Brief History of Organic Farming and the National Organic Program

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Traditional farming practices used prior to the 20th century are generally regarded as 'organic.' Introduction of chemically synthesized farm inputs such as urea and DDT were criticized by scientists, philosophers, and practitioners who questioned whether the widespread adoption of such practices was sustainable. Farmers continued to practice traditional methods rather than adopt 'progressive' methods of chemical farming. Despite some economic disadvantages, a number of these traditional farmers remained competitive.

Organic food became established in the public's mind as a separate identity during the 1960s and 1970s. Rachel Carson's Silent Spring established public awareness of the ecological problems associated with agricultural chemicals in general and the use of synthetic insecticides in particular. Water pollution related to fertilizer and pesticide use and the two energy crises in the 1970s also provided incentives for farmers to reduce the use of farm chemicals. Awareness of the consequences of modern farm practices led to pesticide regulation and created growing consumer demand for food grown without ecologically destructive and toxic chemicals. Many consumers considered organic food to be one such alternative. As the market for organic foods grew, so did the need for standards, certification, and regulation. The Rodale Press established a set of voluntary standards and a certification program in 1972. Several states passed laws governing organic agriculture in the late 1970's. Rodale was also responsible for helping to organize the establishment of California Certified Organic Farmers and Oregon-Washington Tilth Organic Producers Association in the early 1970s.

Many of the pioneers and innovators in organic agricultural research came from the Western US. California has long been the largest producing and largest consuming state for organic food. Robert Papendick, a USDA-ARS soil scientist based at Washington State University in Pullman produced the "Report and Recommendations on Organic Farming," in 1980, regarded by many as the first official recognition by USDA that organic farming was viable and warranted serious research support. Within the University of California system, Robert vandenBosch and others within the Division of Biological Control advanced ecological principles and sought to avoid use of chemical pesticides.

The farm crisis of the 1980's brought bankruptcy and foreclosure rates not seen since the 1930's. A few large-scale bankrupt conventional farms were still able to plant and harvest crops without using purchased inputs. At the end of a transition period, they discovered that there were buyers who would pay a premium for their crops that were 'organic by neglect' because of the absence of chemical inputs. These farms were possibly the first to go organic for strictly economic reasons and were of considerably larger scale than the organic farms that existed prior to their entry into the organic sector. Their market entry made the organic sector more competitive with conventional agriculture. The ability of these farmers to produce without chemical inputs, their rapid expansion of the organic market, and their obvious profitability gained the attention of other nonorganic farmers who faced financial difficulties.

As the ecological, health, and welfare consequences of conventional farming systems became increasingly apparent, organic agriculture found itself serving a growing consumer base seeking an alternative to food produced by conventional farming techniques. In 1989, Sixty Minutes broadcast a story on Alar. Overnight, the sale of organic commodities increased without any change in practices or availability of organic food. Organic farmers and their customers saw limited supply, overwhelming demand, a patchwork of inconsistent or nonexistent state laws, inadequate enforcement programs, and pervasive fraud all threatening the meaning and value of the organic label. A coalition of organic farming, consumer, animal welfare, and environmental organizations persuaded Congress to pass the Organic Foods Production Act (OFPA) in the 1990 Farm Bill.

In 1992, the USDA appointed the National Organic Standards Board (NOSB) and established the National Organic Program (NOP). Over the next five years, the NOSB and NOP convened numerous public meetings to discuss and develop a uniform set of organic standards for the US. Then, in 1997, the USDA published the first proposed NOP Rule. This first proposal did not adopt the NOSB's recommendations, and was directly counter to the organic industry's existing standards. The USDA received more comments on the first proposed NOP Rule than any other proposed USDA rulemaking up to that date. Practically every comment opposed the USDA adoption of the 1997 proposal as the NOP Rule. The USDA incorporated most of the NOSB's recommendations into a final rule published on December 21, 2000. The OFPA was implemented by the NOP Rule on October 22, 2002.

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Organic Practice Guide

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Land Requirements

Soil management forms the foundation of an organic system. Organic farming can be summed up by the aphorism, "Feed the Soil to Feed the Plant." The NOP Rule requires that (a) the soil fertility, seeds and planting stock, crop rotations, and pest management practices all meet the organic standards requirements; (b) prohibited materials cannot be applied for a minimum of ***three years*** prior to the harvest of any crop sold as organic; and (c) that the organically managed area be clearly identified.[1]

Soil Fertility

Organic producers are required to maintain or improve the soil that they manage.[2] The soil is a living system that requires proper maintenance of balanced soil ecology to farm sustainably. Organic farmers regenerate the fertility of the soil through renewable resources. For most farms, operators build the soil through the increase of the partially decomposed biological fraction of the soil, known as organic matter. Increased organic matter makes nutrients more available, buffers and neutralizes soil pH, improves soil structure, raises biological activity, enhances water field capacity and drainage, and decreases erosion. While organic farmers may supplement soluble sources of various nutrients for crop deficiencies, such practice is in conjunction with a soil building program.

Tillage and cultivation

Field preparation practices used by organic operators must conserve soil and water. While tillage and cultivation are an important part of organic farmers' weed management, it must be done in a way that maintains soil and water quality. Surveys show that most organic farmers use what is usually considered minimum tillage equipment, such as chisel plows, disks, spaders, and harrows. While organic farmers will use moldboard plows, ganged plows, and rippers, these are often reserved only for cases where a field has been fallow or has a compaction layer, and are not regularly used equipment. Some organic farmers have adopted various permanent bed systems that do not involve disturbing entire fields. Beds are tilled and cultivated individually by lighter equipment. A growing number of organic farmers are experimenting with no-till systems, at least with specific crops in their rotations.

Cultural practices play an important role in producing favorable conditions for beneficial soil biota. Tillage systems that mix subsoil with surface soil, and cause compaction that leads to poor drainage and air circulation, create conditions favorable to disease-causing organisms. Adequate organic matter in the rhizosphere provides a food source for organisms that cycle nutrients and suppress diseases.

Nutrient Management

Management by neglect is not sustainable and cannot be certified as organic. Organic farmers must replenish what is harvested primarily by relying on renewable resources. Operators are required to have a soil-building program that consists of plant or animal materials. Various crop residues, food processing wastes, blood meal, bone meal, and manure all are available options for organic farmers. The use of manure is tightly restricted.

Most synthetic fertilizers are prohibited by OFPA—in particular, synthetic nitrogen, phosphorous, potassium, and calcium sources.[3] The NOP Rule also explicitly prohibits sewage sludge.[4] Plant foods labeled 'organic' may contain materials prohibited in organic production because fertilizer-labeling laws

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[1] 7 CFR 205.202.
[2] 7 CFR 205.203(a).
[3] 7 USC 6508(b)(2); see also 7 CFR 205.105(a) and 7 CFR 205.203(e)(1).
[4] 7 CFR 205.105(g).

in almost every state in the Western US are not consistent with the NOP Rule. Therefore, it is important to know that all of the ingredients in a blended fertilizer comply with the NOP Rule before recommending that it be applied to an organic farm.

For many farms that transition from conventional to organic production methods, nitrogen management is the greatest difference in nutrient management and perhaps the entire farm operation. Rather than rely on synthetic soluble nitrogen sources obtained from the combustion of natural gas, nitrogen is recycled primarily from two sources: nitrogen-fixing cover crops and animal manure usually applied as compost. Nitrogen applied in this way is stable and slowly released. While organic nitrogen is less likely to leach or volatilize, it is also not as readily available to the plant. As a result, organic crops have physiological differences related to slower growth rates, lower free nitrogen, and less lush green vegetation.

Compost and Manure Management

Manure is a valuable source of nutrients for organic farms. However, manure also contains relatively high levels of human and plant pathogens; soluble or volatile nutrients that may cause water or air pollution; and weed seeds. Manure from conventional farming sources also includes antibiotics, parasiticides, pesticides, hormones administered for growth promotion, and other prohibited substances. Organic farms are thus required to manage manure in a way that protects the crop from potential environmental, health, and food safety risks. The NOP Rule requires that manure either be composted or that the operator observes a minimum interval between the application of manure and harvest of crops for human consumption. The NOP Rule provides a strong incentive to use composted manure and places stringent restrictions on uncomposted manure.

Composting is the decomposition of organic matter through a controlled microbiological process. The use of compost has long been considered a defining feature of organic systems. Organic farmers are strongly encouraged to use compost because it reduces human, plant, and livestock pathogens; destroys weed seeds; decomposes organic matter; and makes nutrients more available to plants. Soluble or volatile nutrients are stabilized when microorganisms consume them. These organisms can also help make relatively insoluble nutrients more soluble by the production of humic acids and other means.

According to organic standards, manure and plant material used as a feedstock must have a carbon to nitrogen (C:N) ratio of between 25:1 and 40:1 prior to composting.[5] Feedstocks must meet a thermophilic temperature range of 131° and 170°F for a minimum time period that varies according to the method used. In-vessel or aerated static pile systems have a minimum thermophilic period of three days. In-vessel systems hold the manure and other feedstocks in a building, reactor, or container with sufficient capacity for the feedstock to reach thermophilic temperatures. In aerated static pile systems, the feedstock is stacked and either passively aerated through tubes inserted into the pile and baffles underneath, or actively aerated through a ventilation system that blows air through perforated pipes. Windrow systems require five turnings over fifteen days. Windrow composting stacks feedstocks in long, relatively narrow, low rows with a large surface area.

If manure is applied without being composted, then it must be incorporated in the soil, and cannot be left on the soil surface.[6] Crops that have edible portions in contact with soil—usually considered root crops and edible greens—the minimum interval is 120 days.[7] Other crops intended for human consumption must be harvested at least 90 days following incorporation of manure into the soil.[8] Manure that is not composted according to these standards require a minimum interval between application and harvest of crops destined for human consumption. Crops that do not meet these standards cannot be sold as organic.

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[5] 7 CFR 205.203(c)(2)(i).
[6] 7 CFR 205.203(c)(1)(ii) and 7 CFR 205.203(c)(1)(iii).
[7] 7 CFR 205.203(c)(1)(ii).
[8] 7 CFR 205.203(c)(1)(iii).

Operators should still manage fields used to grow crops for livestock in a way that breaks the life cycle of parasites and reduces transmission of potential human pathogens.

