to take care that the high-value crops you harvest from the field have maintained their quality and integrity when delivered to the customer. This means careful storage and handling and strictly avoiding commingling with non-organic products.

Because you don't want to compromise the integrity of your organic grains, you'll probably be storing them on-farm until delivery, unless you live in an area where there's a certified-organic elevator or mill. Thus, part of your transition process may be increasing your farm's grain-storage capacity.

If fruits and vegetables are part of your mix, your focus is field-to-plate quality. You may find yourself having to create a few on-farm storage areas to meet the varying ideal conditions of your products. This may well be the cost of doing business in the organic marketplace; it's also the reason you collect the premiums on your products.

IDENTIFY YOUR MARKET BEFORE YOU PLANT

Whether you're raising #2 yellow corn, alfalfa hay or tomatoes, the last thing you want to be doing come harvest time is sitting on a surplus of organic produce destined for the conventional market—or even the compost pile. With demand for organics far outpacing supply, there's no reason for this to happen. But you need to be proactive in lining up your markets.

If you're marketing through a CSA, you should have a pretty good idea of how much you need to produce to fulfill that segment of your customer base. Start by multiplying the number of members you have by what you intend to include in each weekly share. If you grow grains, consider growing a portion of your crop on contracts rather than depending on the spot market to handle your entire crop.

LOCAL=VALUE

Eat 'n Park Hospitality Group provides food to colleges, universities, retirement communities and two chains of family-style restaurants in Pennsylvania and beyond. Jamie Moore, head of the company's Farm Source program, champions local produce whenever he can. He says his institutional customers clamor for local fare even more vigorously than they do for organic.

Farmer's markets and drive-up farm stand sales can be trickier to project, but experience will soon inform you. Retail and restaurant customer sales are similar to farmer's market and farm stand sales, but perhaps a little more predictable. Gauging the volume of retail and restaurant customer sales will depend on the relationships you can build and maintain.

The amount of produce, grain or livestock you raise to fulfill a contract with a wholesaler or retailer may fluctuate from year to year. You should have a good idea of your obligations within any one season. As you move into organic production, try to balance your new investments in time, land and capital as much as you can. In other words, grow your markets by taking risks you are comfortable with.

It is so important to know the market you're growing for, so you can position yourself to best meet the needs of that market ahead of time. Farmers have so many other factors they can't control—weather, pests, market conditions—that you need to give yourself the strongest possible starting point.

GROWING ON CONTRACT

Some farmers are interested in selling to brokers or food service operators but feel it's too risky to increase production to the quantity required. That's where contracts can help minimize both the producer's and the food service operator's risk—especially when both are new to the direct farm-to-institution relationship.

But some food service operators don't like contracts, preferring the flexibility of calling to order what they want, when they want it. One general exception is large food-service organizations that trade in high volumes, including universities and large hospital systems. In some cases, a certain percentage of an institution's food will come from a certain major full-service supplier, but the institution may reserve the right to purchase the remainder from other vendors. From a regional produce broker's standpoint, a contract may be the necessary tool to prove you're a reliable supplier.

On the production side, growers sometimes are reluctant to consider contracts, perhaps because they are uncomfortable with setting or negotiating a price. We'll talk more about pricing in the following lesson. Others—more comfortable with operating on a handshake—may feel their pride is at stake. But if you plan to grow, pick, and pack crops worth thousands of dollars, you need the assurance from your buyers that the money will be there.

Look for buyers who will work with you to create mutually beneficial agreements. For example, producers can offer an advance notification clause pledging that they must notify the buyer a certain number of days in advance if they won't be able to deliver the specified quantity and quality of produce. Also, a clause can specify that the buyer needs to notify the producer a certain number of days before the next delivery if the buyer won't be needing the set volume.

CONTRACTS AND ORGANIC GRAINS

In the organic world, farmers can't just produce and sell, says Lynn Clarkson, of Clarkson Grain Company in Cerro Gordo, Illinois—you need to find a buyer for your crop.

Identity preserved (IP) markets mean that the buyer not only knows what country or state a product is coming from, they know what farm and farmer.

Photo Credit: USDA

Picture of organic grain

"Within the IP grain world, if buyers did not contract in advance of production, the market would not produce what the buyer wanted," Clarkson explains. "In the same IP world, the value of a particular crop might be lower outside a particular market. So, buyers and sellers normally enter [into] acre contracts under which the farmer agrees to produce a stipulated number of acres, and the seller agrees to buy everything produced on those acres for a stipulated price."

If a buyer is running a national, regional or even local program of a certain scale, Clarkson says, he or she will need to know that the product will come through. "For security, he would like to buy in advance perhaps 120% of his needs. For even greater peace of mind, such a buyer might like to contract for supplies for up to three years into the future," says Clarkson. If the price is reasonable, such agreements protect both buyer and seller. They rarely specify production weights, he says, generally specifying only the production acres. "The buyer takes the risks of weather and crop vagaries," Clarkson says, "while the farmer is protected against having to meet a contract with a short crop."

SELLING WHOLESALE TO FOOD DISTRIBUTORS

Selling wholesale means entering an existing market channel as a supplier to someone else. Your first customer has to believe that your product and your business will benefit him or her and the customers he or she serves. Adding steps between you and the end user demands packaging that protects the product, labeling that retains as much farm identity as possible, product quality that will survive the trip, and pricing that allows everyone involved to make a reasonable profit.

Carefully research your wholesale options before you make a pitch. Make sure to ask enough questions on quality and delivery requirements, pricing, payment conditions, the business practices of potential buyers, and the prospect of a further relationship with them. Read their contract carefully—with a lawyer, if you can—to understand all the provisions. Make sure the benefits of someone else taking your products to the final organic consumer outweigh the costs.

Once you decide to attempt to sell to a specific broker, distributor or wholesale buyer, do your homework. Make sure you are presenting a product they want, with packaging that works, with the documentation they need—all at a price that works for you both.

BUSINESS DYNAMICS

As part of the Leopold Center's Value Chain Partnerships for a Sustainable Agriculture (VCPSA) program, Cooperative Development Services (CDS) collaborated with VCPSA and the Leopold Center's Regional Food Systems Working Group to study business dynamics between SYSCO, a national distributor of products to the food service industry, and three Iowa-based, small to midsize food enterprises. Through a series of interviews, CDS collected and analyzed data in order to identify both the challenges and the essential elements for these smaller food enterprises to successfully work with a large food-service distributor.

PRICE SETTING 101

Once you've established the product, its place in the market and your scale of production, you are in a position to begin working on a price that will make the arrangements sustainable for your business.

1. Your costs. In general, prices must cover all production costs, both fixed and variable. I'll cover costs later in this chapter.
2. Your profit plans. If you plan to grow your business or provide an income for yourself and your family, you need to build those plans into your pricing formula.
3. Competitors' prices. Use other sellers' prices on similar products as a gauge for setting prices.
4. Product differentiation. It may be appropriate to charge a higher or lower price for your product, relative to the competition, depending on how your product relates to theirs. If yours is of better quality or is simply unique, then a premium may be warranted. If it is of

lower quality, then you may need to price below your competition to sell it. You can also differentiate your product by its timing. For example, the farmer with the earliest tomatoes enjoys a period in which prices can be set higher than when other producers bring in their tomatoes. A rapidly growing demand for locally produced food means price premiums for you if you can cultivate local markets.

5. Environmental factors. Matching prices and products to economic and ethnic groups is a good way of maximizing value. Other factors, such as prevalence of certain ethnic groups, may affect your ability to modify your prices on certain products that may be more attractive to those groups than to the general population.

PROMOTION AND ADVERTISING

An effective promotional strategy requires an understanding of how promotion fits with other pieces of the marketing puzzle. Think about how promotion affects other areas of the organization. The objective of promotion is for customers to buy the products and remain loyal customers. Effective promotion should include:

- Building brand awareness
- Creating interest
- Providing information
- Stimulating demand
- Reinforcing the brand

Types of promotions include advertising, sales promotions, public relations, and personal selling. Be sure to evaluate the costs and returns from the promotional campaign. Learn to recognize when you need to make changes.

Promotion can take many forms:

- Product promotion
- Advertising your farm image
- Public service (tours, field days or educational events)
- Health, nutrition and environmental advocacy intended to influence a target audience

Begin by developing quality marketing tools, including business cards and brochures. Think about products you can advertise and promote together. Next, think about the media. This could include sending press releases or advertising in local guides or in the classified section of the newspaper. Don't forget about using the Internet, radio, and television.

THE INTERNET

The Internet is one of the world's least expensive and most efficient marketing tools. Here are a few excellent reasons to be online:

- Enjoy low entry costs
- Be accessible 24 hours a day, 7 days a week
- Reach a worldwide audience
- Recruit customers
- Research business collaboration
- Provide background and contact information to media
- Communicate in many ways with customers, from sending seasonal updates to responding to their questions
- Through online surveys, learn customer preferences
- Make your farm and products easy for potential customers to discover and find

The Internet can help you improve your bottom line in a number of ways. It can help build relationships and disseminate product, sales and marketing information to all parts of the world. Use the Internet to find information and broadcast your specialty products, such as organic beans, corn or spelt or other specialty grains. You never know who's out there looking.

THE FIFTH P

The four P's have been part of marketing theory for many years. More recently, there has been a lot of discussion about the need to add a fifth P that addresses an intangible but essential element of successful marketing. Some call it people, some process, others participation or passion. It boils down to the importance of

customers and relationships in your marketing strategy.

"You are not your own customer, so we don't care what you want," says Ohio farmer Jackie LeBerth. "You need to put on your customers' shoes. What makes them let go of their hard-earned cash to buy what you have to sell?"

Figure out the benefit you are trying to sell and the customer to whom you will sell it, and then work to communicate that benefit to the customer, LeBerth says. You can market that benefit by doing research on a product and becoming an expert.

THE FARM-CUSTOMER CONNECTION

If your customers are interested in organics, they want something more than the non-organic market offers. Market segments may include:

Consumers:

- Food-culture types who thrive on local crops with great taste
- Wholesale buyers who are just filling an order
- Social activists looking to build healthier communities
- Health enthusiasts who will ask more questions as time goes on
- New parents who want the very best for their children

Processors and others:

- Entrepreneurs seeking quality ingredients for their products
- Other certified organic farmers who need your products for their own operations

Retailers:

- Health-food stores where customers value a regional farm identity
- Restaurants moving into organic and place-identified foods
- Regional chains of grocery stores

As you get to know your customers and what motivates them, you can highlight the attributes of your products that most appeal to them. Learn what new areas they are interested in that you can develop together. Show them your farm, your people, and your products to achieve the kind of relationship that public-relations dollars can never buy.

Organic certification may give you a label, but it's up to you to back it up by being the kind of farmer your customer wants to do business with. The more you can wear the marketing hat as well as the farming hat, the better you will succeed. The better we can document and communicate the quality of our farm's soil, water, crops, meat, fiber or products, the more confident we can be in saying that we have something distinctly different to bring to the marketplace.

Photo Credit: Emery's Farm

When the Marcheses purchased Emery's blueberry farm and converted it to organic, they kept the name in honor of the original owner, who "had a reputation for being the first person to hook a wagon on a tractor and bring people out to his fields."

RELATIONSHIP MARKETING

Your customers want good food with a story and a face—your face—at a fair price. Savvy grocers and restaurateurs know this. That's why we see pictures of farmers and stories about their farms on product packages and restaurant menus. But when it comes to relationship marketing, nothing means as much as face-to-face contact.

Establishing and maintaining that personal

connection takes time, but it should also help you capture more of the 92 cents out of every U.S. food dollar that typically goes to processors, brokers and retailers. More than dollars, doing business with people who know you changes the process. Many direct-marketing farmers say that interacting with customers is one of the most rewarding aspects of what they do.

FARMER-TO-FARMER

"People are looking for an experience. I don't want to just hand them their items, take their money and say, 'Thanks, see you next month.' I want them to have a vested interest in my farm so they see it as a vital part of the community."

—Brian Moyer
Fleetwood, PA

This relationship building carries over to your local grocers, chefs, food-service managers and other farmers—anyone you choose to do business with. The more you can cultivate and maintain these business relationships based on trust and mutual respect, the more of that consumer food dollar goes into your pocket.

You may feel that dealing directly with customers is not your gift. If that's the case, you can do more wholesaling or marketing through a co-op that brings in professional marketing skills, choosing to share profit so you can focus your time and attention on production. You may find the trade-off of lowering your profile—and the upside potential that your extroverted neighbors may experience—more to your liking.

SUMMARY

In this lesson, we talked about writing a marketing plan while considering product, place, price, and promotion. The heart of marketing is knowing your product, understanding your customers and finding creative ways to bring them together. In order to successfully execute a marketing program, you need a plan. Your marketing plan is a detailed road map for where you are going, how you will get there and what you'll learn along the way.

Using this information in combination with the Crop Conversion Calculator can help you better understand how your production and marketing decisions affect your farm's profitability. Take a deep breath—or even a walk around the farm to think of the possibilities—then plunge ahead. We hope this leaves you excited about the ways that marketing your farm's organic value can open the door to new kinds of farming opportunities.

LESSON 3: ORGANIC DOLLARS

OVERVIEW

The last lesson gave you tips for creating your marketing plan and marketing strategy. This lesson shares some ideas about pricing—one of the four P's of marketing and a central factor in your bottom line. How you set prices can influence your revenue and profits, either negatively or positively.

If you don't think you have the time to take a close look at your costs or don't think you can control the prices you get for your products, this lesson is for you. Pick up tips and strategies on recording and tracking costs, learn how to set prices at profitable levels and get information on budgeting and accounting.

By the end of this lesson, you should be able to use your pricing and cost information to formulate budgets, calculate profit and loss, and use the course's Crop Conversion Calculator to estimate prices.

PRACTICAL ECONOMICS

The steps in this tutorial give you a good handle on the practical economics of your organic enterprise. These are critical tools to help you test what you are doing with the best markets you can find. If you don't find a match, you have to change markets, prices or products to get there. For instance, if your local farmers market doesn't value your hot pepper collection at a price point that is profitable, you may want to consider traveling farther to a larger market where demand is stronger.

To calculate your organic financial advantage, you need to incorporate the additional savings (or costs) of organic production into an

enterprise budget for your whole farm. Consider production, harvest, post-harvest handling, and packaging, compared with what you would be doing if you weren't organic—for the same crop, or for a different crop on the same land base. Also figure in your cost of organic certification, specialized transportation, and any additional marketing work required.

The net result of these figures may change dramatically through your conversion years. Figure your annual steps conservatively, so you can reach your five-year projection even if things prove more challenging than you expect. Once you arrive at these figures for the monetary difference, weigh them with your other reasons for wanting to go organic to make your final decisions.

Remember, no matter how well you plan, you'll probably need to make adjustments along the way. Work with your family and other partners to decide what you want most from your organic farming operation. Work together to track progress and goals from year to year to find out if you are sustaining the land, people, and community in the ways you care about the most.

Photo Credit: Rodale Institute

You may be able to fetch more per pound for microgreens than for the full-size product, but if your packaging costs or losses to waste are too high, it could be a wash.

RECORDING AND TRACKING YOUR COSTS

Let's face it: many people, including many farmers, don't keep very good financial records. But tracking financial data is just as important as tracking cropping data. The silver lining in all the paperwork required of certified organic farmers is that it will not only make you a better farmer, it will make you a better businessperson, too.

If you've been in business for a while, some of this information will be familiar. If you're not the most meticulous recordkeeper, now is the perfect time to make improvements. And even if you are, I'm sure you'll find some nuggets of wisdom in this tutorial to make you a better one (and improve your bottom line).

You may already be saving and organizing a lot of the information you need to keep good records and develop useful cost information. Do you:

- Have a bank account for your farm?
- Keep farm accounts separate from family accounts?
- Keep receipts from purchases and store them in one place?
- Write sales invoices and keep them in one place?
- Enter sales and purchases into a ledger (on paper or on the computer)?
- Inventory supplies and equipment at least once every two years?
- Inventory your products and/or livestock at least once a year?

If you answered "yes" to one or more of these questions, you have the beginnings of a good recordkeeping system. Our goal here is to help you tap into your existing records—even if they're very simple—to determine product costs. Along

COMPUTER OR PAPER?

This is a personal choice and depends on what works best for you. If you're taking this course, chances are good you either own a computer or have some familiarity with them. The key is to make the most of whichever recordkeeping medium you choose.

the way, you may pick up some tips for further improvement. A few minor adjustments can help make your cost calculations and business planning more manageable and effective.

TIPS FOR IMPROVING YOUR RECORD SYSTEM

Run your farm business through a bank. Deposits and check registers can track money flowing into and out of your business. Keep your farm bank account separate from your family account; a clear definition between can clarify financial decisions on both fronts. It can also provide financial protection (depending on how you incorporate your farm business) and offer a clear mechanism for paying yourself for your work.

Record detailed information on every sale. Every time you sell anything (crops, value-added products, equipment), record the following:

- Name of buyer
- Date
- Lot numbers for inventory management
- Quantities or weights
- Unit prices
- Total price

Record all this information in the same place on every receipt, and also include it as you transfer each transaction into your accounting records.

Pay by check or charge, rather than cash, when possible. Checks and charges are much easier to record and track than cash payments. Set up charge accounts with the businesses you buy from the most and pay your accounts regularly. This practice provides another way to itemize and record your expenses, and it can also bolster your credit rating.

If you pay cash, get a receipt. Without a receipt, it's easy to forget how much cash you spent, where it went, or why. Have a designated place where to put receipts as they come in.

Use a pencil (not a pen) to keep your paper records. Pens are appropriate for receipts, but use pencils to balance your check book or to log entries in your account book. This allows you to easily and neatly correct mistakes.

USE IT OR LOSE IT

The key to success with this or any recordkeeping system is simple: use it regularly! If you enter your receipts into your accounting system routinely (either daily, weekly or monthly), you'll head off the problem of "paper pile-up," the downfall of any recordkeeping system.

If you already have an overwhelming pile of paper on your desk, just gather it up, put it in a box or file labeled "Before (today's date)," and set it in a corner of your office for now. Today is a clean slate, and it's time to move forward. Start using your new recordkeeping system with this week's receipts, and be vigilant about keeping up with your current receipts until your new system is a normal, natural part of your daily or weekly routine.

Once your system becomes second nature, you may want to tackle that box of old papers and add them to your system. Just make sure you keep rolling forward with the current data while you integrate the older stuff. However, don't worry if you find you never look back; those older papers are safe in their file, and you know right where to find them when you really need them, like at tax time.

REDCORKEEPINGANDNOP

With regard to organic certification, your recordkeeping requirements are pretty cut and dried. You'll need records of input purchases and crop sales, which will be balanced against acreage to determine appropriate quantities of production. If, for example, you planted 100 acres of corn and sold 50,000 bushels of shelled corn, something is awry (since nobody averages 500 bushels per acre). But, certification aside, it just plain makes sense.

PRODUCTION COSTS

In order to develop a successful pricing strategy, you need to know your production costs, calculated by defining the individual components of your operation and plugging those numbers into a simple recordkeeping system. These figures will give you confidence in the current state of your business and help you find ways to make it more efficient and profitable.

Let's begin by defining four basic—and often misunderstood—terms that affect cash flow in every business:

- Cost: Money you pay, directly or indirectly, to produce a product or service. Costs include labor (your own labor and any hired help), rent, taxes, utilities, production inputs, equipment depreciation, etc. The Crop Conversion Calculator can assist you in analyzing and documenting your costs.
- Price: Money you receive from a customer for one unit of a product or service. Your price should cover all your unit costs, plus your profit.
- Revenue: Money you receive from all sales of your products and/or services (also known as gross income). Government payments also qualify as revenue. Revenue should cover all your business costs and give you some realized profit.
- Profit: Money you get to keep from all sales of your products or services, after all your costs are paid. Profits (also known as net income) allow you to buy your daily necessities, invest back into the business, save for retirement or take that family vacation you've been planning.

These definitions may seem unnecessary because we all use these terms every day. But do we use them correctly? Many farmers get into trouble by thinking of revenues and profits as the same thing. In reality, profits are only a part of revenues, the part that's left after production costs are subtracted. If you confuse the two, you may end up having to choose between covering your costs and paying yourself.

ESSENTIAL COST DEFINITIONS

Cost accounting is the process of tracking, recording and analyzing costs associated with the products or activities of an organization.

Labor costs

Labor costs include all money spent to pay yourself and your employees (if any), and to provide benefits. Even if only you and your family work on the farm, it's important that you calculate your labor costs! To do so, multiply the number of hours required to complete a work task by the hourly wage you pay (or would like to pay) yourself and your family members or employees.

Calculating task-hours may sound nitpicky and time consuming, but chances are you already have good estimates in your head. Start with these and fine-tune them by keeping an occasional start/stop time log for your different tasks. After just a couple of entries, you'll have a very clear record of task-hours, and you may even begin to see a few places where you can improve your efficiency. Later, for more precise labor cost calculation, you can also include in the hourly wage figure the cost of any benefits you provide to yourself, your family or your employees.

Operating (or input) costs

These costs include all money spent on supplies and materials needed to produce your product or service, such as seeds, fuel, inputs and amendments, livestock and feed, purchased ingredients to create value-added products, packaging materials, and similar items. To calculate input costs for a service, you must add up the number and cost of supplies and materials that will be used as part of the service.

Overhead costs

Overhead or capital costs include all money spent on work-related costs other than materials and labor. Overhead costs can be broken into two categories: indirect overhead costs and direct overhead costs.

- Indirect overhead costs are costs not tied to the production of a specific product or service. They typically include items such as utilities, mortgages and interest, rent, insurance premiums, taxes, depreciation, office supplies, any employee benefits, certification fees, dues and subscriptions, advertising, accounting, and attorney fees.
- Direct overhead costs are project-specific, such as equipment costs, travel costs, and similar expenses.

You'll find these primary cost category headings on most enterprise budgets. Each type of cost can be further defined as either fixed or variable.

- Fixed: Expenses that remain the same regardless of how much you produce or sell. Fixed costs include mortgages, taxes, insurance, and (in some cases) utilities and advertising. For example, your tractor payments remain the same whether you sell 200 or 2,000 bushels of beans.
- Variable: Expenses that change according to the amount you produce or sell. Fuel and seed costs are two typical examples.

When figuring production costs, remember that your time is worth money. Too often, farm owner and family labor go unpaid. When you spend time producing or marketing, you forfeit the opportunity to gain income from other employment. Be sure to include your management time in your accounting decisions.

USING RECEIPTS AND BANK RECORDS TO GATHER COST INFORMATION

Step 1:

Make a list of everything your farm produces, for sale or on- farm use. Try not to leave anything out.

- Do you sell a few dozen eggs from your flock or a few bunches of cut flowers from your home garden each week?
- Do you sell tomatoes, pumpkins, sweet corn, feed corn, wheat, or other grains?
- Do you produce hay, silage, or compost for on-farm use?
- Do you trade your livestock manure with your neighbor for hay?
- Do you process and sell jams and pickles?

Include it all, listing each product individually. The length of your list may surprise you. Be sure to write this list on paper; physical writing is an important part of the exercise.

Step 2:

Group your products into categories. Here are a few suggestions:

- Field crops category: Include your field corn, wheat, and possibly the hay and silage.
- Production vegetables category: Group your tomatoes, pumpkins, sweet corn, or other vegetables.
- Value-added category: Such as jams and pickles.
- Farm use category: Include compost and possibly the hay and silage.
- Miscellaneous stuff category: In this example, the eggs and flowers.

These category titles are just suggestions; choose groupings that make sense for your business, and make sure each of your products ends up in a category.

Step 3:

Create "General Operating" and "Overhead" expense listings. Some expenses will obviously correspond to one of your product categories, such as corn seed and canning jar purchase receipts, or wheat and tomato sales slips.

However, receipts for tractor repairs, mortgage and tax payments, or the sale of your old combine usually do not fit in any one product category. Therefore, you'll need to create categories such as "Equipment/Depreciable Assets," "Office Supplies" and "Building/Property Maintenance" in order to capture these more general expenses and income.

Again, choose categories that work best for you, and keep them as simple and straightforward as possible.

Step 4:

Create folders (paper or electronic) for each category. Into each folder, put an accounting spreadsheet for each product that falls in that category. This organizational plan works equally well on paper or with your computer's accounting program. Some of your category headings will probably change once you start using and

improving your system. Stay flexible and, if you're working on paper, consider writing your category names in pencil on your file folders for now.

Step 5:

Also create paper folders labeled "Recorded Expense Receipts" and "Recorded Sales Receipts" (even if you're working on a computer). You will need these files to store your paper receipts once you've recorded their information in your accounting system. These two folders will be used, along with your bank account book, to clarify your whole- farm financial picture.

Now that you've set up this simple system, it's time to start plugging in the numbers.

Step 6:

Enter data from your new receipts (both sales and expenses) into your banking account book (on paper or computer) regularly. Make this a basic part of your routine; once a day is ideal (if you have that many receipts), but once a week is fine and more realistic for most farmers. The goal is to keep the pile of incoming receipts small, because—as we all know—big piles of paper can put a halt to progress.

Step 7:

Once you've completed the bank entry, enter the information again on the product spreadsheets in the appropriate category folder. Enter the same information you included in your banking account book.

If you're working on paper and have access to a photocopier, you might also make a photocopy of each receipt to include in the relevant category folder. (If you do this, be sure to write "copy" on the copy and note the location of the original.)

If you enter receipt information on more than one product sheet or category folder, be sure to make a note next to the entry to cross-reference it so as to avoid double counting.

Step 8:

After recording, collect the original receipts in your "Recorded Expense Receipts" and "Recorded Sales Receipts" folders. Congratulations! You've just collected a lot of your important cost information in one place!

Step 9:

After you set up your initial folders and account sheets—one to four hours of initial work—the cost information collection process should take only 10 to 30 minutes a week.

To calculate a product price using this system, you can easily plug the data from that product's spreadsheet into an enterprise budget. This system may not capture every penny of your costs, but it will take you a long way toward a good calculation.

DEVELOPING A PRICING PLAN

A pricing plan allows you to recapture your production costs and calculate profit or loss. It can help you determine accurate production costs for each of your products, set selling prices that cover your costs and make you a profit, convince your customers to pay that price, expand your customer base, and increase your peace of mind. Collecting the information you need to formulate a fair product price can be a little time consuming. But the records you create the first time around can be used over and over again with a little updating along the way.

Photo Credit: Jack Sherman

Picture of pricing on an organic product on shelf

In order to develop your pricing plan, you will need to:

- Identify and calculate the major components of your production costs
- Develop systems to record cost information as a regular part of your daily operations
- Use basic math to turn cost information into prices that give you a reasonable return
- Find ways to add value to your products to capture a larger share of the food dollar
- Determine the premiums you can charge for your value-added products
- Assess the relative profitability of organic products
- Identify resources for further ideas and assistance

Farmers who have taken the time to figure out their own pricing plans will tell you that the benefits are well worth the effort.

Identify the different channels through which you intend to market products; each has different costs and most likely different price points. The right mix of channels and prices can help you be profitable.

THE ORGANIC PRICE REPORT FOR PRICE DISCOVERY

The Organic Price Report (OPR) carries weekly terminal and other prices from organic wholesale markets across the United States.

Just how much of a premium should you be charging for your organic grains and produce? Find out with the Organic Price Report. The OPR is an online tool that helps you price competitively. The tool tracks selected prices from the fruit, vegetable, herbs and grain sectors, comparing organic and non-organic prices in markets across the country.