Mined Minerals

Another nutrient source used by organic farmers is the application of mined minerals. The mined minerals that are most commonly applied on organic farms are rock phosphate, gypsum, limestone, potassium sulfate, and magnesium sulfate.

After compost, the most widely applied source of phosphate in organic farming is rock phosphate from apatite ore that has not been acidulated or otherwise chemically treated. Hard rock phosphate is the most common in the Western US, and is a dense, non-porous mineral that contains between 59% to 75% tri-calcium phosphate. The main apatite deposits in the Western US are found in Idaho of which some may be high in arsenic, lead, and cadmium. When washed, the dried slurry from rock phosphate mining is a finely divided raw mineral phosphate or phosphatic clay that contains between 50% to 58% tri-calcium phosphate and is marketed as colloidal phosphate. Soft rock phosphate is a powdery clay source that contains between 40% to 60% tri-calcium phosphate.

The addition of rock phosphate to compost can improve the phosphorous content of the compost and make the phosphate more readily available by providing exchange sites for the calcium. Compost's biological activity appears to make the phosphate more readily available, particularly through the production of humic acids and the symbiotic activity of vesicular-arbuscular mycorrhizae (VAM).

Gypsum and limestone are applied for their calcium content, and to help balance the pH of soil. In many alkaline or sodic soils, application of mined gypsum is a common practice to displace sodium from the soil. The sodium must be leached, usually by irrigation sufficient to wash the salts into the drainage system.

In the Western US, natural potassium sulfate obtained from the Great Salt Lake in Utah offers one of the most commonly used sources of natural potash used by organic farmers in the Western US. A number of the less soluble natural potassium silicate sources are also applied, such as basalt and granite. These latter minerals have long been observed as providing a measurable crop response, particularly when combined with organic matter. However, they are generally out of favor with conventional farmers and are not recognized as having fertilizer value by fertilizer control officials.

Some mined minerals are restricted because of their high solubility, high salt index. Sodium nitrate and potassium chloride are on the National List of prohibited natural substances with specific restrictions that allow limited use. Because they are prone to leach, can pollute water, and degrade soil quality when abused, organic operators are discouraged from using these fertilizers. The NOP Rule restricts their use by requiring documentation in the Farm Plan and evidence that the restrictions placed on their use are met. Sodium nitrate cannot provide more than 20% of the total nitrogen added to a crop.[9] Use is particularly discouraged on high sodium desert soils. The nitrogen contribution of compost, cover crops, and other sources of these nutrients either need to be documented by laboratory analyses or estimated conservatively to avoid certification problems. Potassium chloride must be applied in a manner that minimizes chloride accumulation in the soil.[10]

Ashes

Ashes from wood ash and other crop residues offer a readily available, economical source of nutrients, particularly for calcium and potash. Ashes can be blended with a compost to balance their nutrient levels. However, ashes are usually alkali and can have adverse effects on soil pH and structure when applied repeatedly. Also, some sources of ashes have been reported high in arsenic and lead, particularly when

[9] 7 CFR 205.602(h).

[10] 7 CFR 205.602(g).

pressure treated lumber or demolition wastes have been incinerated. Manure ash is prohibited due to the environmental impact of its manufacture and its adverse impact on soil quality when compared with compost and raw manure.

Synthetic Crop Nutrients
Finally, growers may use synthetic substances that are on the National List if their use is planned and they comply with the NOP Rule annotations for those substances. These are described below.

Fish that has been hydrolyzed or emulsified can be an effective source of crop-available nitrogen. However, it must be stabilized to prevent putrefaction and potential food safety problems, with phosphoric acid as the preferred stabilizer and sulfuric acid an acceptable substitute.

Aquatic plant products such as *Ascophyllum nodosum* can be applied either to soil or foliage as a source of trace minerals. They also contain relatively concentrated amounts of plant auxins, growth regulators and stimulants – such as indole-3-acetic acid (IAA), gibberellic acid and cytokinins. Such natural plant hormones can help promote rooting in transplants and cutting, and also help to delay senescence and decay in mature crops. Aquatic plant products are often extracted using potassium hydroxide in order to increase their solubility.
Elemental sulfur offers a means by which alkali soils can be acidified. While gypsum will help to reduce sodium, it will not lower pH appreciably in most situations. Sulfur will have a more immediate effect on lowering pH. However, sulfur is not buffered and can damage soil structure. Also, in soils where available calcium is limited, application of soil sulfur instead of gypsum may cause calcium deficiencies by tying up the available calcium.

Magnesium sulfate from synthetic sources may also be used as a foliar feed or to deal with specific soil conditions. Also known as Epsom salts, magnesium sulfate is available from some natural sources, such as keiserite and langbeinite. However, the synthetic form is more readily applied as a foliar feed.

Synthetic micronutrients—cobalt, copper, iron, manganese, molybdenum, selenium, and zinc—can be applied to correct a deficiency provided that they are from sulfate, carbonate, oxide, or silicate sources. Nitrate and chloride forms of these micronutrients are explicitly prohibited. Synthetic soluble sources of boron can also be applied. The micronutrients cations (copper, iron, manganese and zinc) are less available in soil than the primary and secondary cations, potassium, calcium and magnesium.

Available micronutrients depend on the pH of the soil; total nutrient levels alone will not provide enough information to document sufficiency. In many high pH soils, crop deficiencies are more likely to be diagnosed by leaf or petiole samples than by soil tests. Organic matter is another factor that influences micronutrients availability. Micronutrients attached to inorganic soil particles will not be able to readily contribute to plant nutrition. Use requires documentation of soil deficiency through testing. The NOP Rule does not specify sampling the soil matrix, and professionals may use plant tissue testing to estimate soil deficiencies with models that correlate availability and plant tissue levels of the specific trace minerals intended to be applied. Over the long run, producers are expected to increase the amount of essential trace elements through the application of compost and natural mined minerals, and increase their availability by adjusting the pH and increasing the cation exchange capacity.

Chelating agents are compounds to which an element in its ionic form can be attached. Micronutrients can be made more available to plants by chelation with various compounds. Naturally occurring chelating agents such as citric acid may be used. Synthetic chelating agents on the National List such as lignosulfonic acid and its salts; and humic acids are more commonly used. Synthetic chelating agents not on the National List such as EDTA and DTPA are prohibited.

Seeds and Planting Stock

The NOP Rule requires that organic farmers plant organic seed, but allows nonorganic seeds to be used, if the operator can document that organic seeds are not commercially available. 'Commercially available' is defined by the NOP Rule as "[t]he 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."[11] A growing number of sources for organic seeds are now available. Annual planting stock must be organically produced in any case. Perennial stock from a nonorganic source may be transitioned to organic production after twelve months. The standards permit seeds and planting stock treated with prohibited substances as the result of Federal or State phytosanitary requirements.

Crop Rotation

Crop rotation is the cultivation of different crops in temporal succession on the same land. Diversifying crops cultivated over time in the same field improves the efficiency of nutrient cycling, particularly if leguminous green manures that fix nitrogen are added to the rotation. Crop rotations can break host cycles for pests and diseases. Alternation of crops with different seasonal patterns and growth habits can also help to suppress weeds. Properly managed rotations can also increase microbiological diversity and activity; raise organic matter content; conserve soil; and enhance soil structure. Even simple rotations over a short time period significantly improved soil quality in controlled experiments.[12]
The Farm Plan should include details for which crops will be rotated in a given field. Simply including a fallow period could be a start, but a sustainable rotation will require more diversity over the long run. Assisting farmers to plan rotations will require knowledge of the complimentary nutrient requirements. Organic production systems will have difficulty meeting crop nutrition needs if crops that require high levels of fertility are grown frequently. Heavy feeders produce more when rotated with light feeders and nitrogen-fixing legumes. Transitions to organic production are often best begun with a nitrogen-fixing green manure. Hay crops such as alfalfa or clover can also be successful transition crops.

Rotation and diversification are important strategies to reduce pests and diseases, and improve a diverse balance of organisms in the field. Continuous cultivation of the same crop year after year allows the population of pest organisms that feed on that particular crop to steadily increase. By planting a non-host crop, one can reduce the amount of food available to specific pests and pathogens. Complicating the system by intercropping or planting buffer strips can also reduce soil-borne pest and disease pressure. Completely clearing a field of weeds may actually promote nematodes and soil-borne diseases by reducing the diversity of the habitats for competitive microorganisms and the natural enemies of pests.

Pest, disease, and weed management also depends heavily on rotations. Breaking host cycles requires more than avoiding the same crop planted back-to-back in a given field. Crops that host common pests must also be avoided in succession. Economics ultimately determine the success of crop rotations. Planting a green manure or leaving land fallow carries both operating expenses and opportunity costs, and is particularly difficult to manage on leased land. Farms that produce high value heavy feeders without rotating other crops often face increased production costs and decreased yields over the long run. Operators faced with mounting infestations of pests, diseases, and weeds, and declining fertility may be faced with the choice of either withdrawing from organic production or farm failure.

Pest, Disease, and Weed Management

Crop protection is based on a systems approach that is founded upon the premise that healthy plants are protected by natural defenses and immune systems. Experience backed by research indicates that crops that are nutritionally imbalanced can have a greater potential to be infested with opportunistic pests and

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[11] 7 CFR 205.2.

[12] For example, see the literature review by M. Liebman and E. Dyck. 1993. Crop rotation and intercropping strategies for weed management. *Ecological Applications* 3(1):92-122.

diseases. Thus, proper, balanced nutrition is the cornerstone of organic pest management. Crop rotations, sanitation, planting of resistant varieties, and other preventive measures offer a planned, strategic approach that minimizes the use of interventions. Operators may resort to the use of a limited number of pesticides only if biological, cultural, and mechanical means prove ineffective, and only if they are included in the Farm Plan. It is important to know that the standards apply to formulations and not simply active ingredients. Inert ingredients must also be nonsynthetic or appear on the National List. The National List includes all inert ingredients that the EPA has determined to be minimum risk (List 4) and was recently amended to allow specific inerts of unknown toxicity (List 3) to be used with passive pheromone dispensers.

Pests

Organic farmers need to protect crops from various pests without the use of most chemical insecticides. The few exceptions that are made to this rule are based on criteria that take into account considerations of human health and the environment. Classical biological control—the release of the natural enemies of pests—is another strategy that helps to control insect and arachnid pests. Various predators and parasites can help to reduce the population of insects if their release is properly timed and they are released in sufficient quantities. Their effectiveness can be enhanced through the management of a community of plants that provide shelter and alternate food sources. Various mechanical controls are also available. Finally, there are a number of non-toxic repellants that are exempt from registration as pesticides. These can also serve to discourage insects from feeding as well as form physical barriers that protect crops from pests.