CREATING A BUDGET THAT WORKS

Once you know your different types of costs and have created a system to capture them, you need to decide how you want to use your cost numbers. There are four distinct kinds of budget you can plug your cost and income data into: an enterprise budget, a whole farm budget, a partial budget analysis, or a cash flow budget.

FARMER-TO-FARMER

Eric Finch, of State Center, Iowa, added a profitable meat goat enterprise to his hog operation through innovation and careful planning. While Finch continues to work in his family's conventional corn and swine operation, he's learned that direct-marketing specialty products can pay off. But it requires a different mind-set.

"You have to think outside the traditional agricultural box. You have to learn to work with customers directly, and you have to respond to what they want to buy." He advises: Before you do anything, run the numbers to determine your cost of production.

Enterprise Budget

This budget records the costs and income from the production of one type of farm product during one cycle of production. For example, if your farm produces poultry, beef, hay, corn and soybeans, you could create an individual enterprise budget for each of these five products, covering a single crop growing season, or one animal life cycle. These budgets are usually developed on a per-acre or per-head basis. Crop Conversion Calculator, a companion enterprise budget calculator for this course, provides a great place to pull together this data and see what could result financially.

Enterprise budgets are the foundation on which all the other types of budgets are built. They also provide hard-nosed economic information you can use right away. Accurate enterprise budgets tell you what's making money and what's not. From there, you can decide whether other factors make a marginal or break-even enterprise worth keeping.

An enterprise budget can help you to:

- Set reasonable production goals for each of your farm products
- Accurately calculate your costs of production for each product

- Estimate the break-even price and net return you need from each product in order to cover all your costs and make a profit
- Choose management strategies that help you achieve your production and price goals
- Identify problems that can cause you to miss your production and price goals
- Compare returns across enterprises as a factor in overall profitability
- Quickly gather important information for business planning and loan applications

Whole Farm Budget

This budget adds the costs and income from each enterprise budget, along with other miscellaneous income and expenses, to determine total expenses and income for the farm as a whole. This budget includes off-farm income and other small-scale miscellaneous work, expenses and income.

Partial Budget Analysis

This budget measures the effects of small changes in a farm operation, leaving out unaffected parts of the overall farm budget. This approach provides quick information to help guide smaller-scale decisions, such as changes in a production practice, or choosing between hired custom harvesting and an equipment purchase.

The Crop Conversion Calculator makes it easy to change one or two variables to check their influence on the outcome. For example, it can help you prepare partial budgets to compare the use of purchased compost versus growing a legume cover crop to achieve the soil nitrogen contribution you need for specific crops.

Cash Flow Budget

This budget tallies the cash receipts and expenses of the farm over a fixed time period (usually a year). It shows whether expected total cash income will be adequate to cover cash expenses, which is useful in assessing major purchases and in planning for loan requirements.

Of course, the value and usefulness of any budget depends on the type and quality of numbers you plug into it. A good recordkeeping system can help ensure that your budget numbers are as accurate as possible and identify which numbers are spot on and which are less than perfect.

ACCOUNTING STYLES

The numbers you use in your budget will depend on the budget accounting style you choose. Any budget can be presented in one of two different accounting styles:

- Economic accounting includes dollar values for all inputs and outputs, including operations and transactions that aren't cash-based, such as use of farm-raised feeds for livestock, or use of livestock manure as an ingredient in compost. Economic accounting works best for enterprise and whole farm budgets and is often useful for partial budgets.
- Financial accounting lists only inputs and outputs that require actual cash transactions. Financial accounting works best for cash flow budgets and sometimes for partial budgets.

In most cases, economic accounting creates a better, more complete budget, especially if you're developing an enterprise budget. Also, if you start with economic accounting, it's very easy to pull out the basic financial accounting numbers when you need them.

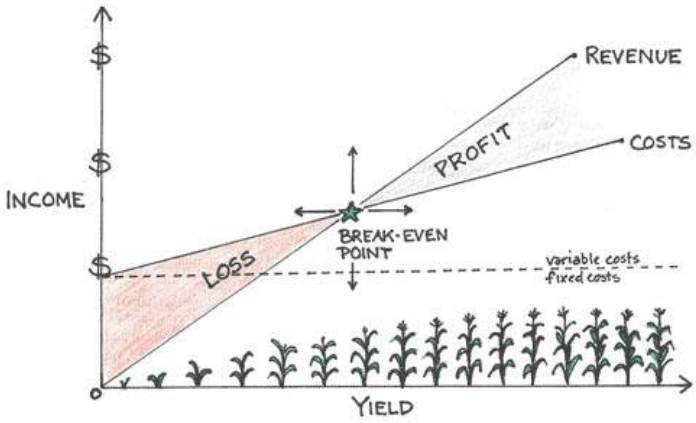
Don't get discouraged if you're not able to fill in all the blanks in an economic accounting budget. To reiterate the most important point of budgeting and cost calculations, a few numbers are better than no numbers at all! It's good enough to plug in the numbers you have, to get started. Just be sure to make an effort to fill in the blanks as time goes on.

PULLING IT ALL TOGETHER

Your profit is determined by three factors: yield, market price, and production costs.

The graph shows how yield, costs and revenue work together to generate a profit or loss, depending on where your numbers land.

Profit=(Yield x Market Price)–Production Costs



You probably already know that you can calculate your profit or loss per unit by subtracting your production costs from your price:

(Profit [or Loss] = Price – Cost)

But look at this equation again. The key idea is that your costs and your prices have equal power to influence your revenue and profits, either negatively or positively. Notice that the "break-even point" on the graph above is not a single fixed location. It can move left and right or up and down, depending on adjustments you make to your prices (revenue) and/or costs.

SUMMARY

This lesson discussed the tools that you need to track and monitor costs, understand pricing, formulate budgets and, finally, calculate profit or loss. Armed with these basic tools, you should be prepared to make the most of your conversion to a successful organic operation.

LESSON 4: BUSINESS PLANNING

OVERVIEW

A formal business plan is a critical road map to your success in organic farming. It isn't so bad, once you get started.

A summary of the Organic System Plan you've already worked on is part of what will go into your business plan; a summary of your marketing plan is another. The budget and financial plans are a third component.

Even if you don't have a business plan, you've surely thought about many of these things as you started or grew your business. The business plan will serve you much like your Organic System Plan, keeping you focused, organized and thinking about the logical sequence of your strategies. It's a good tool and exercise for you, but it also serves to inform others—such as potential lenders or partners—who may not know a whole lot about the organic marketplace.

If you need some more personal assistance to kick this thing off, don't be afraid to reach out for business-planning help in your locality, economic development region or state. Learning how to put a business plan together, if you've never done one, is an important skill that will serve you well.

This lesson describes the elements within a business plan, strategic ways to use the plan, and how to incorporate your marketing plan into your overall business.

BUSINESS PLAN COMPONENTS

- The executive summary is a one- to two-page overview of your plan (put it first, but write it last). Use this section to grab the reader's interest and say why your business idea will be successful.
- The organic sector analysis provides details about opportunities and growth, who's involved in organics and how they've made their mark.
- The market analysis tells what's happening where you plan to do business, who the competition is and how the future looks in terms of who will buy your product.

INNOVATORS

When you run your own farm, you're an entrepreneur as much as a producer. That means you need to understand Business Planning 101, says Penny Brown Huber, program administrator for Iowa's Growing Your Small Market Farm Business Planning Program.

"Entrepreneurs are innovators," Huber says. "They have a strong desire to create something new. They also have a vision of how their business will grow and a plan to make it happen."

- The business description tells how long you've been in business, describes the business' legal structure and ownership, and summarizes your short- and long-term goals.
- The product-line section describes your products or service and emphasizes their benefits to current and potential customers.
- The marketing plan describes your customer base, outlines your pricing strategy and tells how you will distribute your products and promote your business.
- An organizational chart outlines who runs your business and how all the work gets done, from field manager to farmer's market help.
- Funding needs explains total money needed, how it will be used, and why the investment makes sense.
- The financial statement summarizes the past three years' balance sheets and income statements, along with five-year projections for income and cash flow.
- An appendix might include items such as field maps, marketing literature or a summary of a recent contract.

BUSINESS PLAN TIPS

Here are a few more reasons to prepare a business plan:

- Preparing a business plan triggers creative thinking about your business opportunities, risks, research options, and expectations.
- You can use the business plan to track, monitor, and evaluate your business's progress against milestones and timelines.
- A business plan helps you identify your competition and take your share of the market by providing different or better value to customers.
- A business plan will help you identify roadblocks so you can avoid them or establish alternatives.
- Even if you aren't borrowing money or seeking investors or partners, the business plan exercise helps you put and keep your plans in perspective.

If the sections in your business plan are long, summarize them at the beginning of each section to help busy loan officers or investors get the gist of your overall plan

FARMER-TO-FARMER

"I neglected to consider the cost of trucking in my initial business plan. All organic grain was trucked in at up to $100/ton from mills at least 150 miles away. Moral of the story: Match your location to your business model, match your business model to where you are, or do something else."

—Marc Lichtenstein
Wayne County, PA

MARKET ANALYSIS

The market analysis section of your business plan summarizes the market you are in and what is happening in that market. In this section, identify your market, its overall size and its growth potential. Think back to the work you did in lessons 1 and 2, looking at your products and customers. Consider these questions:

- What do you know about your target market?
- What are your customer demographics in terms of age, income, geographic location, and education?
- What motivates these people to buy organic products even if they cost more than conventionally grown products?

Another way to think about your farm enterprise is by doing a SWOT (strengths, weaknesses, opportunities, and threats) analysis, in which you consider:

- What are your strengths?
- What are your weaknesses?
- What are the opportunities?
- Are there any threats?

Think about maximizing your strengths, minimizing your weaknesses, seizing the opportunities, and protecting against threats. What are your competitors' strengths and weaknesses? What will you do if your target market is adversely affected by economic events? How will you remain competitive?

IDENTIFY YOUR MARKETS

Once you have provided a picture of the market environment for your products, the rest of the marketing section of your business plan will be a summary of the five P's you worked on in lessons 1 and 2.

Give a compelling description of:

1. Your brand identity and position
2. Your product and what makes it unique
3. Your product placement strategy and rationale
4. Your pricing strategy
5. Your people strategy (how you will build customer loyalty)

The costs associated with each of these strategies, such as packaging, product sampling, signs, etc., will show up in your budget projections. Your placement and pricing strategies will also be reflected in your financial projections. The more background thinking that goes into your preparation of those numbers and the assumptions behind them, the clearer and more convincing you can be in making the case that your business plan is sound and worthy of support.

CONCLUSION

Business and marketing plans are the basis of a well-run organic enterprise. The information in this chapter will help you build your business through developing sustainable relationships with customers who value what you offer them, in products and in service. The steps outlined here will guide you in harnessing the economic opportunities that spring from the distinctive aspects of your enterprises.

Value and values go hand in hand when it comes to marketing. Organic farming values the land, the environment and the people. Your role is to extend the value to your past, current, and future customers while sustaining the viability of your business.

Following the planning steps outlined in this chapter should be helpful to you even if you never actually write down a plan. Each time you re-evaluate the details of your farm in a systematic way, you should gain insights and deeper understanding. This information helps you improve production and is the foundation for capturing the maximum benefit in the marketplace.

Combine what you learn internally with the best marketing matches on the outside—and expect things to change frequently. Get to know your customers and stay attuned to their changing interests. Along the way, keep an eye out for the competition. Learn from them and your business records to home in on your areas of advantage. Do the best planning and marketing you can, but be ready to ask for help when you need it.

The next chapter is about certification through an accredited certifying agency. Yes, it's the paperwork of organics, but there's a real payoff for the effort if it fits your situation. Even if you don't plan to pursue certification, read through the chapter to see what's involved.

Photo Credit: Jack Sherman

Rodale Institute's garden store

RESOURCES

Resources are free online unless otherwise noted.

BUSINESS MANAGEMENT

Building a Sustainable Business: A Guide to Developing a Business Plan for Farms and Rural Businesses
Sustainable Agriculture Network, 2003
A hands-on guide featuring worksheets to help you develop your farm business plan. $17, 280 pp.

MARKETING

Agricultural Marketing Resource Center
(USDA Rural Development/Iowa State University, 2007)

Marketing Strategies for Farmers and Ranchers
(Sustainable Agriculture Network, 2006) 20 pp.

The New Farmers' Market: Farm-Fresh Ideas for Producers, Managers and Communities
(Sustainable Agriculture Network, 2001) $24.95, 272 pp.

Selling to Restaurants
Janet Bachman
(ATTRA, 2004) 16 pp.

ACCOUNTING AND RECORDKEEPING

University of Missouri Farm Accounting Resources
(University of Missouri Extension)
Includes the Missouri Farm Business & Tax Record Books and Quicken, Quick Books and PC Mars Farm Accounting Software.

Farm Files
(2005, Level Five Solutions)
An agricultural software package "designed by a farmer, for the farmer," that can help you manage crops, livestock, and accounting for your farm.

CHAPTER 6

CERTIFICATION

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Photo Credit: USDA

CHAPTER 6

CERTIFICATION

INTRODUCTION

So far in this course, we've talked about the basic principles of organic farming systems, soil biology, crop rotations, and pest management. We've outlined organic livestock management requirements and discussed some of the many marketing strategies open to organic producers.

If you've been completing sections of your electronic Organic System Plan (e-OSP) along with each chapter, you've made significant progress toward formulating the management steps and assembling the information you'll need to get certified.

In this chapter, we'll discuss certification in more detail—from choosing a certifying agent, to filling out the forms, to having your farm inspected. We'll review organic regulations concerning materials and inputs, describe recordkeeping systems to facilitate the certification process, and underline the importance of maintaining organic integrity

from planting to post-harvest handling. We'll also talk briefly about certified organic processing rules.

At the end of this chapter, we'll invite you to complete the final sections of your e-OSP. Remember that you can make changes to sections you filled out earlier and print or download your work at any time. If you're planning on doing any value-added processing of farm products for the organic market, you may want to complete the electronic Organic Handling Plan as well.

LESSON 1: CERTIFICATION PROCESS

OVERVIEW

Completing this course will give you a big head start on the certification process, but you'll still have to follow the basic steps required of anyone seeking to produce and sell certified organic products:

1. Obtain and review application documents from one or more certifiers
2. Read the NOP Standards
3. Document land-use practices and create a farm map. Get soil and water tests, if needed.
4. Develop an Organic System Plan (including an Organic Livestock Plan and/or Organic Handling Plan if necessary)
5. Submit your complete application packet, including payment
6. Go through the initial inspection
7. Correct any non-compliances as requested by your certifier

CERTIFIED GROWTH

How many organic farms are there in the United States? The USDA Economic Research Service reported 8,493 certified operations in the United States in 2005. Data suggest there may be an equal or slightly greater number of non-certified organic operations, for a total of perhaps 20,000 organic farms nationwide.

If you haven't yet done so, now is a good time to read through the NOP Standards. You can access the full text of the Standards, along with the Organic Foods Production Act itself (with amendments), by visiting the NOP webpage. To read or print the Standards, choose "View Regulatory Text Only"—this is the heart of the Standards as they relate to production and marketing. It comes to about 60 pages, including lists of approved and prohibited substances.

8. Renew your certification annually by updating your Organic System Plan, paying your fees, and getting re-inspected

In this lesson, we'll review key elements of the NOP Standards, consider the different factors that go into choosing a certification agent, and outline the organic farm inspection process. We'll suggest ways to make your first inspection go smoothly and discuss procedures for complaints and other issues within the certification regulation.

WHAT THE STANDARDS SAY

Let's review some key elements of certified organic production:

1. Organic producers must manage soil fertility through the use of rotations, cover crops, and the application of plant and animal materials or low- solubility natural minerals.
2. These practices must maintain or improve soil organic matter content, manage deficient and excess plant nutrients, and control erosion.
3. Producers must use preventive practices to manage crop pests, weeds, and disease.
4. Certified organic seed and annual planting stock must be used if available.
5. Organic livestock must have access to the outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight as appropriate for the type of animal and the local climate.

6. Organic livestock may not be given antibiotics or hormones and must be fed 100% organically grown feed. Ruminants must have access to pasture offering significant feed value.
7. Organic products (crops and livestock) must be kept separate from non- organic products and handled without the use of prohibited materials.
8. An independent organic inspector will visit the farm annually to review both production operations and recordkeeping systems.

For annual crops or a perennial livestock feed crop such as hay, a period of three years is required for the transition from conventional to organic production, calculated from the date of application of the last prohibited material or practice to the harvest of the first organic crop. NOP Standards make no provision for marketing products as "transitional"—any crops and livestock sold during the transition years must be represented as non-organic.

Land free of prohibited materials for three or more years can often be immediately put into certified organic production upon approval by the certifier. A signed affidavit verifying that there's been no use of prohibited substances on that specific land is needed from the person responsible for the land's management during that period.

ORGANIC IS A STANDARD OF PRODUCTION

It's important to understand that organic is a standard of production, not a guarantee of final product characteristics. For certification purposes, organic products are tested for contaminants only when there is reason to believe contamination has occurred. If tests show contamination in excess of 5% of the Environmental Protection Agency tolerance level for a particular substance (such as a pesticide), the crop cannot be sold as organic.

Buyers of organic products may require testing to satisfy their own purchasing specifications, however. Buyers of food-grade crops may test for GMO contamination, which may occur via use of non-organic seed, insufficient equipment cleanout, or pollen drift. If contamination is found, the crop does not lose its organic certification, but the buyer may reject it.

Like all laws and regulations, the National Organic Program Standards are subject to change. To remain certified, you'll need to stay up to date on the regulations. Your certification agency should inform you of any changes.

The Organic System Plan is the central piece of your certification application. It should fully describe your farm's operational features, from production and marketing to recordkeeping and natural resource conservation.

After the application has been submitted and reviewed, the certification agency may have additional questions. When the application package is complete, an inspector will conduct the on-site inspection and submit a report to the certifying agency. If the report and the application are satisfactory, the agency will issue an organic certificate.

Organic certificates are not dated and technically do not expire, although they can be revoked. This is to avoid situations in which producers can't conduct business due to delays in inspection and renewal. Instead, each year, you'll receive an addendum to your certificate listing specific organic crops to be grown and sold over a given period of time. Your Organic Farm Plan or Plan Update should cover all crops or livestock you intend to raise in a given year.

DO YOU REALLY NEED TO GET CERTIFIED?

The USDA National Organic Program regulates use of the term "organic" as a marketing and labeling claim. If you want to sell your agricultural products as organic, then you need to be certified. There is a small-farmer exemption: if your gross agricultural income from products sold as organic is less than $5,000 a year, you don't have to get certified, but you still have to follow the organic standards (including the paperwork requirements). You should be able to document that you qualify for the exemption and that your production methods are in keeping with the rules. By statute, the USDA and/or your state organic program can ask to see your records going back

three years.

The under-$5,000 exemption is meant for direct-to-consumer sales, such as at farmers markets. Exempt producers may not use the USDA Organic seal, cannot describe their products as "certified organic," and cannot sell their products as organic ingredients to be processed by others. You may process your own produce—say, organic strawberries into strawberry jam—as long as you meet the criteria above.

Note that the exemption does not allow livestock feed to be sold as organic to a farmer feeding certified organic livestock. For example, a certified organic dairy may not purchase non-certified organic hay from a neighbor claiming exemption from certification under the $5,000-a-year limit.

Some states invite exempt producers to register with the state. This gives state departments of agriculture, policymakers, and organic advocates a more accurate understanding of current farming practices so they can better serve the public.

FARMER-TO-FARMER

"Certification makes all the difference in the world. If you use 90% less pesticides, or you're almost organic, you don't get the organic premium. And if you don't get the premium, you're never going to make that much money."

—Ron Rosmann
Harlan, IA

CHOOSING A CERTIFIER

Choosing a certifier may not seem like a big decision compared to your production and marketing choices, but it's something you should consider carefully. Your certifier serves as your interface with the National Organic Program Standards, which is important because interpretations of the Standards vary somewhat among certifiers. Depending on your market, your certifier can also function as the symbolic link between your farm and your customers. Some buyers may request that you be certified by a specific certification agency.

In general, the closer a certifier is to your farm geographically, the more likely they'll be easy to work with. But you also need to consider whether the certifier's areas of expertise match what you're doing on your farm. If you're planning to sell soybeans to Japan, you'll want to work with a certifier that's familiar with Japan's organic standards (known as JAS, for Japan Agricultural Standard) and can offer an export certificate for that country.

Certification fees vary depending on the size and complexity of the operation. Fees are generally calculated on a sliding scale or as a percentage of gross sales. Cost-share programs for certification fees are available in some states.

You're free to switch certifiers at any time, although doing so may involve additional paperwork. Your new certifier will want to know what other agents you've been certified with, whether they found any non-compliances and how those non-compliances were addressed. The bottom line is to find somebody who understands your operation and can provide the services you need.

Key factors to consider when choosing a certifier:

1. Fees. Are annual certification fees based on gross sales, or is there a fixed fee structure, or do you pay an additional royalty fee on your organic sales? Is there a separate new-applicant fee? Are inspection costs included? Many certifiers charge additional fees for separate field sites or for export certificates.
2. Areas of expertise. What sizes and types of farms does the certifier primarily handle?

FARMER-TO-FARMER

"Talk to other organic producers to learn about the different certifiers and how they work with producers. Are they available to answer questions when you need them? Are they prompt and organized with paperwork? Ask about all the costs."

—Jack Erisman
Pana, IL

3. Market access. This is particularly important if you think you may be selling your product(s) overseas. European, Japanese and other international organic markets require certification to their own organic standards and/or accreditation of the certifying agent.
4. Other services offered. These can include everything from annual conferences to seminars, field days and newsletters. Some certifiers also offer testing and consulting services or ancillary certification programs such as biosecurity assessments and restaurant/retail organic practice standards.
5. Structure. Would you prefer to work with a state agency, a large for-profit company, a large nonprofit, or a small nonprofit? Certifiers come in all shapes and sizes.

UNDERSTANDING ORGANIC STANDARDS

Certifying agencies and inspectors are prohibited by law from consulting with applicants for certification about ways to overcome certification barriers. Generally, certifiers prefer to discuss rules in a meeting-type format, telling everyone at the same time; that's clearly "education" and not consulting. They can also put you in touch with other farmers who do well—saying, in effect, "Here's how other people have solved the problem." Some organic certification agencies have developed separate certification and outreach units in order to keep these two functions clearly distinct. Private consultants and extension agents may also offer advice on issues related to certification.

International organic standards are broadly similar to the NOP Standards but vary in some details. For example, the European Union organic standards (known as EEC 2092/91) prohibit the use of manure from large confinement livestock farms on organic land. Some inputs such as lignin sulfonate, potassium bicarbonate, and alkali-extracted humic acids are allowed under the NOP, but not under Japan's organic standard.

Complying with as many international standards as possible maximizes your global marketing opportunities. Some U.S.-based certifying agencies can offer export certificates for areas such as the European Union and Japan, usually for an additional fee. The International Federation of Organic Agriculture Movements (IFOAM) is working to harmonize global organic certification programs to facilitate trade.

THE INSPECTION PROCESS

The basic farm inspection consists of an interview, a farm tour, and a report. During the interview, the inspector will review your application, field histories and maps, and the specific production system for which you're seeking certification. Questions may also be asked about your background and interest in organic farming, as well as your long-term plans for the land. The audit trail consisting of all relevant records will be reviewed. If applicable, the inspector will ask to see your package labels for organic products processed on-farm.

Next, the inspector will tour the farm with you to verify the information listed on your application and look for potential problems. He or she will usually:

- Verify that the crops match the field acreage and field numbers on the application
- Look at soil conditions and review soil management practices
- Check buffers on fields adjacent to non-organically managed areas
- Verify seed and/or planting stock sources

CERTIFIERS

As of August 2007, there were 55 USDA-accredited certifiers in the United States and 40 overseas. At least 17 state departments of agriculture (in Colorado, Idaho, Iowa, Kentucky, Louisiana, Maryland, Mississippi, Montana, Nevada, New Hampshire, New Jersey, New Mexico, Oklahoma, Rhode Island, Texas, Utah and Washington) also act as certifying agents. A complete list of USDA-accredited certifiers can be found on the NOP website.

- Tour any greenhouses, evaluating plant health, growing media, and general environmental conditions
- Note weed and pest problems and discuss management strategies
- Note water sources and quality, particularly for washing or processing
- Tour livestock housing and/or pasture to evaluate animal health and living conditions
- Tour farm buildings, equipment, and post-harvest storage areas to note their condition and possible sources of contamination
- Note any signs of prohibited materials use such as burned-down vegetation or empty containers

The inspector will also be looking to see that your overall numbers make sense. If you have 100 acres of corn and your yields average 100 bushels an acre, but you sold 20,000 bushels of corn, that's going to raise some eyebrows. Similarly, if your fields are 100 percent weed-free, you have 1,000 acres, and you say you cultivated only once, it might look a little suspicious.

GETTING THROUGH THE FARM INSPECTION

Try to approach the inspection as an opportunity to review your operation from top to bottom. Provide full and honest answers to the questions asked of you, and ask your own questions in return. Most inspectors have been on dozens if not hundreds of organic farms. Although inspectors are not allowed to tell you how to correct a noncompliance, they can point you toward other sources of information. They can also clarify areas of the regulation that may be confusing. If you don't have many other organic farmers nearby to talk to, it can be refreshing to have someone on your farm who supports and understands your organic farming methods.

If you have a mixed operation (with both organic and non-organic production), the inspector will be particularly interested in seeing what systems you have in place to prevent contamination and to keep organic and non-organic crops from getting mixed up. Show the inspector where you store your organic as well as your non-organic inputs, where you keep your equipment and how you distinguish organic harvest containers from non-organic harvest containers.

Most inspections take three to five hours, depending on the size and complexity of the operation. First-time inspections often take longer than annual renewals. Inspections involving livestock or processing also generally take longer. The more prepared you are with your paperwork (input labels, sales receipts, etc.), the faster this aspect of the inspection will go. Then you will have more time to spend outside looking at fields and livestock and discussing your farm management system.

INPUT FROM RODALE

It's natural to feel apprehensive about your first organic inspection, but try not to. In my experience, inspectors are smart, good-natured people who are committed to organic farming principles and have a broad familiarity with organic production systems. Their role is to act as neutral observers—to be the eyes and ears of the certification agency and, by extension, of the public.

—Jeff Moyer

TIPS FOR A SMOOTH INSPECTION

- Don't be in a rush. Schedule the inspection at a time when you'll be able to meet with the inspector personally and show them what they need to see.
- Review your letter from the certifying agency in advance. The inspector will want to see that any previously noted non-compliances have been corrected.
- Take another look at your farm map to make sure it's up to date. Add up your field acreages to check for consistency with your total acreage requested for certification.
- Get rid of any inputs or materials you no longer use. Having them on hand will only give the inspector more work.

- Be open—show your weediest fields as well as your cleanest ones. Talk about what you'd like to improve as well as what you're happy with. Inspectors are trained to ask questions in a variety of ways to verify that statements are true. They are also bound by confidentiality agreements (as are certification agencies), so they will not discuss what they have seen or learned about your operation with other farmers or processors.

POST-INSPECTION FOLLOW-UP

At the end of the inspection, the inspector is required to review with you any potential compliance problems he or she has identified, in each case citing the relevant section(s) of the NOP Standards. This is good because it prevents any surprises when you hear back from the agency later on. If there are items you need to follow up on—labels you need to chase down or figures that need to be verified—do so as soon as possible, before some other pressing farming task puts it out of your mind.