A number of mechanical and physical devices are available to protect crops from insects, mites, and other pests. Some of these tools involve various baits. Ammonium carbonate can be used as bait in insect traps, provided there is no direct contact with crop or soil and is primarily used to bait traps used to control various flies (diptera). Lures, traps, and repellants are also allowed for pest control. For example, various adhesive bands may be wrapped around trees to repel ants in citrus. Copper bands are used to protect various crops from mollusk pests such as snails and slugs.

Mating disruption with pheromones is an important tool for many organic farmers to manage caterpillar (lepidoptera) pests found in the Western US, such as codling moth, oriental fruit moth, and pink bollworm. Various sticky traps and barriers can also help to prevent the movement of insects. Copper bands can prevent molluscs from moving up the trunks of citrus trees. Adhesive bands used on trees can form a barrier for ants in citrus. Boric acid is allowed as a structural pest control, provided there is no direct contact with organic food or crops and is primarily used to control ants and cockroaches.

Only a few synthetic insecticides are allowed for foliar application. One is soap—widely used for soft-bodied insects such as aphids. Elemental sulfur and lime sulfur are also used on foliage. Both are used more for disease control, but are also labeled for other pesticide uses. Sulfur is used as an acaricide; lime sulfur can be used to control scale as well as mites. Oils that are within the narrow range—a 50% distillation point of between 415° and 440°—can be applied as a dormant spray. Petroleum distillates in the narrow range are also applied to foliage as suffocating oil. In some areas, petroleum distillates are only recently accepted for use in organic production. Historically, organic farmers have been discouraged from applying petroleum distillates to the edible parts crops.

Two natural insecticides are on the list of prohibited nonsynthetic substances: sodium fluoaluminate from the mineral cryolite and nicotine from tobacco. The potential risks these insecticides posed to the environment and human health led to their prohibition. Given their limited production and availability, reduction in their registered uses, and declining use based on the introduction and distribution of superior alternatives for the few remaining crop / pest complexes allowed on their labels, tobacco and cryolite were not widely used by organic farmers in the Western US prior to their prohibition.

Organic farmers rely on traps, physical barriers, and cultural practices to reduce vertebrate pest pressure. In the Western US, the principle vertebrate pests of concern are gophers and ground squirrels. Deer can be repelled using ammonium soaps, provided they are applied without no contact with soil or edible portion of crop. Newly planted trees can be painted on the trunk. Sulfur smoke bombs can only be used underground to control rodents. The natural botanical strychnine from *Nux vomica* is banned as a rodenticide because of its high toxicity and potential risk to non-target species. The only synthetic rodenticide allowed is vitamin D3, also known as cholcalciferol.

Diseases and Plant Pathogens

Organic farmers have a number of cultural and biological tools to protect the health of plants in addition to nutrition, rotation, and variety selection. Removal of diseased plant tissue, and roguing seriously or systemically infected plants offers another cultural means to reduce pressure from pathogenic organisms. Compost has been shown to have disease-suppressive capability, particularly for soil-borne pathogens. While there are fewer natural substances that are available for disease control than for pest management, there are still a few options. These include various clays, such as kaolinite and diatomaceous earth, certain EPA registered biological pesticides such as *Trichoderma* spp. and botanicals such as garlic and neem.

Fixed coppers exempted from the requirement of a pesticide residue tolerance by EPA can be applied as long as they are used in a way that minimizes copper accumulation in the soil. Among those that are allowed include copper sulfate, copper hydroxide, copper oxide, and copper oxychloride. Copper sulfate is often combined with hydrated lime to make Bordeaux mix. Sulfur and lime sulfur are two other fungicides allowed for use in organic production. Narrow range oils used as dormant, suffocating, and summer oils can be used for disease control as well as for insects and other pests. Hydrogen peroxide and potassium bicarbonate are two familiar substances that are relatively new as fungicides. Finally, growers with fire blight can use streptomycin, (in apples and pears only) and tetracycline (oxytetracycline calcium complex). Antibiotic resistance is a concern, so growers with fireblight are advised to prune and rotate antibiotics with other tools, such as copper.

Weeds

In survey after survey, organic farmers have identified weed management as their single greatest production problem, and the highest priority for research. Most organic farmers build a weed management program around tillage and cultivation practices. Most operations rely on hand weeding for at least some measure of control. For many intensive vegetable operations, labor for hand weeding will be the single greatest expense that an organic farm incurs. Crop rotation and planting competitive varieties are strategic management measures used to reduce weed pressure. Mowing is practiced mainly in perennial systems. More extensive operations can use livestock. Flame, heat, or electrical control are other options, but these methods generally require special equipment. Mulching with straw, leaves, or other fully biodegradable materials can smother weeds. Finally, the NOP Rule permits plastic or other synthetic mulches for weed control, with the provision that they are removed from the field at the end of the growing or harvest season. In general, synthetic substances are not permitted for weed control. The National List explicitly forbids a number of substances such as copper products and other micronutrients to be used as herbicides.

Wild Harvest

Wildcrafted herbs and wild-picked berries, and gathered mushrooms are the main crops that are wild harvested in the Western US. Plants gathered in the wild can be marketed as organic, provided that (1) the land from which they are gathered has not had a prohibited substance applied for three years prior to harvest, (2) the gathering of the crop is not destructive to the environment, and (3) the growth and production of the wild crop is sustainable. Throughout much of the Western US, wild harvested crops are mostly harvested from public lands. Agricultural professionals can assist wildcrafters by identifying and facilitating contact with the responsible public agency. Certification is a particular challenge given the vast areas covered and the lack of control that the operator has over the management of the land.

Livestock

Organic livestock production has four basic parameters: (1) organic livestock sources; (2) organically produced feed; (3) holistic health care; and (4) humane living conditions.

Stock Sources

The NOP Rule specifies the conditions under which dairy and breeding stock can be converted from conventional to organic production, and when an animal can be sold organically, depending on both its origin and the products produced.[13] In principle, organic animals are raised organically from birth. The NOP rule requires that non-poultry slaughter stock must come from organic breeding stock and be raised organically from the last third of gestation.[14] In the case of poultry, stock may come from any source and are raised organically beginning day one.[15]

Animals that produce milk or dairy products sold as organic must be under continuous organic management for at least one year. The rule contains an exception for entire new herds to be converted to organic production.[16] Breeder stock may be brought into the organic operation at any time before the final trimester of gestation.[17] The NOP rule prohibits livestock, edible livestock products, breeder, or dairy stock from being represented as organic if the animals are not under continuous organic management for the specified time requirements.[18]

Feed

Organic animals are required to receive a complete, balanced ration composed of organically produced agricultural products, including forage and pasture.[19] Organic livestock production is best integrated into the whole organic farming system and requires a connection of livestock to the land and surrounding vegetation.

Range and Pasture

One possible strategy used by mixed crop-livestock operations is to rotate pasture with crops. Organic producers have found that pasturing animals improves nutrition and health care. Rotation that includes a well-managed pasture for grazing animals can also help to cycle nutrients and control weeds for subsequent crops. While the NOP Rule specifically requires access to fresh pasture only for ruminants,[20] producers have also found nutritional, health, and crop benefits to pasturing non-ruminant animals as well. Most of the research on pasture-based systems has taken place in temperate humid climates. More research in animal nutrition is needed to find which grass and clover mixes offer the best forages on irrigated pasture for various Western climates.

Feedstuffs

The common operating assumption in much of the Western US is that animals are maintained in drylots and fed concentrated rations and dry hay, rather than pastured. The opportunity to rotate organic feed and forage crops is a potential benefit for the Western environment, given the extensive production of animal feed and forage. Wheat, barley, triticale, and berseem clover may all be more appropriate concentrates and hays than corn, soybeans, and alfalfa in the arid and hot regions of the Western US.

Additives and Supplements

[13] 7 CFR 205.236(a).
[14] 7 CFR 205.236(a).
[15] 7 CFR 205.236(a)(1).
[16] 7 CFR 205.236(a)(2).
[17] 7 CFR 205.236(a)(3).
[18] 7 CFR 205.236(b).
[19] 7 CFR 205.237(a).
[20] 7 CFR 205.239(a)(2).

A balanced diet requires that all nutrient requirements be met. However, it is often difficult in arid regions and areas with short growing seasons to consistently meet vitamin and mineral requirements. In general, all feed, feed additives, and feed supplements must comply with FDA regulations. Natural feed additives and supplements are permitted.[21] For example, mined minerals, enzymes, and probiotic organisms may be used in animal feeds. Synthetic vitamins and minerals also appear on the National List as feed additives, provided FDA approves them.[22] Such feed additives must be included in the Farm Plan, and the amounts fed must be for adequate nutrition and health maintenance for the species.[23]

A number of feeding practices are explicitly and categorically prohibited. Organic livestock producers must not use animal drugs, including hormones, to promote growth. Animals provided feed supplements or additives in amounts above those needed for adequate nutrition and health maintenance for the species at its specific stage of life are not eligible for organic certification. Plastic pellets cannot be fed as a source of roughage.[24] Feed formulas that contain urea or manure are also prohibited.[25] Given the concerns about BSE, organic mammals and poultry cannot be fed mammalian or poultry slaughter by-products.[26]

Health Care

The organic paradigm for health care relies on (1) the selection of appropriate breeds and types; (2) proper balanced nutrition; (3) appropriate housing, access to the outdoors, and sanitation; (4) stress reduction by the allowance of natural behavior and exercise; and (5) preventive measures such as vaccines and other inoculants. Prophylactic treatments, hormones, and antibiotics are categorically incompatible with organic practices.

Animals are treated with medications only when they are sick—indeed the standards make it illegal to withhold treatment from an ill animal. However, animals treated with a prohibited substance cannot have their products sold as organic. The animal must be diverted from organic production and the products must be sold through conventional channels. Veterinarians and other professionals who work with organic producers need to be aware that the Food, Drug, and Cosmetic Act (FDCA) takes precedent over OFPA for medications and internal parasiticides, and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) takes precedent over the NOP for external parasiticides.