VIOLATIONS, COMPLAINTS AND CONSEQUENCES

In addition to defining standards for organic food production and handling, the Organic Foods Production Act (OFPA) spells out detailed procedures for reporting suspected violations, petitioning for a specific material to be reviewed for organic permissibility, filing complaints against certifying agents and appealing a decision to decertify.

The National Organic Standards Board (NOSB) was established as part of the OFPA to act as the public's representative in researching and addressing inconsistencies and ambiguities in, and proposed revisions to, the federal organic regulation. The NOSB has 15 rotating members representing organic farmers, food processors, consumers, scientists, environmentalists, retailers, and certification agencies, and makes official recommendations to USDA National Organic Program staff. Topics addressed by the NOSB include commercial availability of organic seed, pasture requirements for organic livestock, and the use of synthetic methionine in organic poultry production.

If an accident or emergency results in contamination of an organic crop or field, generally the worst that can happen is that you'll lose the ability to sell the crop as organic and/or you may have to start again with one or more fields at the beginning of the 36-month transition period. You or an inspector can take soil, tissue, or product samples to be tested for contamination. This is in your best interest, since there may be less contamination than you think.

Any operation that knowingly sells or labels a product as "organic" without following the NOP Standards may be subject to a civil penalty of up to $10,000 per violation. A certified operation or any person in charge of an operation for which certification has been revoked becomes ineligible for recertification for five years.

Any person who believes a violation of the Standards has occurred or is about to occur may file a complaint with the NOP or with any state or independent certifying agency. For more information see the NOP website or call NOP Compliance at 202-720-8311.

SUMMARY

Use of the word "organic" as a food marketing claim has been regulated by the U.S. Department of Agriculture's National Organic Program since October 2002. Organic is a standard of production, not a guarantee of final product characteristics. The NOP Standards stipulate that crops be grown without synthetic fertilizers, that natural resources be protected, and that preventive measures be used to promote crop and livestock health. Organic standards in place in other countries vary in some details, but are broadly similar to the U.S. program.

Organic status is verified through a third-party certification process. Individual certification agencies receive accreditation from the USDA to certify producers, processors, and handlers to the

NOP Standards. There are currently nearly 100 USDA-accredited certification agencies operating worldwide. Certification agencies contract with independent organic inspectors to conduct scheduled annual inspections for all certified farms and processing facilities.

Choose your certification agency carefully, and get input from other organic farmers in your area. Your best approach to the certification and inspection process is to be completely open about your farming practices and recordkeeping systems. Good recordkeeping makes the difference between a certified and a non-certified organic producer.

In the next lesson, we'll talk in more detail about allowed and prohibited inputs for organic production.

LESSON 2: MATERIALS AND INPUTS

OVERVIEW

Producers new to organic production frequently have questions about allowable materials. The NOP Standards do not explicitly list all materials permitted for use in organic systems. Instead, they provide general guidelines as well as specific prohibitions for certain types of inputs, such as genetically modified organisms.

In earlier sections of this course, we've talked in passing about various organic inputs and emphasized that the Standards require an integrated approach to fertility and pest management issues. As an organic farmer, you should try to avoid an "input substitution" mind-set toward transitioning. You're also generally better off keeping the use of purchased inputs to a minimum. But the use of some organic inputs can be essential to commercial viability.

In this lesson, we'll review the rules governing input use, list some commonly used materials, and caution you about some common material pitfalls to avoid.

By the end of this lesson you should:

- Understand what the National List is and how it regulates the use of synthetic and natural materials
- Recognize commonly used fertility and pest management inputs
- Understand organic regulations regarding the use of composts and manures
- Be able to list the three types of "categorically prohibited" inputs under the NOP Standards

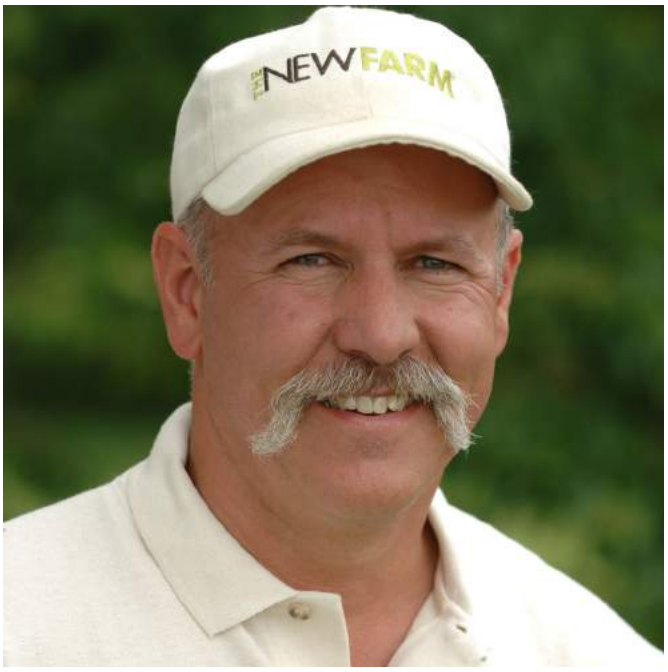


Photo Credit: Rodale Institute

Jeff Moyer, Executive Director of Rodale Institute

WHAT THE STANDARDS SAY ABOUT MATERIALS AND INPUTS

All input materials used in organic production must comply with the NOP's National List of Allowed and Prohibited Substances, §205.600-606 of the Standards.

The basic principle underlying the National List is this: natural materials are considered innocent unless proven guilty; synthetic materials are considered guilty unless proven innocent.

The National List is thus a list of exceptions, itemizing prohibited natural materials (the Standards refer to these as "nonsynthetic") and allowed synthetics. All synthetic substances must appear on the National List in order to be used in production. A wide variety of natural substances commonly used in organic farming do not appear on the list because they are understood to be nonsynthetic and are thus allowed.

Because the National List is not a comprehensive list of materials for use in organic crop and livestock systems, it is sometimes

referred to as an "open" list. By contrast, some countries' organic programs maintain "closed positive lists," meaning everything allowed is listed.

Note too that the National List is actually made up of several lists, with allowed synthetics and prohibited naturals itemized separately for crop production (§205.601-602), livestock production (§205.603-604), and processed food (§205.605-606).

Section 205.607 states that "any person may petition the National Organic Standards Board" (NOSB) to have a substance evaluated for inclusion or deletion from the list. Items on the National List are also required to be reviewed by the National Organic Standards Board every five years.

All inputs used or intended for use must be listed in your Organic System Plan, including the product, source, and location used. The certification agent will review the plan and verify that all inputs and practices comply.

IS IT ALLOWED?

The single best source of information on organic materials and brand-name products is the nonprofit Organic Materials Review Institute. Not all approved brand-name products are on the OMRI list, but you are more assured of an item's acceptability when it is present. Your certifier can also answer questions about what materials you can use. Always ask your certifier before using any new or questionable input.

THE NATIONAL LIST—SYNTHETICS

The NOP Standards define synthetic as "A substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes."

Synthetic substances permitted for crop fertility include fish products stabilized with acids, seaweed products extracted with potassium hydroxide, humic acids that are alkali-extracted, lignin sulfonate used as a binding agent, and synthetic micronutrients formulated without chlorides or nitrates. Synthetic micronutrients are restricted to use when a soil deficiency is documented by testing.

Most synthetic fertilizers are prohibited. This includes ammonium nitrate, anhydrous ammonia, ammonium sulfate, urea, superphosphate, triple phosphate, calcium oxide, and calcium hydroxide. Calcium chloride (derived from the brine production process) is permitted only for foliar sprays to treat disorders related to calcium uptake, such as blossom-end rot in tomatoes.

Minor synthetic ingredients added to formulations (such as, the plastic polymers in seed pellets) are also prohibited unless included on the National List. This includes preservatives in fish or algae products, as well as chelating agents and binders in fertilizers, unless they are derived from natural sources.

If you wish to purchase a soil amendment, you will need documentation from the supplier that it is a mined product and has not been heated or chemically changed in any way. For example, mined rock phosphate, potassium sulfate from a mined source, and crushed lime direct from a quarry are all acceptable.

All active and inert ingredients that you use must be acceptable. To verify all inerts are allowed, you either need to get permission to use the specific brand name product from your certification agency, or look to the OMRI list. Inerts are often not identified on the product label since suppliers consider this information proprietary.

FARMER-TO-FARMER

"In the Rodale Institute gardens, we use a kelp-and-fish product called Kelpak, made by processing freshly harvested kelp at low temperatures. Naturally occurring enzymes are isolated from the kelp and help break it down into a rich brew. The active compounds stimulate the growth and productivity of most crops."

—Eileen Weinsteiger
former Rodale Institute master gardener

THE NATIONAL LIST—NONSYNTHETICS

The NOP Standards define nonsynthetic, or natural, as "A substance that is derived from mineral, plant, or animal matter and does not undergo a synthetic process as defined in section 6502(21) of the [Organic Foods Production] Act."

An example of a natural substance is pyrethrum, which is extracted from chrysanthemum flowers using acids or alcohol solvents that do not change the chemical structure of the active pyrethrum compound. As long as the solvents are not present in the final product, the compound is considered to be nonsynthetic.

Combustion of natural minerals at high temperatures can cause a synthetic reaction, as in the case of calcium oxide (burnt lime) and calcium hydroxide (quicklime). These forms of lime are considered to be synthetic and are prohibited because high temperatures were used to change the molecular structures of the compounds.

Natural mined substances are allowed and include commonly used minerals such as limestone, gypsum, and potassium sulfate. Other natural substances commonly used include wood ashes, bonemeal, blood meal, microbial inoculants, and plant products such as non-GE corn gluten meal, alfalfa meal, and soy meal.

Acetic acid, lactic acid, and citric acid derived from fermented sources are permitted and are used as pH adjusters. Tocopherols (vitamin E from plant oils) may be used as antioxidants. Yucca is a permitted natural plant extract used as an adjuvant for spray materials.

GLOSSARY TERMS

Excluded methods: A variety of methods used to genetically modify organisms or influence their growth and development by means that are not possible under natural conditions or processes and are not considered compatible with organic production. Such methods include cell fusion, microencapsulation and macroencapsulation, and recombinant DNA technology (including gene deletion, gene doubling, introducing a foreign gene, and changing the positions of genes when achieved by recombinant DNA technology). Such methods do not include the use of traditional breeding, conjugation, fermentation, hybridization, in vitro fertilization, or tissue culture. *(NOP definition)*

CATEGORICALLY PROHIBITED INPUTS AND METHODS

In addition to the guidelines provided by the National List, three types of inputs are specifically excluded from organic production in any form. These are:

- Genetically modified organisms (GMOs)
- Irradiation
- Sewage sludge

The NOP Standards refer to genetic modification techniques as "excluded methods." Such methods and any products derived from them—with the exception of GMO vaccines if present on the National List—are prohibited for use in organic production.

Products derived from microorganisms—such as microbial seed inoculants, microbial pest-control products and microorganisms fed to livestock for nutritional purposes—must come from non-GM strains. Products made from plants, such as corn gluten meal (used as a weed suppressant) and soy meal (used as a fertilizer), generally must also be made from non-GM plant materials, although this point has been subject to varied interpretation by some certifiers. Check with your certifier for clarification.

Irradiation (or ionizing radiation) is mostly a food processing issue, but sometimes farm inputs like peat moss are sterilized using irradiation, so these types of inputs should be avoided.

Sewage sludge is prohibited because of concerns about heavy metals and other types of contamination in materials derived from sewage waste. Even if the supplier can prove the absence of heavy metals in its specific product, the use of sludge is very clearly prohibited in organic systems.

! Some bagged fertilizers derived from sewage sludge are labeled "organic," meaning carbon-based. This does NOT mean they are acceptable for certified organic production.

COMMONLY USED FERTILITY INPUTS

Soil amendments used on organic farms vary widely by region and system type. Some of the best organic inputs are inexpensive, locally available carbon- and nitrogen-based materials such as dairy manure, fish processing waste, seaweed, wood chips, etc.

Sodium nitrate, also known as Chilean nitrate, is a natural (nonsynthetic) fertility input whose use has been somewhat controversial due to its high solubility and salt content. NOP Standards restrict use of Chilean nitrate to "no more than 20% of the crop's total nitrogen requirement" [§205.602(g)]. Some growers find it useful for early-season nitrogen needs.

If you use sodium nitrate, you must provide clear documentation showing the crop's total nitrogen requirement and exactly how much of that was provided by the sodium nitrate. If sodium nitrate is present in a fertilizer blend, information must be obtained from the supplier as to how much of the total nitrogen in the blend is derived from the sodium nitrate. If more than 20% of the nitrogen needs of the crop are provided by sodium nitrate, you could lose certification for three years on that land.

Check and double-check the history of any amendments you import to your farm. Hay mulch contaminated by herbicide residue severly damaged crops on Rachel Bynum and Eric Plaksin's Waterpenny Farm in June 2007. They estimated their losses at 12,000 plants with a harvest worth of $80,000.

MANURES AND COMPOSTS

As we saw in the Soils chapter, the NOP Standards include strict requirements governing the use of raw and composted animal manures. Raw manure and other animal and plant materials must be handled to meet rule requirements in order to prevent water, soil, and crop contamination. Manure does not have to be from organic sources, but it should be known to be free of any prohibited materials.

Basic documentation that may be required on manure from non-organic sources includes documentation that no herbicides or insecticides were used on solid manure piles and no synthetic additives were put into manure lagoons. If the manure comes from a broiler operation, documentation should show that the chickens were not fed arsenic, since it will not break down, and is prohibited in organic systems. There may also be some question concerning bedding used in a non-organic operation, especially if there are wood shavings that are not from raw wood and may contain synthetic treatments, paints, or glues.

Raw animal manure must either be composted according to specific guidelines or, in the case of human food crops, be incorporated into the soil a minimum of 120 days prior to harvest for crops whose edible portion is in close contact with the soil (like root crops and greens), or 90 days prior to harvest for other crops whose edible portion is not in contact with soil (like sweet corn or shell peas).