Vaccinations are helpful preventive measures against such endemic diseases as bovine diarrhea and vibrio-lepto. No matter how well a producer manages a herd, animals still get sick in spite of all the preventive measures taken. Holistic veterinarians specialize in alternatives that do not rely on synthetic chemicals for treatment of animal illnesses. Traditional **herbal medicine, homeopathy**, **acupuncture, chiropractic,** and **probiotics** all offer alternative modes to veterinary treatments administered in conventional livestock production to counter the effects of illness, also referred to as <u>allopathic</u> medicine. These modes of animal health care need not be mutually exclusive. Each deserves consideration, criticism, and further exploration. However, organic animal husbandry has far more questions than answers. Organic standards go beyond food safety concerns. They also include issues of consumer acceptance, animal welfare, and resource management. In general, organic consumers expect organic animals to be both treated humanely and not treated with drugs. Organic producers may need to resort to allopathic methods in order to save the life of an animal. However, an animal treated with a prohibited substance loses its organic status.[27]

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[21] 7 CFR 205.237(a).
[22] 7 CFR 205.603(d).
[23] 7 CFR 205.237(b)(2).
[24] 7 CFR 205.237(b)(3).
[25] 7 CFR 205.237(b)(4).
[26] 7 CFR 205.237(b)(5).
[27] 7 CFR 205.238(c)(7).

Traditional **herbal medicine** is based on the use of botanical preparations to cure ailments. Many plants have healing powers that are documented and recognized by both practitioners and skeptics of modern Western medicine. Many farmers and their veterinarians have come to recognize the prophylactic and therapeutic benefits of many of the plants that commonly grow in pastures, on the edges of fields, and in rangeland. Animal husbandry throughout the world makes use of readily available local herbs to treat sick animals. Much of this lore has been lost with the development of Western medicine. Herb-based medicines have been used throughout recorded history, and show great healing potential. While organically produced herbs comply with the NOP rule when used as feed or feed supplements, it is important to recognize that commercial preparations that are marketed with health claims may not be sanctioned under the FDCA and thus their regulatory status may be questionable.

Homeopathy is the use of remedies that would produce the symptoms of the disease being treated in healthy animals. This is referred to as the principle of *"Similia Similibus Curentur"* or "like cures like." Homeopathic remedies are based on plants, minerals, drugs, viruses, bacteria, or animal substances that are diluted to the point where they are rendered harmless. When a large dose of a toxic substance is swallowed, it can produce death, but when a homeopathic, diluted, minute dose of the substance is given, it can save an animal's life. While the mode of action is not entirely understood, homeopathic remedies are thought by some to contain vibrational energy essences that match the patterns present in the diseased state within an ill animal. Homeopathy is a well-established field of veterinary practice commonly accepted in the organic community. However, professionals should be aware that the FDA officially regards homeopathic medicine to be a 'nontraditional' form of veterinary practice, and the legal status of various remedies is not always clear.

Acupuncture is also a long-established practice, based on traditional Chinese health care. Needles are inserted into the patient in a way intended to stimulate the body's adaptive–homeostatic mechanism. Treatment is viewed as complimentary with other forms of treatment. The physiological responses to the insertion of needles in various sites of the surface of the body have long been documented in both animals and humans. However the specific action remains to be fully understood. The primary aim of veterinary acupuncture is to strengthen the body's immune system. Acupuncture is also used as a technique to relieve pain and to stimulate the body and improve the function of organ systems.

Chiropractic can be used to treat a broad spectrum of conditions in animals through the manipulation of their spine, bones, joints, and muscles. The practitioner makes specific adjustments to vertebra in order to restore homeostasis.

Organic producers may treat their animals with **probiotics** consisting of a number of naturally occurring live microorganisms. Many probiotic organisms help to boost immunity, while others produce substances that are closely related to antibiotics, but in much lower concentrations. Some also appear to act as antagonists to pathogenic organisms. The FDA has been receptive to probiotics, and a number are FDA registered. As long as the organisms contained in these products are not genetically engineered, there is general agreement that prophylactic use is allowed without probiotics appearing on the National List.

Parasite Management

Parasite management and health care pose the greatest barriers to organic livestock production in the Western US. Parasites are generally managed by cultural methods. Routine use of parasiticides is prohibited.[28] Slaughter stock treated with parasiticides is not eligible to be sold as organic.[29] At present ivermectin is the only FDA registered internal parasiticides allowed for use in organic farming in the US, and that use carries with it a number of restrictions.[30] Like all other parasiticides, ivermectin is prohibited

[28] 7 CFR 205.238(c)(4).
[29] 7 CFR 205.238(c)(5).
[30] 7 CFR 205.603(a)(12).

for use on slaughter stock. Ivermectin is only allowed as an emergency treatment for dairy and breeder stock when organic system plan-approved preventive management does not prevent infestation.[31] Milk or milk products from a treated animal cannot be labeled as organic if it is taken within 90 days following treatment with ivermectin.[32] Breeder stock must be treated with ivermectin prior to the last third of gestation for their progeny to be sold as organic and young stock may lose their certification if nursing on an animal treated with ivermectin during the lactation period.[33] As with diseases, heavily infested animals are required by the NOP Rule to be treated and if treated with a prohibited substance must be diverted to conventional channels.[34]

Given the limited access to conventional parasite management tools, cultural and biological means are essential for successful animal production. Because of growing resistance of parasites to anthelmintics, even conventional producers cannot necessarily rely entirely upon parasiticides. Local concerns for parasite management vary widely and need to be taken into account. Breeding stock and fiber-producing animals–in particular sheep for wool–appear to have the greatest need in the Western US. Cattle, goat, and sheep production in warmer and wetter climates, such as the coastal areas may prove to be more difficult to manage without the use of parasiticides than is the interior.

Understanding the ecology, phenology, morphology, and genetics of parasitism in a broader context is crucial to develop a classical biological control program for internal parasites. Livestock host a broad array of organisms: many, if not most, are beneficial, a great number innocuous or obscure in their biological function, and only a few clearly pathogenic or parasitic to domesticated animals and humans. A wide variety of micro-arthropods, protozoa, viruses, bacteria, and fungi are potential biocontrol agents for nematode parasites of farm animals. The evolution of host-parasite relationships are believed to be the result of immunological phenomena.

The most promising alternatives to internal parasiticides require methods that disrupt the life cycle of the target organism outside the host. Rotational grazing, fecal examination, culling heavily infected animals, selection of resistant breeds, biological control at susceptible (usually free-living) stages in the life-cycle are all components of an overall strategy to break parasite-host cycles and maintain parasite loads to tolerable levels.

Producers can break the life-cycle of parasites by providing a sufficient host-free period. Strategies to break the host cycle include rotational grazing, spelled pastures, alternating sheep and cattle on pasture, or alternation between irrigated and non-irrigated pastures. Three systems of systems grazing that are commonly used to break the host cycle are characterized as (1) deferred grazing; (2) alternate grazing; and (3) alternate use.

Deferred grazing is a form of pasture rotation in which the pasture is rested for 6 months during the cool season and 3 months in the warm part of the year. Pastures are then tilled and replanted with infective larvae succumbing to the effects of UV light and desiccation.
Alternate grazing depends on the two or more species of grazing animals ingesting different parts of the forage and coincidentally ingesting each other's parasite larvae. To be effective, it is important for the animals to not serve as alternate hosts, and to have supplemental strategies when those species share common parasites.

[31] 7 CFR 205.603(a)(12).
[32] 7 CFR 205.603(a)(12).
[33] 7 CFR 205.603(a)(12).
[34] 7 CFR 205.238(c)(7).

Alternate use relies on intensive grazing of the pasture for a short period of time, leaving that pasture to the production of harvestable hay that when baled and removed takes away most of the parasite burden, and returning animals to the original pasture when new growth emerges after haying.

In conjunction with pasture management, there is evidence that organic farming practices such as green manuring and decreased emphasis on anthelmintic (dewormer) use increase the abundance and variety of coprophilic micro-organisms and arthropods in the dung of pasturing animals that, in turn, act to control fecal forms of intestinal parasites.

Cultural practices, such as fecal examinations of all incoming stock, routine fecal examinations of all animals, and culling heavily infested animals can help maintain levels of parasites within tolerable levels. Selection of livestock resistant to parasites is a long-term strategy that is limited in the short run by the availability and suitability of eligible breeding stock.

Live organisms applied outside of the animal are not considered drugs. Hyperparasites of the infective stage of nematodes can reduce fecal counts of nematodes of animals grazed on treated pastures. New methods are being developed in which new antiparasitic agents such as certain *Bacillus thuringiensis* (B.t.) isolates, *Penicillium* spp., *Streptomyces* species, among others are used. Such substances may not necessarily be considered nonsynthetic depending on how they are derived or if a synthetic analog of a natural compound is commercialized from the natural compounds that are the original subject of research.

While some claim that nonsynthetic herbal remedies, botanicals, and mined minerals have anthelmintic properties, most of these materials have not had their efficacy substantiated in controlled experimental trials. Pharmaceutical companies are in the process of screening a number of natural compounds derived both from plants and from micro-organisms. Whether traditional or novel, most of these alternatives are not FDA registered and may not be legal to prescribe or use for the purpose of controlling internal parasites.

Certain nonsynthetic and allowed synthetic materials are registered with EPA for parasite management. Botanical ectoparasiticides, such as pyrethrum, are nonsynthetic and are allowed for external application to livestock subject to the restrictions that they appear in the Farm Plan and not be used on a routine basis. Pyrethrum, copper sulfate, hydrated lime, and mineral oil also are used as synthetic external parasiticides. External parasiticides used on organic animals must be formulated with only natural or minimum risk (List 4) inert ingredients.

Hygiene and Sanitation

In general, teat dips and udder washes must be natural or on the National List. A number of commercial teat dips contain synthetic antimicrobials that are prohibited for use in organic production. Among those that are allowed are iodine, glycerin, and lanolin, as well as a number of vegetable oil bases. Chlorohexidine is allowed for use as a teat dip only when alternative germicidal agents and/or physical barriers have lost their effectiveness

Pain and Stress Reduction

Physical alternations are performed as needed to promote the animal’s welfare and in a manner that reduces pain and stress. Local anesthetics lidocaine and procaine are on the National List to help reduce pain. Chlorohexidine is also allowed for surgical procedures conducted by a veterinarian, as are a number of other topical disinfectants.

Living Conditions
Organic livestock producers are required to provide living conditions to accommodate the health and natural behavior of the animals that they raise.[35] The NOP Rule requires that all animals have access to the outdoors.[36] Ruminants are also required to have access to pasture.[37] Animals are also required to have access to shade and shelter, as well as exercise areas, fresh air, and direct sunlight.[38] The shelter must be designed to accommodate the natural maintenance, comfort behaviors, and opportunity to exercise.[39] In general, animals are expected to have adequate space to be able to stand up, lie down, turn around, groom, and engage in other behavior that is natural. Tie stall are generally considered inappropriate. Shelters are required to maintain a temperature level, ventilation, and air circulation suitable to the species. Equipment and facilities must reduce the potential for livestock to be injured. These must be suitable to the species, its stage of production, the climate, and the environment. Animals must have clean,dry bedding, and if the bedding can be eaten, then it is required to be organically produced.[40]

Animals may be confined only on a *temporary* basis and then only for the following reasons:[41]

(1) Inclement weather;
(2) The animal's stage of production;
(3) Conditions under which the health, safety, or well being of the animal could be jeopardized; or
(4) Risk to soil or water quality.

Manure Management
Organic farms maintain stocking densities, rotate grazing lands, and manage manure to sustain the resource, nourish the animals, and maintain soil and water quality. As with crop producers, the NOP Rule also requires that organic livestock operations manage manure to prevent contamination of crops, soil, and water and optimize the recycling of nutrients from manure.[42]

Cleaning Compounds
The materials used to disinfect livestock facilities must either be nonsynthetic or appear on the National List and used consistently with any restrictions. At present, the chlorine products sodium hypochlorite, calcium hypochlorite, and chlorine dioxide; hydrogen peroxide, and phosphoric acid are the only synthetic equipment and facility cleaners allowed.

Handling, Processing, and Labeling
Once the crops are grown or the animals are raised, they are ready for the organic market. Growers, packers, shippers, handlers, and processors must meet the standards for handling, processing, and labeling organic food. Organic food processing is beyond the scope of this practice guide, but as a general rule, agricultural products that are labeled as 'organic' must meet organic standards. While it is not possible to make non-agricultural products organic, it is very possible to make organic products nonorganic. This can be done by commingling organic and nonorganic agricultural products, or by contaminating an organic product with a prohibited substance.

[35] 7 CFR 205.239(a).
[36] 7 CFR 205.239(a)(1).
[37] 7 CFR 205.239(a)(2).
[38] 7 CFR 205.239(a)(1).
[39] 7 CFR 205.239(a)(4).
[40] 7 CFR 205.239(a)(3).
[41] 7 CFR 205.239(b).
[42] 7 CFR 205.239(c).

Handling Requirements

Operations that pack, ship, store, and sell crops other than their own are considered *handlers.*[43] *Commingling*[44] is generally a problem on split operations—ones that handle both conventional and organic products at the same facility. Split operations require a much greater degree of caution in handling commodities. Harvest equipment, packing lines, and storage facilities all need to be thoroughly cleaned before being used to handle organic products.

Materials such as floating aids used when post-harvest handling unprocessed agricultural commodities must be either nonsynthetic or appear on the National List. Packaging materials and storage containers are not permitted to contain synthetic fungicides, preservatives, or fumigants. Container, bins, and bags need to be made of food grade material that does not migrate into food. Reused bags and containers must be thoroughly cleaned. Organically produced products or ingredients cannot come into contact with prohibited substances remaining in the container from previous uses.

Post-harvest Pest Control

As with production in the field, *handlers*[45] are expected to rely first on management practices to prevent pest infestations that threaten stored crops. Exclusion or prevention of the pests from having access to the handling facility is one such practice. The pest habitat, food sources, and breeding areas all need to be removed. Environmental factors, such as temperature, light, humidity, atmosphere, and air circulation, all must be managed in a way that prevents pest reproduction. Any subsequent action taken to control pests is predicated on all of these positive management steps taking place.

Handlers may use lures, repellents and other materials with either nonsynthetic ingredients that are not prohibited or synthetic ingredients allowed for such purposes on the National List. Such products may be applied in direct contact with food provided they are labeled for such use and are not present as an ingredient in the final product. If allowed materials are not effective, a handling operation is then permitted to use any synthetic substance provided that the operator and certifying agent agree on the substance, the method of application and the measures taken to prevent contact with organic ingredients or products with the substance used.[46] Pesticide applicators and other professionals need to realize that synthetic pesticides that do not appear on the National List are prohibited, even if their use in a post-harvest handling facility does not automatically result in decertification. The operator is responsible to prevent pesticides from contacting the commodities. Products contaminated by prohibited substances may still lose their organic status if the levels exceed 5% of EPA tolerance.[47] Even residues that fall below that level may trigger an investigation and an operator who failed to take sufficient precautions to prevent contamination may also lose certification. Finally, any pest control materials required by Federal, State or local laws and regulations are permitted, provided that the handler take measures to prevent contact with organically produced products or ingredients.[48]

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[43] The NOP Rule defines to handle as "[t]o 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." 7 CFR 205.2.

[44] Commingling is defined as "[p]hysical contact between unpackaged organically produced and nonorganically produced agricultural products during production, processing, transportation, storage or handling, other than during the manufacture of a multiingredient product containing both types of ingredients." 7 CFR 205.2.

[45] A handler is defined as "[a]ny person engaged in the business of handling agricultural products, including producers who handle crops or livestock of their own production, except such term shall not include final retailers of agricultural products that do not process agricultural products." 7 CFR 205.2.

[46] 7 CFR 205.271(d).

[47] 7 CFR 205.671(a).

[48] 7 CFR 205.271(f).

Labeling

Organic food ingredients that are labeled as 'organic,' or are used in products labeled '100% Organic' must be organic. Ingredients that comprise at least *95%*[49] of a product that is labeled as 'Organic' must also be organically produced. All non-agricultural substances used in or on organic food, whether synthetic or nonsynthetic, must be included on the National List of Allowed Synthetic and Prohibited Nonsynthetic Substances. Otherwise, any non-agricultural substance is prohibited.[50] Products with a minimum organic content of 70% can make a claim that the product contains specific organic ingredients, provided that the label does not make the claim that it is an organic product.

The NOP Rule applies not only to ingredients that are required to appear on the label, but also to any substance used in or on organic food. Processed products labeled as '100% Organic' must be processed only using processing aids that are organically produced.[51] Solvents, filtering aids, and other substances that have a technical functional effect are required to appear on the National List. All ingredients in products that bear an organic label—including the nonorganic ingredients in a 70%+ 'Made with Organic [specified ingredients]' claim—must not be produced or handled using Genetically Modified Organisms (known as 'excluded methods' under the rule), sewage sludge, and ionizing radiation.[52]

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[49] The 95% figure is calculated based on the net weight of the nonorganic ingredients excluding water and salt. 7 CFR 205.302(a).
[50] 7 CFR 205.105(c).
[51] 7 CFR 205.301(f)(4).
[52] 7 CFR 205.301(c) and 7 CFR 205.301(f)(1), 7 CFR 205.301(f)(2), and 7 CFR 205.301(f)(3) respectively.

USDA National Organic Program Rule
Summary Outline

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Subpart A – Definitions

See the Glossary for additional definitions.

Subpart B – Applicability

The applicability subpart determines the production and handling operations that must be certified under the NOP. In general, the NOP provides for many exemptions and exclusions from certification. The applicability subpart also includes recordkeeping requirements and a broad list of prohibited substances.

§205.100 What has to be certified.

1. Requires all organic production and handling operations to be certified unless they are exempt or excluded from certification.
2. Provides for continuation of certification if the production or handling operation is certified by an accredited certifier prior to October 21, 2002.
3. Specifies that knowingly selling a product as organic that is not in compliance with the NOP may result in a $10,000 civil penalty.

§205.101 Exemptions and exclusions from certification.

Exemptions

1. Producers that sell less than $5,000 worth of organic products are exempted from organic certification requirements.
2. Handlers that sell less than $5,000 worth of organic products are exempted from organic certification requirements.
3. Organic products from exempt producers and handlers may not be used in processed organic food products.
4. Organic products from exempt producers and handlers may be sold at farmers markets and retail stores as organic.
5. Retail food stores are exempt from organic certification requirements.
6. Processors that produce products with less than 70 percent organic ingredients are exempt from organic certification requirements.
7. Processors that produce products that limit their organic claims to the information panel are exempt from organic certification requirements.

Exclusions

1. Handlers that only sell packaged organic food products are excluded from organic certification requirements. This exclusion would include produce and grocery distributors.
2. Retailers that have in-store bakeries, delicatessen, salad bar or ready to eat food are excluded from the organic certification requirements.

§ 205.102 Use of the term, "organic."

Specifies that agricultural products sold, labeled, or represented as "100 percent organic," "organic," or "made with organic ingredients" must be produced and handled in accordance with the National Organic Program standards.

§205.103 Recordkeeping by certified operations.

Specifies that records must be maintained to fully disclose all activities of the certified operation, must demonstrate compliance with the Act, and must be available for inspection.

§205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling.

1. Specifies that synthetic substances are prohibited unless specifically allowed under the National List.
2. Specifies that nonsynthetic (natural) substances are allowed unless specifically prohibited under the National List.
3. Specifies that nonagricultural substances used in processed organic food products must be approved on the National List.
4. Specifies that nonorganic agricultural substances used in processed organic food products must be approved on the National List.
5. Prohibits genetically modified crops for use in organic food production or handling except for animal vaccines approved on the National List.
6. Prohibits the use of ionizing radiation.
7. Prohibits the use of sewage sludge in crop production.

Subpart C – Organic Production and Handling Requirements

§205.200 General

Specifies that organic production practices (for crop and livestock operations) must maintain or improve the natural resources of the operation, including soil and water quality.

§205.201 Organic production and handling system plan.