If animal manure is used in a composted product, the compost must be managed so that it reaches 131° to 170°F (55 to 75°C) and stays in that range for 15 days, with five turnings of the pile during that period of heating. In addition, the carbon-to-nitrogen ratio of the compost ingredients must fall between 25:1 and 40:1. Plant materials composted without animal manures or applied as mulch are allowed without restriction.

As of July 2007, the NOP allows processed manures to be applied like compost (no interval between application and harvest) if documentation can show that the processing of all portions of the product, without causing combustion, reached a temperature of 150°F for one hour or 165°F and dried to a maximum moisture content of 12%. An equivalent dehydration process may be used if testing can show that the finished product contains less than 1,000 MPN (most probable number) of fecal coliform per gram of processed manure sampled, and less than 3 MPN of *Salmonella* per 4 grams sampled.

COMMONLY USED PEST MANAGEMENT MATERIALS

Farmers faced with pest, weed, and disease problems must demonstrate the use of cultural methods (use of resistant varieties, rotations, sanitation, beneficial insects, traps, mulching, mowing, etc.) before applying a pest control substance.

Natural substances frequently used for organic pest control include pyrethrum, neem extracts, Bacillus thuringiensis, Beauvaria bassiana, spinosad, limonene, and other plant extracts, such as garlic oil and hot pepper spray.

Permitted synthetic substances on the National List for pest management include soaps, narrow-range oils (also called dormant or summer oils), sticky traps and barriers, copper products, hydrogen peroxide, elemental sulfur, and pheromones.

ACTIVE VS. INERT INGREDIENTS

You should be aware that many packaged pest management materials contain both active and inactive (inert) ingredients. Inert ingredients typically include adjuvants, surfactants, dispersants, and diluents used to help the product adhere to the crop, apply more uniformly, or last longer on the plant surface.

Pesticides used in organic crop production must have active ingredients that are either natural or included on the National List. In addition, any inert ingredients must be classified as "List 4 Inerts" by the United States Environmental Protection Agency. List 4 Inerts are defined by the EPA as inert ingredients "of minimal concern" or, in other words, of low toxicity.

United States pesticide regulations do not require manufacturers to disclose all inert ingredients in proprietary products. This creates a challenge for organic farmers and certifiers, who must verify that all product ingredients, including all inerts, are permitted in organic systems. If you cannot get the information you need from the manufacturer, it's best to be cautious and not use it, or you may jeopardize your organic certification status. Ignorance of ingredients is no excuse if the product is not acceptable.

The EPA has created a voluntary labeling program to help identify products meeting NOP requirements. The phrase "For Organic Production" with a three-leaf logo means the product met EPA review for organic use. But because the program is voluntary, not all products that are compliant with organic rules will carry the label.

The EPA is currently in the process of changing its management of the inert list, and the NOP and NOSB are seeking to determine how best to verify that only inerts of minimal concern are present in approved-for-organic pesticide products. Again, check with your certification agency before using any products on your transitioning or certified organic land.

Photo Credit: Rodale Institute

Companies are not required to disclose all inert ingredients in proprietary products, but prohibited inerts can still jeopardize your certification.

SUMMARY

Materials and inputs for use in certified organic systems are governed by the National List of Allowed and Prohibited Substances. The National List is an "open" list, itemizing allowed synthetic and prohibited nonsynthetic inputs; it is not a comprehensive list of all materials permitted for use in organic systems. Allowed use of materials is specific to organic crop, livestock,

and food processing applications.

While a variety of generic and brand-name materials are in common use by organic producers, brand-name products can be difficult to classify, since they may contain proprietary, inactive ingredients that may or may not be allowed. The Organic Materials Review Institute (OMRI) and your certifier are your best sources for information about permissibility of a particular product. Always check with your certifier—don't risk three years of transition time.

The National Organic Program's "big three" of prohibited materials and methods are genetically modified organisms, sewage sludge, and irradiation. Bagged fertilizers derived from sewage sludge are available for purchase in many farm and garden centers and may not always be clearly labeled as such.

For more information about specific fertility inputs, pest management materials and other products, consult the Resources section at the end of this chapter. In the next lesson, we'll discuss recordkeeping systems and strategies for organic producers.

LESSON 3: RECORDKEEPING

OVERVIEW

For many farmers, recordkeeping is among the most daunting aspects of certified organic production. But most people find that the reality of organic recordkeeping is not all that bad—and, in fact, has a number of benefits. Getting things on paper can help you look at your operation from a new perspective. Even just making a farm map—one of the first requirements for certification—can be instructive.

Some of the records and documents required for certification, you may already be keeping for other reasons, such as mandatory nutrient management rules or worker safety regulations. Knowing how much manure or compost you're spreading on your fields is required for organic certification, but it's a good thing to know anyway.

Good recordkeeping is also good business. Keeping inventory logs of Rodale Institute grain bins and other storage areas, for instance, also helps with marketing. If somebody calls to say they'd like to buy 100 bales of organic alfalfa hay, we can look at one form and give them an answer.

Since organic farming is based on management rather than inputs, having records that you can use as a historical reference as to what works well, what could be improved and what should be changed is invaluable in both developing and managing a lucrative operation. Long-term, successful organic farmers all have at least one thing in common: a good recordkeeping system that they refer to regularly when making decisions.

FARMER-TO-FARMER

"Certification takes less time and paperwork today than it did before the creation of the National Organic Program. Because of the cost-share program, it's more economical as well."

—Anne and Eric Nordell
Trout Run, PA

"Over the years, I've learned that documenting my practices enables me to evaluate my operation based on reality—not memory. For me, farming is a continuous learning process, and the creation and maintenance of an organic farm plan is an integral part of that."

—Rosie Koenig,
Gainesville, FL

WHAT THE STANDARDS SAY ABOUT RECORDKEEPING

Section 205.103 of the NOP Standards states that certified operations "must maintain records on the production, harvesting, and handling" of all products to be sold or represented as organic. Records must:

- Be tailored to the particular operation
- Fully disclose all activities and transactions
- Be readily understood, auditable, and sufficient to demonstrate compliance with the Standards
- Be kept on file for at least five years

Beyond that, there are no specific rules about

how your recordkeeping system has to be set up.

There are, however, some basic systems and forms that organic farmers and farmers' organizations have developed that seem to work well for certification. The array of different types of records may seem overwhelming at first, but trust me—it's not as bad as it looks.

> **!** It's a good idea to request application materials at least six months before you hope to be certified. Many certifiers make some or all of the necessary forms and instruction materials available on their websites; some charge a fee of $25 or so to cover photocopying and postage costs for a full application packet. Sit down and read or at least skim through all the materials before you start filling out the application.

CREATING A FARM MAP

A farm map is not explicitly required by the NOP Standards as part of the Organic System Plan, but it's widely accepted as the easiest and best way to help inspectors and certifiers understand your operation and in particular to show that border and buffer requirements are being met.

Some people have artistic talent and create beautiful farm maps showing detailed aspects of their entire operation. This is great, but it's not required. The key is to indicate all of your fields, assign each a unique number and have these numbers correspond to those listed on your Field History sheets (part of the Organic Farm Plan). You should also indicate adjoining land uses and buffer zones. Vegetable growers may want to assign bed numbers within fields to indicate field operations at a finer level. Storage units, buildings, roadways, water sources, greenhouses, and conservation areas such as wetlands or woodlots are other essential items to identify.

Many farmers use aerial photo-maps provided by their local Farm Services Agency office. If the detail on the photo is too distracting, try tracing the major features onto a clean sheet of paper and using that to create your farm map template. Making multiple blank copies of this template to fill out each year with annual rotations creates an invaluable graphic record for your farm's files.

FREQUENTLY USED FORMS

Rodale Institute recordkeeping categories

Categories	*Types*
Activity Records	• Field Activity Log • Activity Calendar • Field Maps
Input Records	• General/Whole Farm ▪ Purchase and Receiving Log ▪ Input Application Record • Soil Management and Fertility ▪ Compost Production Record ▪ Manure Application Record ▪ Other Soil Amendments Used ▪ Soil Tests • Seed and Planting Stock ▪ Seed Sources ▪ Organic Seed Search ▪ Inoculants and Seed Coating Log • Crop Rotation Plan/ Record • Pest Management Activities and Materials Use Record
Harvest, Storage, and Sales Records	• Bin Logs • Sales Invoices
Monitoring Logs	• Water Log • Pest/Weed/Disease Monitoring Log
Commingling and Contamination Prevention	• Equipment Cleaning Log • Buffer Crop Disposition Record

Depending on your operation, other records you may need to maintain include:

- Clean-transport affidavits
- Adjoining land-use verifications
- Conventional farming records

GETTING ORGANIZED

It's important to develop a recordkeeping system that fits your work style and personality—that way, you'll be more likely to follow through and keep it up-to- date. Some use ring binders for keeping paperwork under control; the binder can be divided into sections for purchases (things brought onto the farm), field activity records (things happening on the farm), and sales (things leaving the farm). Small bits of paper like receipts or labels can be kept in plastic sleeves with three-hole tabs.

Other people like accordion files. An aluminum clipboard with an internal box for papers can be handy for taking records out into the field. Carrying a pocket-size notepad at all times is another good habit to develop. Scrawled field notes can be transferred to more permanent records at the end of the day or the end of the week. Even a calendar hanging at the door or where you wash your hands when you come in from chores can be used to track your activities.

One basic decision is whether to keep your records by hand or on a computer. At the Institute farm we use both computer and handwritten systems. Many of the forms we use outside were created as computer spreadsheets, making it easy to write in the relevant information and then transfer it to the computer later on.

RECORDKEEPING RULES OF THUMB

- Save all your receipts and input labels. If a product has no removable label, save at least one empty bottle or bag to show the inspector.
- Make a place for your receipts and records and develop a habit of putting them there.
- Document your efforts to obtain organic seed. You should be able to show that you tried three separate seed houses to find the variety you wanted in organic form. Make a copy of your seed order, and keep a phone log including the date, the name of the person you talked to, and the outcome of the conversation. Save seed catalogs—most seed companies serving the organic market include policy statements regarding certified organic and non-GM seeds. You can ask your seed supplier to write on the invoice that all seeds purchased are non-GM and untreated, or that the supplier did not have organic seed available in a particular variety, if that is the case.
- Document cleanout of any combines, trucks, bins, and augers used for both organic and non-organic product. Cleanout logs are often the only evidence you can show that proper procedures were followed to prevent cross-contamination. If you do the cleaning, you can note this on your activity logs or calendar.
- Document strategies to prevent GMO contamination. These might include offsetting crop flowering periods with non-organic neighbors or keeping cleanout logs for trucks and equipment.
- Find some filing cabinets. Certified operators are required under the NOP to keep organic production, harvesting, and handling records for a minimum of five years.

TRACEABILITY AND THE AUDIT TRAIL

Traceability is fundamental to the idea of organic certification and is becoming increasingly important in all forms of agricultural production. The "certified organic" label is a promise to the consumer that the labeled item has been produced, processed and handled in accordance with organic standards, including safeguards to make sure it hasn't gotten mixed up along the way with non-organic product.

The audit trail is the chain of paperwork backing up this promise. A solid audit trail makes it possible to trace an individual item—a package of pork chops, a bag of frozen peas, a jar of apple sauce—from the market shelf back

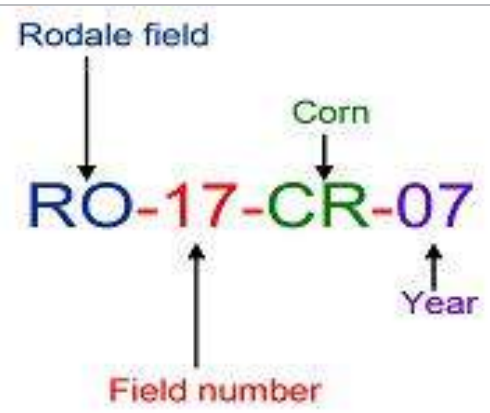
to the field it came from. The organic premium can be understood as payment for this "extra" recordkeeping.

The NOP Standards define an audit trail as documentation "sufficient to determine the source, transfer of ownership, and transportation of any organic agricultural product." Some items have long audit trails; others have short ones. Each time an organic product changes hands from farmer to processor to distributor to retailer, paperwork testifying to its organic status must accompany it.

CREATING LOT NUMBERS

Lot numbers are a key part of the audit trail. A lot number is a unique code of numbers and/or letters that stand for specific pieces of information connected to a specific batch of product. Information that a lot number should contain includes the type of crop, crop year, and either field or storage unit numbers. Make your lot numbering system as simple as possible while still including all the necessary information.

The lot numbering system we've developed at the Rodale Institute farm reflects the fact that some of our acreage is rented to a neighbor, John Brubaker. Because we have more bin space than he does, we store and ship out some of the organic grain he produces together with our own. The first element of our lot numbers is an "RO" for a Rodale field or a "BU" for a Brubaker field. Next comes the field number (1 through 132), then the type of crop ("CR" for corn, "SB" for soybeans, "RY" for rye, etc.), then the year ("07" for 2007). "RO-17-CR-07," then, is the corn crop from Rodale field #17 harvested in 2007. "BU-04-OT-06" is the oat crop from Brubaker field #4 in 2006.



Bin logs record the lots as they go into the bins after harvest. Then, as we sell crops out of the bins, each shipment is assigned a number indicating the bin it came out of, the year, and the shipment order in the season. Since we know which crops went into which bins when, we can trace a particular shipment back to the fields those crops came from.

Additional care is necessary in our joint Rodale-Brubaker operations because John also farms some land non-organically, including a few fields he rents from other neighbors. To prevent mix-ups, he never grows the same crop handled in the same way both organically and non-organically in the same year. With corn, for instance, he typically cuts all his non-organic corn for silage, saving only his organic corn for grain.