This section requires all producers and handlers to have an organic system plan that must include:

1. A narrative or descriptive format that identifies the practices and procedures performed. Practices include the method for applying manure, fertilizers, or pest control materials; mechanical and biological methods used to prepare and combine ingredients; methods used to package finished products; and measures taken to exclude pests from a facility. Examples of procedures include protocols established for locating commercially available organic seeds, and procedures to inform neighbors about the organic status of the fields.
2. The plan must include a list of all materials that will be applied to the land or within the handling facilities. The plan must also address how the application of these materials meets other requirements of the NOP (e.g. how their plan will prevent any manure applications from contributing to water contamination).
3. The plan must include a description of the monitoring practices used to evaluate the effectiveness of the organic plan. Monitoring practices could include soil tests to monitor effectiveness of plan for maintaining or improving soil quality; production objectives such as pounds of product produced per acre; or number of organic apples distributed; or results of pesticide residue tests.
4. The plan must include a description of the recordkeeping system used to track a product from harvest through sale; or receiving through shipping; or identifying each animal in production.
5. Split operations must describe the management practices and physical barriers that have been established to prevent commingling or contamination of organic food products.

6. Certifying agents may require additional items to be included in the plan to determine if an operation meets the organic requirements.

Crop Production

§205.202 Land requirements.

1. Requires organic crops to have had no prohibited materials applied within three years of harvest of the crop.
2. Requires distinct boundaries and adequate buffer zones to prevent drift. The NOP does not specify a minimum buffer zone requirement.

§205.203 Soil fertility and crop nutrient management practice standard.

1. Standards require organic producers to select tools (e.g., tillers, plows) and practices that maintain or improve soil quality and minimize soil erosion.
2. Producers are required to utilize crop rotations, cover crops and 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.
3. Prohibits the use of raw manure unless it is incorporated into the soil more than 120 days prior to harvest for products whose edible portion is in direct contact with the soil.
4. Prohibits the use of raw manure unless it is incorporated into the soil more than 90 days prior to harvest for products whose edible portion does not have direct contact with the soil.
5. Defines compost as material that has an initial C:N ratio of between 25:1 and 40:1. Requires compost to reach specific temperature parameters for specific time periods.
6. Allows use of uncomposted plant materials.
7. Allows mined substances of low solubility.
8. There are many questions about allowable materials for managing soil fertility.

§205.204 Seeds and planting stock practice standard.

1. Requires annual transplants to be organically grown from seed.
2. Requires perennial transplants to be-organically grown for one year prior to harvest.
3. Requires use of organic seeds unless organic seeds are commercially unavailable. Producers have to choose an "equivalent" organic seed variety that was commercially available. The term, "equivalent," indicates that two seed varieties have similar performance attributes, such as resistance to drought and insects, and production traits, including yield, size, and shape of the commodity.
4. If organic seeds are unavailable, requires use of untreated seeds.
5. If untreated seeds are unavailable, only allows use of seeds treated with a substance included on the National List. There are currently no allowed seed treatments on the National List. Thus, the NOP currently prohibits the use of treated seeds under all circumstances.

§205.205 Crop rotation practice standard.

Crop rotation is required. There is a requirement for cover crops and/or habitat required in perennial crops to provide for pest management.

§205.206 Crop pest, weed, and disease management practice standard.

The producer must use practices to prevent crop pests, weeds, and diseases. These practices include crop rotation, sanitation measures, and cultural practices. Producers may use other preventative practices including beneficial insects and natural habitat enhancement. If the preventative practices are not adequate to prevent or control pests the producer may use materials allowed under the National List.

§205.207 Wild-crop harvesting practice standard.

Wild crops harvested from non-agricultural lands can be sold and labeled as organic as long as no prohibited materials have been applied to the land for 3 years and the harvest of the crop is not destructive to the environment.

Livestock Production

§205.236 Origin of livestock.

1. Poultry and edible poultry products (eggs) must be from poultry that has been under organic management since the second day of life.
2. Slaughter stock (animals raised for their meat, e.g. cattle, pigs, sheep) must be under organic management since the last third of gestation.
3. Dairy animals must be under organic management for at least one year prior to the production of organic milk, except When an entire herd is converted to organic the producer may feed 80 percent organic feed for the first 9 months and 100 percent organic feed for the last 3 months.
4. Breeder stock may be brought onto an organic farm from a nonorganic operation prior to the last third of gestation. Breeder stock must be under organic management during the last third of gestation.
5. The producer must maintain records that preserve the identity of all organic animals.

§205.237 Livestock feed.

1. Organic livestock must be fed organic feed.
2. Organic feed may contain feed additives and feed supplements that are allowed on the National List. Approved feed supplements include nonsynthetic substances (e.g. fish meal) and synthetic milk replacers for emergency use only (must not contain antibiotics or be from a BST treated animal) and nonsynthetic.
3. Approved feed additives include trace minerals and vitamins.
4. Prohibits use of animal drugs to promote growth.
5. Prohibits feed supplements or additives in amounts in excess of basic nutritional needs of the animal species.
6. Prohibits plastic pellets for roughage, urea, manure, or mammalian or poultry by-products in feed.

§205.238 Livestock health care practice standard.

1. The producer must establish preventative health care practices such as:
   - Selection of species and types of livestock with regard to resistance to disease and parasites.
   - Providing quality feed.
   - Establishing living conditions that minimize occurrence and spread of disease.
   - Provide conditions that reduce stress.
   - Perform physical alterations (e.g. beak trimming) as needed to promote the animal's welfare.
   - Administer vaccines and veterinary biologics.

2. When preventative practices are not adequate to prevent sickness producers may use synthetic medications allowed on the National List. Approved medications include aspirin; chlorohexidine for surgical procedures and teat dip; electrolytes; glucose; glycerin as a teat dip; iodine; hydrogen peroxide; magnesium sulfate; oxytocin for postparturition; copper sulfate for external use; and mineral oil for external use.
3. Ivermectin may be used on breeder stock prior to the last third of gestation and dairy stock at least 90 days prior to milk production when preventative measures fail.
4. Antibiotics are prohibited for slaughter stock, poultry and dairy stock.
5. It is prohibited to administer any medication or drug in the absence of illness.
6. Hormones are prohibited.

7. It is prohibited to withhold medical treatment to a sick animal in an effort to preserve its organic status.

§205.239 Livestock living condition.

1. Producers must establish living conditions that accommodate the heath and natural behavior of the animals, including:
   - Access to the outdoors, shade, shelter, fresh air as suitable to the species.
   - Access to pasture for ruminants.
   - Appropriate clean, dry bedding. If the bedding is consumed it must be organic.
2. The producer may provide temporary confinement because of inclement weather, the animal's stage of production (e.g. young birds, finishing cattle), risk to the animal's health or safety, or risk to soil or water quality.
3. The producer must manage manure in a manner that does not contribute to the contamination of crops, soil or water.

Handling

§205.270 Organic handling requirements.

This section provides general requirements for ingredients used in organic processing.

1. All ingredients and processing aids used in <u>100% organic</u> food must be organic.
2. All agricultural ingredients in <u>organic food</u> (at least 95% organic ingredients) must be either organic or not commercially available in organic form. These ingredients must also not be genetically engineered; irradiated; produced from sewage sludge; or be produced with a volatile synthetic substance.
3. All non-agricultural ingredients and processing aids used in <u>organic food</u> (at least 95% organic ingredients) must be approved on the National List.
4. All agricultural ingredients in <u>made with organic food</u> (at least 70% organic ingredients) must not be genetically engineered; irradiated; or produced from sewage sludge.
5. All non-agricultural ingredients and processing aids used in <u>made with organic food</u> (at least 70% organic ingredients) must be approved on the National List.

§205.271 Facility pest management practice standard.

1. The handler must use practices to prevent pests, including removal of pest habitat; prevention of access to facilities; and managing environmental factors to prevent pest reproduction.
2. The handler may use mechanical traps; lures and repellants (must be natural or on National List).
3. If preventative practices are not adequate, the handler may use materials approved on the National List.
4. If the preventative practices and the materials approved on the National List are not adequate to control pests, the handler may use a synthetic substance that is not on the National List as long as the material does not contact the organic products (e.g. the organic products are removed during treatment or the organic products are in sealed steel drums).

§205.272 Commingling and contact with prohibited substance prevention practice standard.

1. The handler must implement procedures to prevent commingling.
2. The handler must implement procedures to prevent organic products from contacting nonorganic products.
3. Containers must not contain preservatives or fungicides.

4. Containers may be reused as long as they are thoroughly cleaned and pose no risk of contact with prohibited substances.

§205.290 Temporary variances.

1. Temporary variances to the requirements in the organic production and handling requirements may be granted by the NOP for natural disasters; damage from drought, flood, hail, tornado, earthquake or other business interruption; and for research.
2. A State organic program or state certifying agent may recommend to the NOP that a temporary variance should be granted.
3. Temporary variances will not be granted for the use of prohibited synthetic or natural substances; genetically modified organisms; irradiation; or sewage sludge.

Subpart D - Labels, Labeling and Market Information

The National Organic Program has created five label categories for organic food:

1. **100 percent organic –** All ingredients and processing aids must be organic.
2. **Organic –** At least 95% of ingredients must be organic.
3. **Made with organic ingredients –** At least 70% of ingredients must be organic.
4. **Products with less than 70% organic ingredients.**
5. **Organic Livestock feed.**

Key definitions –

Processing aid – A substance used during processing that does not become an ingredient or is present at insignificant levels in the finished food product.

Principal display panel – That part of a label that is most likely to be displayed, presented, shown, or examined under customary conditions of display for sale.

Information panel – That part of the label of a packaged product that is immediately contiguous to and to the right of the principal display panel as observed by an individual facing that principal display panel, unless another section of the label is designated as the information panel because of package size or other package attributes.

Ingredients statement – the list of ingredients contained in a product shown in their common and usual names in the descending order of predominance.

§205.300 Use of the term, "organic."

This section specifies that the term "organic" may only be used on labels that comply with the National Organic Program regulations. Products for export may be labeled to meet the receiving countries specifications as long as they are labeled "for export only." Products imported to the United States from foreign countries must be certified and labeled according to the NOP regulations.

§205.301 Product Composition

1. **100 percent organic –** All ingredients and processing aids used in 100% organic food must be organic.
2. **Organic –** At least 95% of ingredients must be organic. All agricultural ingredients in the product must be either organic or not commercially available in organic form. All non-organic agricultural ingredients must not be genetically engineered; irradiated; produced from sewage sludge; or be produced with a volatile synthetic substance. All non-agricultural ingredients and processing aids used must be approved on the National List.

3. **Made with organic ingredients –** At least 70% of ingredients must be organic. All non-organic agricultural ingredients must not be genetically engineered; irradiated; or produced from sewage sludge. All non-agricultural ingredients and processing aids must be approved on the National List.

4. **Products with less than 70% organic ingredients.** All organic ingredients must be produced in compliance with the NOP regulations. There are no restrictions on the non-organic ingredients used in this labeling category.

5. **Livestock feed** – Organic livestock feed must include only organic agricultural ingredients and approved feed additives and supplements.

§205.302 Calculating the percentage of organically produced ingredients.
This section describes the procedure for determining the percentage of organic ingredients in a food product. Water and salt are not included in the calculation of the percentage of organic ingredients.

§205.303 Packaged products labeled "100 percent organic" or "organic."
Optional labeling provisions - Products in these categories may display on the principal display panel:

- The percentage of organic ingredients,
- The USDA seal,
- The seal of the state or private certification agency,
- The term "100 percent organic" or "organic" as appropriate,

Required labeling provisions – Products in these categories must:

- Identify each organic ingredient with the word , "organic," or with an asterisk that identifies the ingredient as organic.
- Water and salt cannot be identified as organic.
- On the information panel, the statement "Certified organic by … (name of certifying agent).

§205.304 Packaged products labeled "made with organic (specified ingredients or food groups(s))."
Optional labeling provisions - Products in this category may display on the principal display panel:

- The percentage of organic ingredients,
- The seal of the state or private certification agency,
- The term "made with organic (specified ingredients)" as appropriate. The term "made with organic (specified ingredients)" must appear in letters that do not exceed one-half the size of the product identity.

Required labeling provisions – Products in this category must:

- Identify each organic ingredient with the word , "organic," or with an asterisk that identifies the ingredient as organic.
- Water and salt cannot be identified as organic.
- On the information panel, the statement "Certified organic by … (name of certifying agent).

Prohibited labeling provisions – Products in this category must not display:

- The USDA seal,

§205.305 Multi-ingredient packaged products with less than 70 percent organically produced ingredients.
Optional labeling provisions - Products in this category may display on the information panel:

- Identify each organic ingredient with the word , "organic," or with an asterisk that identifies the ingredient as organic.
- If the organic ingredients are identified on the ingredients statement then the percentage of organic ingredients may be displayed on the information panel

Prohibited labeling provisions – Products in this category must not display:

- The word "organic," on the principal display panel,

- The USDA seal,
- The seal of the state or private certification agency,
- The statement "Certified organic by … (name of certifying agent).

§205.306 Labeling of livestock feed.

Optional labeling provisions – Organic livestock feed may display on any package panel:

- The USDA seal,
- The seal of the state or private certification agency,
- The term "100 percent organic" or "organic" as appropriate,
- Identify each organic ingredient with the word , "organic," or with an asterisk that identifies the ingredient as organic.
- Water and salt cannot be identified as organic.

Required labeling provisions – Organic livestock feed must display:

- On the information panel, the statement "Certified organic by … (name of certifying agent).

§205.307 Labeling of nonretail containers used for only shipping or storage of raw or processed agricultural products labeled as "100 percent organic," "organic," or "made with organic (specified ingredients or food group(s))."

Optional labeling provisions – These products may display:

- The name of the certifying agent.
- Identification of the product as organic.
- The seal of the state or private certification agency.
- The USDA seal.

Required labeling provisions – These products must display:

- The production lot number to maintain identity of organic products.

Export labeling provisions – Products for export may display:

- May be labeled in accordance with foreign labeling requirements provided that they are labeled "For Export Only."

§205.308 Agricultural products in other than packaged form (e.g. produce, bulk food) at the point of retail sale that are sold, labeled, or represented as "100 percent organic" or "organic."

Optional labeling provisions – Retailers may display on non-packaged "100 percent organic" and "organic" products (e.g. produce, bulk food):

- The term "100 percent organic" or "organic" as appropriate.
- The seal of the state or private certification agency.
- The USDA seal.

§205.309 Agricultural products in other than packaged form (e.g. bulk food) at the point of retail sale that are sold, labeled, or represented as "made with organic (specified ingredients or food groups (s)).

Optional labeling provisions – Retailers may display on non-packaged "made with organic (specified ingredients)" products (e.g. bulk food):

- The seal of the state or private certification agency,
- The term "made with organic (specified ingredients)" as appropriate. The term "made with organic (specified ingredients)" must appear in letters that do not exceed one-half the size of the product identity, provided that each organic ingredient is identified with the word , "organic," or with an asterisk that identifies the ingredient as organic.

§205.310 Agricultural products produced on an exempt or excluded operation.

Optional labeling provisions – Organic products from exempt or excluded operations may:

- Identify organic products as organic. These organic products may not be used as an organic ingredient in processed organic foods.

Prohibited labeling provisions – Organic products from exempt or excluded operations must not display:

- The USDA seal.
- The seal of the state or private certification agency.
- Be represented as a certified organic product.

§205.311 USDA Seal.
It's round and it says "USDA ORGANIC."

Subpart E - Certification

The Certification subpart specifies the requirements for certification including the application requirements, inspection procedures and conditions for granting and denying certification.

§205.400 General Requirements for certification
Persons seeking to receive or maintain organic certification must:

1. Comply with the standards.
2. Establish and implement an organic production and handling system plan.
3. Update the plan on an annual basis.
4. Permit on-site inspections.
5. Maintain records for five years.
6. Pay annual application fees.
7. Certified operations are required to immediately notify the certifying agent concerning any application, including drift, of any prohibited substance.

§205.401 Application for certification
Application – Must contain organic production and handling system plan and appropriate fees.

§205.402 Review of application

1. The certifying agent is responsible for reviewing application and responding to applicant within a reasonable amount of time. The response to the application must communicate whether the applicant appears to comply with the organic regulations.
2. The certifying agent must schedule an inspection to determine whether the applicant qualifies for certification.
3. The applicant may withdraw application at any time.

§205.402 On-site inspections.

1. Initial inspection must be conducted within a reasonable period of time. Inspection must be conducted when the land, facilities, and activities that demonstrate compliance or capacity to comply can be observed.
2. Initial inspection must be conducted within 6 months of application or time of renewal.
3. Additional announced or unannounced inspections may be conducted at the discretion of the certifying agent.
4. All inspections must be conducted with an authorized representative who is knowledgeable about the inspected operation.
5. The inspection must verify that the operation is in compliance or has the capability to comply with the organic regulations.

6. The inspection must verify that the organic production and handling system plan accurately reflects the practices used by the applicant.
7. The inspection must verify that no prohibited substances have been applied.
8. Inspectors must conduct an exit interview with an authorized representative who is knowledgeable about the inspected operation. The purpose of the exit interview is to discuss known issues of concern regarding their application for organic certification.
9. The certifying agent must provide a copy of the inspection report to the inspected operation within a reasonable time frame.

§205.404 Granting certification

1. The certifying agent must review the on-site inspection report within a reasonable time frame and grant certification if the operation is in compliance with the organic regulations.
2. The criteria for granting certification are 1) the applicant's operation is in compliance with the organic standards and 2) that the applicant is able to conduct operations in accordance with its organic system plan.
3. Once certified, a producer's or handler's organic certification continues until it is suspended or revoked by the State Organic Program, or voluntarily withdrawn from the program by the applicant.

§205.405 Denial of certification (Note: This pertains to new applicants only)

1. When an applicant is not in compliance or not able to comply with the organic regulations, the certifying agent must issue a notification of noncompliance that specifies 1) each noncompliance and 2) the date by which the rebuttal or correction of the noncompliance must occur .
2. Upon receipt of the notice of noncompliance the applicant may 1) Correct the noncompliance, or 2) Submit information to rebut the noncompliance.
3. A notice of denial of certification is issued when a correction of noncompliance is not possible, when an applicant fails to respond to a notice of noncompliance, or when the corrective actions are not sufficient for qualifying for certification.
4. A notice of denial of certification must state the reasons for denial, include information about the applicants right to reapply for certification, request mediation, or file an appeal of the denial.
5. An applicant may be denied certification for willfully making a false statement or misrepresenting the applicant's operation.

§205.406 Continuing of certification (Note: This pertains to renewal applicants only)

1. To continue certification an operation must annually pay certification fees and submit an updated organic production and handling system plan.
2. An on-site inspection must be conducted within six months of the renewal date.
3. The Rule seems to prohibit the placement of an expiration date on the certificate – (see page 80595).
4. When a certified operation is not in compliance with the organic regulations, the certifying agent must issue a notification of noncompliance that specifies 1) each noncompliance and 2) the date by which the rebuttal or correction of the noncompliance must occur.
5. Upon receipt of the notice of noncompliance the certified operation may 1) Correct the noncompliance, or 2) Submit information to rebut the noncompliance.
6. A notice of proposed revocation of certification is issued when a certified operation fails to take the corrective actions within the prescribed time period.
7. A notice of proposed revocation of certification must state the reasons for the proposed revocation, the proposed effective date, and the right to request mediation.

Subpart F – Accreditation of Certifying Agents

205.500 Areas and duration of accreditation.

1. The NOP shall accredit qualified domestic or foreign applicants to certify production or handling operations.
2. Accreditation may be issued for crop certification, livestock certification, wild crop certification, handling certification or any combination of certification areas.
3. Accreditation shall be for five years.
4. Foreign certifying agents may be accepted by USDA under the following criteria:
   - the foreign certifier is accredited by the foreign government authority to meet similar requirements, or
   - the foreign government that accredited the certifier has an equivalency agreement with the United States.

205.501 General Requirements for accreditation.

This section contains the criteria that must be met for a private or state certifier to obtain accreditation, the certifier must:

1. have sufficient expertise in organic production and handling.
2. demonstrate the ability to comply with the requirements for accreditation.
3. carry out the provisions of the National Organic Program.
4. use a sufficient number of adequately trained personnel.
5. ensure that personnel have sufficient expertise in organic production and handling.
6. ensure that all personnel have an annual performance evaluation.
7. conduct an annual program review of its certification activities.
8. provide sufficient information to persons seeking certification to enable them to comply with the regulations.
9. Maintain required records.
10. Maintain confidentiality of records.
11. Prevent conflict of interest.
12. Accept the certification decisions made by another certifying agent accredited or accepted by USDA.
13. Submit to the NOP any notice of denial of certification, notification of noncompliance, notification of proposed revocation; and an annual list of the name address and telephone number of all operations granted certification.
14. Pay the accreditation fees to USDA.
15. Provide the inspector with copies of previous inspection reports, and decisions regarding the certification of production and handling operations that they inspect.
16. Comply with a State's organic program for the states that the certifier operates within.
17. Certifiers may establish a seal or logo to identify products certified by that certifier.
18. Certifiers may not require any additional requirements as a condition for allowing the use of its seal or logo.