RECORDKEEPING FOR ORGANIC LIVESTOCK PRODUCTION

Organic livestock production generally entails more recordkeeping than crop production. Recordkeeping systems for organic livestock need to be detailed enough to track individual animals (flocks in the case of poultry, hives in the case of bees) from birth to sale or slaughter.

For poultry, you'll need to maintain flock health records including date and number of mortalities, a running flock inventory, records to document outdoor access, and slaughter and/or sales records. For laying hens, you should keep monthly egg packing records as well as monthly egg sales summaries. Many farmers find that the "best by" or "laid on" date works well as a lot number for organic eggs. For meat birds, a lot number can be made up of your farm's initials, the flock number, the year, and the slaughter date.

Systems for larger animal should include purchase records (with documentation of organic status, if applicable), breeding records, dates on pasture, and detailed health records including all treatments, vaccinations, procedures, and medicines. Organic dairy producers should record somatic cell and standard plate counts as well as milk sales records.

All organic livestock must be fed 100% organic feed or forage. Mineral feed additives are not classified as agricultural products and

thus cannot be certified organic; these can be fed without restriction so long as they are in compliance with the National List. Any agricultural ingredients such as soy oil or wheat middlings in a mineral supplement must be certified organic.

Bedding materials do not need to be certified organic if they are not normally eaten by the livestock. If they are eaten (like cornstalks for cattle, say), then they must be certified. Sawdust must be free of prohibited materials (no sawdust from chemically treated wood).

Organic livestock rules are covered in more detail in the Livestock chapter.

SUMMARY

Good recordkeeping is essential to the certified organic system. Documentation of production, processing and handling methods from the field to the final retail product underpins the "certified organic" label and the price premium that consumers pay for certified organic items.

Forms and activity logs suitable for organic recordkeeping purposes have been developed by groups like ATTRA and may also be available through your certifier. Don't be discouraged when you first start looking through the forms. You probably won't need to use all of them, and it's perfectly appropriate to tailor them to suit your particular operation.

Most successful organic producers find that once they get their recordkeeping system set up, it's not that difficult to maintain. More important, it can provide the basis for sound financial management of your operation and help you evaluate and improve your systems over time.

LESSON 4: MAINTAINING ORGANIC INTEGRITY

OVERVIEW

For most of this course, we've focused on organic production methods, starting with the soil and moving on to crops and animals. But organic certification is equally concerned with what happens to crops and animal products after harvest and even after they leave the farm.

Photo Credit: Rodale Institute

Jeff Moyer, Executive Director of Rodale Institute, checking the grain bin

In terms of maintaining quality, organic crop storage and handling is similar in many ways to conventional crop storage and handling. All of the basic rules still apply: keep it cool, keep it clean, and keep it dry or damp, according to the needs of the crop in question.

What's different about handling and storing organic crops comes down to three fundamental issues:

- Many synthetic fumigants and disinfectants allowed for non-organic production are prohibited for organic production.
- Organic crops are frequently grown for high-value markets (like food-grade soybeans for tofu or vegetables for high-end restaurants), so quality is of primary importance.
- NOP Standards require detailed recordkeeping and established procedures for keeping organic crops separate from non-organic crops.

Maintaining high quality without resorting to chemicals requires familiarity with the optimal storage requirements of different crops, attention

to detail and a generous helping of common sense. Maintaining organic integrity calls for careful recordkeeping and attention to organic handling and processing regulations. It also requires open communication with neighbors, public utility workers, truckers, and other individuals who can affect the organic status of your land and its products.

WHAT THE STANDARDS SAY ABOUT ORGANIC INTEGRITY

There are two sections of the NOP Standards that relate specifically to the maintenance of organic integrity. §205.272 states that handlers of organic foods and other products "must implement measures necessary to prevent the commingling of organic and nonorganic products and protect organic products from contact with prohibited substances."

It goes on to prohibit:

- Packaging materials, storage containers, or bins containing synthetic fungicides, preservatives, or fumigants; and
- "The use or reuse of any bag or container that has been in contact" with any prohibited material, unless "such reusable bag or container has been thoroughly cleaned and poses no risk" of contamination.

The "Facility pest management practice standard" (§205.271) stipulates that pest control for organic handling and storage areas must begin with:

- Physical exclusion (such as closing up cracks to keep out mice),
- Removal of nesting areas (such as mowing around bins), and
- Environmental management (such as reducing temperatures to eliminate insects).

Physical controls such as traps or noisemakers are also permitted, as are lures and repellents consistent with the National List. Vitamin D3, for instance, is allowed as a rat poison.

If these methods aren't enough (or if federal, state, or local regulations require use of a particular control measure), materials not on the National List may be used along with an approved method for preventing contamination of organic product, contingent upon permission of the certifying agent.

BORDERS AND BUFFERS

Properly maintained buffer zones along the perimeter of an organic production area are another cornerstone of organic integrity. The NOP Standards don't specify a required buffer width (as did some earlier organic standards); instead, evaluation is made on a case-by-case basis as to the adequacy of the buffer to prevent contamination of organic fields by prohibited materials applied to adjacent non-organic fields. If you have a tight hedgerow of trees along your border, your buffer zone could be 15 feet wide; if your organic land is downhill with black dirt between you and the non-organic land, then you may need 60 feet of buffer. If your neighbor doesn't apply prohibited materials and is willing to sign an affidavit to that effect, you may not need a buffer at all.

Buffer zones can be made up of grassy areas, tree lines, hedgerows, or just a designated margin of a crop field. Most buffer areas primarily serve to stop airborne drift of pesticides or other prohibited materials, but water runoff from adjacent non-organic fields can also create contamination issues.

Crops harvested from within buffer zones must be kept separate from organic crops and sold as conventional, not organic. If any of your buffer areas are cropped, your Organic System Plan will need to include information about how you harvest and sell the buffer-zone crop.

Think about road frontage and utility lines as well as neighbors. State, county, and local road crews and utility companies have various rules concerning use or nonuse of herbicides and insecticides. Some road crews are willing to mow rather than use synthetic herbicides; others may require you to do the mowing. All agreements should clearly document the rights and responsibilities of both parties and be signed and dated. If the road crew sprays without

notification, then the organic farmer may be eligible for damages, since the agreement was broken.

Remember, communication is key—prevention of contamination is better than dealing with liability claims or losing your organic certification.

MIXED OPERATIONS

Farms producing both organic and non-organic crops (sometimes referred to as "mixed operations") have to be particularly careful about maintaining organic integrity. Some people make a distinction between "parallel operations," or farms producing the same crop both organically and non- organically, and "split operations," or farms producing some crops organically and other crops non-organically. Some certifiers disallow parallel production altogether (as do some international organic standards, such as the European regulation).

The NOP Standards define "commingling" as "physical contact between unpackaged organically produced and non-organically produced agricultural products during production, processing, transportation, storage, or handling, other than during the manufacture of a multi-ingredient product containing both types of ingredients." Contamination is contact of organic products with prohibited substances such as pesticides, heavy metals, or genetically modified organisms.

All organic farms need to protect against commingling and contamination, but mixed operations must be doubly vigilant. Any and all tillage equipment, harvest containers, combines, etc., need to be either permanently dedicated to the organic side of the business or thoroughly cleaned between nonorganic and organic use. The same applies for the equipment of any custom operators you may use.

Equipment used for the application of prohibited materials, such as spray rigs, should not be mixed-use. Sprayers used for the application of organic-approved materials (such as fish fertilizers or compost teas) should be purchased new, not secondhand.

Photo Credit: Rodale Institute

If equipment can't be dedicated to organic production, it must be thoroughly cleaned between organic and non-organic work.

ORGANIC GRAIN STORAGE

For some farmers, crop storage and handling take a backseat to the main business of production. As an organic farmer, however, that attitude is not one you can afford. Remember, the organic market is a premium market, and to receive a premium price, you need to supply a premium product. This means doing everything you can to make sure your high-value crops stay that way from the field to the final sale.

Organic grain storage is different from non-organic grain storage in part because of differences in how the organic grain market works. Many non-organic farmers store grain (either on-farm or off-farm) in hopes of selling it later at a better price. Organic farmers are more likely to hold grain short-term until trucking can be arranged (since many local elevators can't take field-run organic grains) or to store grain to supply contracts to other farmers or small processors with limited storage facilities.

If you're in an area with a large number of organic farmers, you may be lucky enough to have an elevator or mill nearby that's certified as an organic handler. If not, you may find you need to increase your on-farm grain storage capacity as

part of your transition to organic.

If you do store your grain on-farm, the same rules that apply to organic handlers apply to you as well. This includes the development and use of a lot numbering system (so individual units of sale can be traced back to where and when they were harvested), not using prohibited materials in or around storage and handling areas, and keeping records of all activities and materials.

ORGANIC GRAIN HANDLING

Organic grain handling requires close attention to details like weed management around bins, keeping bins rodent-, water- and weatherproof, and sweeping and vacuuming out bins in between lots. If you get those bins as clean as you can, down to the last little piles of grain dust, you'll be more likely to eliminate insect eggs and other tiny potential contaminants that could lead to headaches later on.

Climate and season are two critical storage factors: grain is much easier to store in cold weather than in warm weather and in dry climates than in humid climates, since most insects and molds spread faster in warm and humid conditions.

Another strategy for preventing pest problems in storage is to rotate crops (e.g., using a bin for corn one year and for soybeans the next). Some farmers use diatomaceous earth (DE) products to limit insect populations in stored grain. Sprinkling DE on the floor of an aerated bin and running the fan on low while filling helps incorporate the DE through the grain; adding some periodically as you're filling the bin also works.

When shipping organic grains, obtain a signed statement from the truck driver verifying that the truck is clean before loading to show your inspector. Climb up and view the truck to make sure this statement is true. If the truck opens the bottom chute at the buyer's facility and a few handfuls of corn come out before your organic food-grade soybeans, you have just lost your significant organic premium.

Ultimately, it is the responsibility of the farmer to make sure the truck is clean, since it is the farmer's responsibility to protect organic integrity until the crop has left the farm. If the trucker says he or she carried an organic crop immediately prior to yours, have him or her sign a document to that effect.

FARMER-TO-FARMER

Klaas and Mary-Howell Martens farm and run a mill in upstate NY. Here are some tips they wish all farmers would follow:

1. Prepare the destination of the grain before you start harvesting. If you're delivering the grain to the buyer directly out of the field, be sure you let them know when it's coming before you harvest and give them an accurate, honest assessment of grain moisture, cleanliness and condition.
2. Get a good moisture meter and calibrate it carefully. Learn how to read and interpret samples accurately for percentage of moisture with appropriate temperature calibrations. Check moisture often as you harvest.
3. Clean before drying. If the grain is above 2% foreign matter, run it through a rotary cleaner before drying and/or storing.

ORGANIC PRODUCE STORAGE AND HANDLING

For fruits and vegetables, as for grains, organic rules restrict the use of synthetic fungicides and other post-harvest treatments. This means that extra care has to go into good sanitation practices and the maintenance of optimal storage conditions for your crops. Whether you're selling to wholesalers, to restaurants, or directly to consumers, your customers are going to expect consistent, top-quality produce that looks great and keeps well until they expect to use it.

The major determinants of storage survival for fruits and vegetables are temperature and humidity. Fruits and vegetables can be roughly divided into four classes in terms of preferred storage conditions: cold and dry (garlic, onions), cold and humid (apples, berries, beets, carrots), cool and dry (winter squash), and cool and humid (citrus, potatoes). It's not always easy for smaller

farms to maintain that many different storage areas, but good storage facilities can be a crucial investment for reaching high-value markets.

Post-harvest quality can also be affected by variety selection, soil conditions and the care with which crops are handled during harvest and post-harvest operations.

Again, as for grains, produce harvest and handling equipment, such as boxes, bins, and bags has to be new, free of prohibited materials and dedicated to organic production or thoroughly cleaned with approved materials prior to entering the organic system. Wagons or bins made from treated wood are not acceptable for organic production. Wooden crates from conventional orchards cannot generally be recycled for organic purposes; plastic ones can because they can be thoroughly cleaned. Waxed or unwaxed boxes that previously held non-organic produce cannot be used to harvest, store, or sell organic crops.

WASH WATER

Water sources used for organic produce washing must be legally fit to drink and tested at least once a year for nitrate and coliform bacteria. Many organic farmers growing baby salad greens use mesh bags and household washing machines set to the spin cycle to remove excess water from greens after rinsing. You can also purchase commercial-size salad spinners. Regular hose sprayers or barrel-washers can be used to remove field dirt from root crops.

Organic growers may use periacetic acid, hydrogen peroxide, or sodium hypochlorite (Clorox) to disinfect wash water, but should take care to get the correct dilution level, especially with bleach, which is classified as "restricted" rather than "approved" for organic production.

The bleach restriction states that "residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act" (§205.601). This has been interpreted to mean that if chlorine concentrations in wash water of edible crops exceed 4 ppm (parts per million), the crops must be rinsed afterward in fresh water. Hydrogen peroxide solutions as low as 0.5 percent can eliminate the fungi that cause post-harvest decay.

SUMMARY

Maintaining organic integrity refers to the protection of organic products from contamination with prohibited materials and commingling with nonorganic products. It encompasses everything from establishing adequate buffer zones along property perimeters to making sure harvest containers are not treated with synthetic preservatives. Recycled or secondhand containers should be thoroughly cleaned prior to organic use.

Equipment can also be a source of potential contamination. Tractors and trucks should be kept in good repair to prevent oil or other fluid leaks in organic fields. Equipment used in both organic and nonorganic applications should be thoroughly cleaned between uses. This usually means hosing off soil from tillage equipment and tractor tires and vacuuming out combines and seed drills. Check with your certifier about the acceptability of your clean-out procedures.

Maintaining organic integrity goes hand in hand with maximizing organic crop quality. As in so many other areas of organic management, careful sanitation is a key to preventing pest and disease problems in stored crops. Storage bins and areas should be scrupulously cleaned between uses and kept in good repair to prevent the entry of rodents and other pests. Cleaning materials must be approved for organic use.

In the final lesson of this chapter, we'll talk more about organic processing and handling requirements.

LESSON 5: ORGANIC HANDLING AND PROCESSING

OVERVIEW

Since this is primarily a course about transitioning to organic farming, we're not going to go into extensive detail about organic food processing. But it's important to have a basic understanding of how the NOP Standards relate to the processing and retail handling of organic products. You may find you can bring in more income by adding value to your crops with some basic processing. Or you may operate an organic farm stand and be thinking about selling organic

Photo Credit: Rodale Institute

Wisconsin-based certified organic Sibby's ice cream uses organic cream and eggs from nearby farms.

baked goods along with vegetables and flowers.

Organic processing has three aspects: ingredients, facilities, and labeling. If you want to make and market organic bread, for instance, you'll need to use organic ingredients (and be able to document that they're organic), process them in a certified organic processing facility, and comply with organic labeling requirements. We'll talk about each of these aspects in the following pages.

By the end of this lesson you should:

- Recognize the four USDA categories for organic labeling
- Understand organic rules regarding storage and processing facilities
- Understand the basic requirements for sourcing organic ingredients
- Know whether you'll need to complete an Organic Handling Plan as part of your certification application

WHAT THE STANDARDS SAY ABOUT ORGANIC HANDLING AND PROCESSING

The NOP Standards define handler as "any person engaged in the business of handling agricultural products, including producers who handle crops or livestock of their own production," but not including "final retailers of agricultural products that do not process agricultural products" (§205.2).

The Standards further define "to handle" as "to sell, process or package agricultural products, except such term shall not include the sale, transportation or delivery of crops or livestock by the producer thereof to a handler." If you do nothing but harvest your organic crop and deliver it to a buyer, you're not a handler.

Processing is viewed by the NOP as a specialized type of handling, including:

> "…cooking, baking, curing, heating, drying, mixing, grinding, churning, separating, extracting, slaughtering, cutting, fermenting, distilling, eviscerating, preserving, dehydrating, freezing, chilling, or otherwise manufacturing," including "packaging, canning, jarring, or otherwise enclosing food in a container." (§205.2)

In other words, just about anything you might think about doing to a food or feed product to prepare it for sale beyond simple washing and bagging is considered processing. On-farm grinding or mixing of organic grains for livestock feed also counts as processing.

Handlers who do not process are not required to be certified if the products remain in the same containers or packages they were received in. These "excluded" handlers—a group including most retail markets selling organic items—must be able to show that organic products do not come in contact with prohibited substances and aren't getting mixed up with non-organic products.

CATEGORIES OF "ORGANIC"

There are four different organic labeling categories for certified organic processed food items:

- "100% Organic"
  - All ingredients of the final product, including processing aids, must be certified organic. Water and salt don't count, since they're not "agricultural products" and hence cannot be certified.

    - The USDA Organic seal and/or the certifying agent's seal may be used.
- "Organic"
    - At least 95 percent (by weight or fluid volume) of all ingredients must be certified organic, excluding water and salt.
    - If a given ingredient is commercially available in organic form, it must be organic in your product. Organic and non-organic forms of the same ingredient may not be mixed. Non-organic ingredients may not include irradiated or GM products or products raised with sewage sludge.
    - The USDA Organic seal and/or the certifying agent's seal may be used.
- "Made with Organic Ingredients"
    - At least 70 percent of all ingredients must be organic, excluding water and salt. Other ingredients may not include irradiated or GM products or products raised with sewage sludge.
    - The USDA Organic or other certifying agent's seal may not be used.
- List of ingredients with organic products identified
    - Products with less than 70 percent organic ingredients (by weight or fluid volume) may not be identified as organic on the primary display panel, but may identify organic items in the ingredients list.
    - Products in this category do not need to be processed in a certified organic processing facility.
    - The USDA Organic or other certifying agent's seal may not be used.

LABELING RULES

Specific rules govern where the USDA Organic seal and the certifier's seal may be placed, how the ingredients may be listed and what other information needs to be on the label. Other label claims, such as "kosher" or "biodynamic," may be made as long as they are truthful and not misleading. But the bottom line is that organic labeling requirements are complicated, and if you're ordering custom-made labels, mistakes can be expensive. Have your certification agency review and approve your label before printing and use in the marketplace. They can help you understand the fine points detailed in the regulation to ensure that you to have a legal label.

INPUT FROM RODALE

I learned more than I wanted to know about organic processing and labeling requirements when we started selling jarred organic apple and pumpkin butters here at the Rodale Institute. We were looking for a value-added product to make use of our processing-quality organic apples and pumpkins. They've been good products for us, and it was worth the effort, but it took a while to work out all the kinks.?

—Jeff Moyer

ON-FARM PROCESSING IDEAS

All on-farm organic processing facilities must follow any applicable state and/or local regulations. Items such as honey, maple syrup and apple cider may not be required to be made and packaged in a licensed kitchen, depending on the state. Some states also allow a certain number (less than 1,000, for example) of poultry to be slaughtered on-farm and sold direct to consumers without a licensed kitchen. Large animals such as hogs or beef usually need to be slaughtered and packaged in a state or federally licensed facility.

A wealth of opportunities await those interested in value-added organic production and marketing. Grain farmers can sell organic livestock feeds (again, check with local regulations), or they can clean grain and sell it to local bakeries. You could buy a small grain mill and make pancake or bread mixes and sell these to stores or at farmers markets.

For fruit and vegetable growers, there is a wide range of possibilities, including pickles from many types of veggies (beets, cukes, green beans, cauliflower, brussels sprouts, hot peppers, etc.),

sauerkraut, jams, jellies, conserves, chutneys, ketchups, salsas, pancake sauces, tomato sauce, and much more. Dried vegetables can be made into soup mixes, pasta toppings, or salad dressings. It's a good idea to visit some of your possible outlets first to assess your competition and market, and perhaps find a niche you could fill.

Herbs can be dried and used in blended seasoning mixes and teas, added to vinegars and oils, or just bound nicely and sold for hanging as decoration and food. Catnip can be dried and put into little toys and sold for pets. Many types of flowers dry well and can be made into everlasting bouquets or sachets. Garlic and chilis can be fashioned into braids or ristras.

Body care products such as lip balms and soaps made from milk, beeswax, oils, and herbs are another possibility. A good idea, a high-quality product, a nice label, and package can do a lot to get you on your way to an enjoyable home business. Your only limit is your imagination.

STORAGE AND PROCESSING FACILITIES

Facilities used for processing organic foods—even small on-farm facilities—must be certified just like farms. They don't necessarily need to be on-site, however, and in some cases, you can save money by combining certification applications of linked farms and processing facilities. If you have a dairy farm and you make cheese, for instance, you'll need to complete an Organic Farm Plan, Organic Livestock Plan and Organic Handling Plan, but it can all be part of a single certification application. If you have the dairy and your neighbor has the cheese business, you may also be able to be certified under one joint application.

Even if you don't have your own processing facilities and there are no certified processors in your area, you may be able to work something out for processing with a local facility. We arranged to have our organic apple and pumpkin butters made by a small-line processor nearby, with inspection and certification of their facility falling under our certification application. They have to follow all the organic processing and handling rules; we pay for the inspection and handle some of the paperwork.

The additional regulations aren't so different from what our processor already has to do to follow health department and FDA rules. The facility processes our organic product at the beginning of the run (after clean-out), so there's no possibility of contamination with non-organic product. We've worked with them to make sure all of their cleaning materials and methods comply with the NOP Standards.

We also contract with an off-site facility for bulk apple storage. We pay for that inspection, too, but I think it's worth it because there's no way we could buy or build our own large-scale apple storage for that price.

Before investing in your own licensed kitchen, see if a local school, community center or church will rent its kitchen to you during off hours or days. You'll have the benefit of trying out their equipment, perfecting your recipes and working out your production needs before making an investment in your own facility.

ORGANIC INGREDIENTS AND PROCESSING AIDS

The simplest way to create a processed organic product is to use all your own organic ingredients. Our apple butter, for example, has one ingredient: organic apples. Our pumpkin butter posed additional challenges because the recipe also called for white grape juice concentrate, lemons, oranges, cinnamon, and mace, so we had to find organic sources for these items.

One challenge is that it can be difficult to obtain documented certified organic product in small quantities. You can combine with other farmers for a group purchase, or buy part of a larger lot from another processor. No matter where you get your ingredients, you'll need documentation to show that they're organic. If you buy prepackaged ingredients in small quantities at the grocery store, save the receipt and the package.

Earlier in this chapter we talked about the National List governing allowed and prohibited organic inputs. Part of the List relates to organic processing:

- §205.605 lists nonagricultural substances allowed as ingredients in products labeled as "organic" or "made with organic ingredients"
- §205.606 lists non-organic agricultural products allowed as ingredients in products labeled as "organic" or "made with organic ingredients"

The former group includes things like ascorbic acid, low-methoxy pectin and sodium bicarbonate; the latter is much shorter and includes kelp, carob bean gum, and unbleached lecithin. Most of these substances are used primarily by large-scale commercial processors, but some, like pectin and xantham gum, can be purchased in retail quantities and are used by farm-based processors in products like jams or lotions.

All production methods, facilities and recipes—including all ingredients and processing aids (such as oil used on bread pans)—must be approved by the certification agency before sale with an organic label.

SUMMARY

Organic food processing has become big business in recent years, with an increasing number of companies offering organic ingredients, approved-for-organic processing aids and related services. Finding a slaughterhouse, bakery or other facility that can offer custom, certified organic processing for your value-added product is gradually getting easier.

But if you can't find a certified processor in your area, you can still find ways to create value-added, certified organic products for sale as part of your marketing mix. You may be able to rent a facility from a local school or other community group; you may be able to contract for certified processing with a local firm; or you may decide to invest in your own facilities for on-farm certified organic processing.

Remember that in addition to the organic standards, you also need to comply with any and all applicable federal, state and local regulations for public health, food safety, waste management, worker safety, etc.

The NOP Standards provide for four organic label categories based on the level of organic ingredients: 100% organic, 95% organic, 70% organic, and less than 70% organic. Each one carries specific labeling requirements. Make sure you have your product label approved by your certifier (and any other relevant state or federal authorities) before you begin using it for sales.

The NOP Standards define handling and processing very broadly. Check with your certifier to find out if you need to fill out an Organic Handling Plan in addition to your Organic Farm Plan.

GLOSSARY TERMS

Nonagricultural substance: A substance that is not a product of agriculture, such as a mineral or a bacterial culture, that is used as an ingredient in an agricultural product. For the purposes of this part, a nonagricultural ingredient also includes any substance, such as gums, citric acid, or pectin, that is extracted from, isolated from, or a fraction of an agricultural product so that the identity of the agricultural product is unrecognizable in the extract, isolate, or fraction. *(NOP definition)*

CONCLUSION

This concludes the Certification chapter. In the pages of this chapter we've reviewed the steps toward certification and discussed specific details like how to choose a certifier and what to expect from your visit with the organic inspector. We've talked about the rules governing organic inputs, some guidelines for organic recordkeeping and the importance of maintaining organic integrity, particularly if you have organic and non-organic farm activities under way at the same farm location.

Finally, we've talked about the different legal categories of organic products, the labeling rules for each and the definition of processing and handling under the NOP Standards. We've discussed some basic on-farm processing ideas and things you should consider before venturing into organic processing.

The paperwork required for organic certification may seem daunting at first, but it's

essential to providing a guarantee to consumers about the methods by which the food and other items they're purchasing were produced and handled. It also gives you the opportunity to evaluate your farm business from year to year, to find new efficiencies and make improvements.

Don't forget to finish filing out your Organic System Plan, and to download and save your work. If you need to review any sections of the course, you can do that now, too.

RESOURCES

THE CERTIFICATION PROCESS

National Organic Program Compliance Checklist for Producers
(NCAT/ATTRA, 2003) 20 pp.

Organic Certification, Farm Planning, Marketing and Management
Laura Tourte et al
(UC Davis Small Farm Center, 2006) 5 pp.

Organic Farm Certification & the National Organic Program
(NCAT/ATTRA, 2002) 8 pp.

Preparing for an Organic Inspection: Steps and Checklists
Ann Baier
(NCAT/ATTRA, 2005) 8 pp.

MATERIALS AND INPUTS

Alternative Soil Amendments
Preston Sullivan
(NCAT/ATTRA, 2001) 12 pp.

Current Evaluation Procedures for Fertilizers and Soil Conditioners Used in Organic Agriculture
Stefano Canali et al, eds.
(Research Institute of Organic Agriculture/ FiBL, 2005)

Directory of OMRI-Approved Products
(Organic Materials Review Institute)

RECORDKEEPING

ATTRA Organic Documentation Forms Series
Organic Field Crops Documentation Forms
Organic Livestock Documentation Forms
Organic Market Farm Documentation Forms
Organic Orchard, Vineyard and Berry Crop Documentation Forms
Forms, Documents and Sample Letters for Organic Producers
George Kuepper et al
(NCAT/ATTRA, 2005)

Organic Vegetable Operation Recordkeeping Systems
Jim Riddle & Joyce Ford
(Carolina Farm Stewardship Association).

ORGANIC INTEGRITY

Making Sense of Rules Governing Chlorine Contact in Postharvest Handling of Organic Produce
Trevor Suslow
(University of California, 2006) 6 pp.

Postharvest Handling for Organic Crops
Laura Tourte et al
(University of California Small Farm Center, 2000) 8 pp.

HANDLING AND PROCESSING

National Organic Program Compliance Checklist for Handlers
Holly Born
(NCAT/ATTRA, 2006) 18 pp.

Organic Processing Fact Sheet Series
Organic Food Processing Basics
Organic Meat and Poultry Processing Basics
Organic Livestock Feed Processing Basics
(Minnesota Dept. of Agriculture, 2005)
4 pp. each