205.502 Applying for accreditation.
This section specifies where the application for accreditation must be sent.

205.503 Applicant information.
This section specifies the information that must be submitted by the applicant for accreditation.

205.504 Evidence of expertise and ability.

This section specifies the information that must be submitted to demonstrate its expertise in organic production and handling.

205.505 Statement of agreement.
This section specifies the conditions that state and private certification agencies need to agree to in order to obtain accreditation. A state certifier must agree to accept the certification decisions made by another USDA accredited certifier; refrain from making false or misleading claims in regards to its accreditation status; conduct annual performance evaluations of all persons; have an internal review process; pay required fees; and meet other terms and conditions. In addition to these criteria, private certifiers must hold the Secretary harmless and furnish reasonable security to protect the rights of certified operations.

205.506 Granting accreditation.

1. Accreditation is granted when 1) the required information is submitted, 2) the fees are paid, and 3) the NOP determines that the accreditation criteria have been met.
2. Accreditation is granted for one or more specific areas such as crops, livestock, wild crops or handling.

205.507 Denial of accreditation.

This section specifies process that the NOP must follow in order to deny accreditation to a certifier.

205.508 Site evaluations.

Site evaluations of certifiers are conducted to examine a certifier's compliance with the NOP. Site evaluations are conducted by NOP staff and involve reviewing certification procedures and production and handling operations certified by the certifier. Site evaluations are conducted at least once during the five year accreditation period.

205.509 Peer review panel.

The NOP will establish a peer review panel to review the NOP accreditation policies and procedures and ensure the procedures meet ISO Guide 61 standards (General requirements for assessment and accreditation of certification/registration bodies).

205.510 Annual report, recordkeeping, and renewal of accreditation.

1. Accredited certifiers must submit an annual report that includes any changes to the certification program; a description of measures taken to address the terms and conditions of the accreditation; the most recent performance evaluations; the annual program review; and the required fees.
2. Certifiers must maintain required records (most records must be maintained for ten years).
3. Renewal of accreditation occurs every five years. Certifiers must apply to renew their accreditation at least six months prior to the expiration date of their accreditation.

Subpart G – Administrative

The National List of Allowed and Prohibited Substances

The National List within the NOP is constructed very differently than most organic materials lists (e.g Organic Material Review Institute's Generic and Brand Name Lists). Under the NOP all nonsynthetic substances (= natural materials) are allowed to be used unless they are specifically prohibited. Conversely, all synthetic substances are prohibited unless specifically allowed. The difficulty with this approach is that it is often difficult to determine whether a material is natural or synthetic. In addition, many materials that are approved for use in organic crop production are not included on the National List because they are nonsynthetic (= natural).

The NOP definition of synthetic is "a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring sources, except that such term shall not apply to substances created by naturally occurring biological processes." It may be difficult to determine whether materials such as calcium chloride, humic acid, fish emulsion and mined materials are synthetic or natural under this definition. The NOP has left a lot of materials open to interpretation. <u>Who will determine whether a material is synthetic or natural? It appears that the NOP has given that discretion to the certifying agent.</u>

205.600 Evaluation criteria for allowed and prohibited substances, methods, and ingredients.

The criteria for adding a synthetic substance to the National List for use in organic crop production or for adding to processed organic food is:

1. The substance cannot be produced from a natural source.
2. The substance's manufacture, use and disposal does not have an adverse effect on the environment.
3. The nutritional quality of the food is maintained when the substance is used.
4. The substance's breakdown products do not have an adverse effect on human health.
5. The substance's primary use is not as a preservative or to recreate flavors lost during processing.
6. If used in food, the substance is listed as generally regarded as safe (GRAS) by FDA.
7. The substance is essential to the handling of organic food products.

205.601 Synthetic substances allowed for use in organic crop production.

1. This section contains a list of synthetic materials allowed to be used for pest control, weed control, disease control and soil management.
2. The Organic Materials Review Institute (OMRI) *Generic Materials List* includes allowed non-synthetic and prohibited synthetic substances, as well as substances that appear on the National List.
3. The only inert ingredients allowed on the National List are List 4 Inert Ingredients (Inerts of Minimal Concern). Many currently approved brand name materials will be prohibited because they contain List 3 inerts. Manufacturers of these materials will need to either a) reformulate their products; b) expedite the review of the List 3 inerts to List 4 status, or c) petition the NOSB to have the material added to the list of approved synthetic substances.

205.602 Nonsynthetic substances prohibited for use in organic crop production.

This section contains a list of natural materials prohibited for use as pest control substances or soil amendments. The prohibited natural materials list includes strychnine, sodium fluoaluminate (cryolite), tobacco dust (nicotine), arsenic, and ash from manure burning.

This section also includes restrictions on the use of sodium nitrate (only for up to 20% of nitrogen inputs) and potassium chloride (mined sources only).

205.603 Synthetic substances allowed for use in organic livestock production.

This section contains a list of synthetic materials allowed as feed additives, feed supplements, parasiticides, disinfectants and medicines in organic livestock production.

205.604 Nonsynthetic substances prohibited for use in organic livestock production.

This section contains a list of natural materials that are prohibited for use in organic livestock production. At the present time, only strychnine appears on the list.

205.605 Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))."

1. Many food products contain both agricultural and nonagricultural ingredients. Nonagricultural ingredients include substances such as salt, pectin, baking soda and citric acid. Under the NOP, nonagricultural ingredients and processing aids must be listed in this section in order to be used in an "organic" food (more than 95% organic ingredients) or "made with organic" food (more than 70% organic ingredients).
2. Approved natural nonagricultural ingredients and processing aids include citric acid, non GMO enzymes, sodium bicarbonate (baking soda), nutritional and baking yeast.
3. Approved synthetic nonagricultural ingredients and processing aids include ascorbic acid, lecithin, and pectin.

205.606 Nonorganically produced agricultural products allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))."

Requires agricultural ingredients used in an "organic" food (more than (95% organic ingredients) to be organically produced unless the ingredient is not commercially available in organic form.

205.607 Amending the National List.

This section states that any person may petition the National Organic Standards Board to add materials to the National List.

State Organic Programs

The NOP provides four options for States.

1. A state may be a state certifying agent. States that currently run state certification agencies include Washington, Idaho, Texas, Maryland, Louisiana, Nevada, Iowa, and Kentucky.
2. A state may have a State organic program. The State of California is a good example of a State with a State organic program that does not provide certification services. The California Department of Food and Agriculture enforces California's Organic Food Products Act and obtains money for enforcement through registration fees.
3. A state may be a state certifying agent and have a State organic program.
4. A state may choose to not have a State organic program or be a state certifying agent (e.g. Wyoming, New York, Arkansas, Kansas)

205.620 Requirements of State organic programs.

1. Specifies that any State may establish a State organic program .
2. Specifies that State organic programs must meet the NOP requirements.
3. Allows a State to have more restrictive requirements because of environmental conditions or specific production or handling practices.
4. Requires a State organic program to assume enforcement obligations of the NOP.
5. Requires a State organic program to be approved by the USDA Secretary prior to implementing its state program.

205.621 Submission and determination of proposed State organic programs and amendments to approved State organic programs.

This section includes the details of the information that must be submitted by a State in order for a State organic program to be approved under the NOP.

205.622 Review of approved State organic programs.

Specifies that NOP must review State organic programs at least once every five years.

Fees

Sections 205.640 and 205.641 205.642

These sections specify the costs for accreditation. Accreditation costs for initial accreditation (until August 2002) will be $500 plus travel and per diem charges for site visits. There will be no hourly rate charged for the initial accreditation.

After August 2002, an hourly rate will be charged for site visits (Note: the current hourly rate is $42/hour).

205.642 Fees and other charges for certification.

1. Certifiers are required to charge reasonable fees for the certification services they provide.
2. Certifiers are required to publish their fee schedules, provide justification for any nonrefundable fees that are charged.

Compliance

The NOP compliance proceedings are similar to administrative procedures of many states.

205.660 General

This section specifies that the NOP may conduct inspections or initiate revocation proceedings against a certified operation or a certifying agents accreditation.

205.661 Investigation of certified operations.

Allows certifying agents and State organic programs to investigate complaints of noncompliance with the NOP regulations.

205.662 Noncompliance procedure for certified operations.

Specifies the procedures that certifiers and State organic programs must take for any compliance action. The procedures provide due process for certified operations. The procedures outline notification procedures, resolution options, proposed suspension or revocation notices, and procedures for willful violations.

205.663 Mediation.

This section specifies the procedures for a mediated settlement of noncompliance proceedings. Mediation is not mandated but offered as an option for settlement of a noncompliance proceeding.

205.665 Noncompliance procedure for certifying agents and 205.668 Noncompliance procedures under State organic programs.

These sections specify the procedures for noncompliance proceedings against certifying agents and State organic programs respectively.

205.670 Inspection and testing of agricultural product to be sold or labeled "organic."

1. Organic food products must be available for sampling for pesticide residues.
2. State organic programs or certifying agents may require preharvest or postharvest testing when there is reason to believe that the product has come into contact with a prohibited substance or has been produced using genetically modified ingredients.
3. Sampling may only be conducted when there is reason to believe that there may be residues present. This may require the SOP's and state certification agencies to only sample producers where there is a risk of pesticide drift, residual soil contamination, or misapplication of prohibited substances. On the other hand, it could probably be demonstrated that in all situations there is a reason to believe that the product may have come into contact with prohibited substances.
4. Sampling must be done by qualified inspectors and must maintain chain of custody.
5. Chemical analysis must be done by official methods of analysis.
6. Results of all analyses must be provided to the National Organic Program and must be available for public access.

205.671 Exclusion from organic sale.

1. The NOP establishes an organic tolerance level at 5% of the Environmental Protection Agency's tolerance levels for registered pesticides.
2. The NOP establishes the FDA action level as the organic tolerance level for pesticides that are no longer registered (e.g. DDT, dieldrin, chlordane).
3. When residues are detected that exceed these levels the products must not be sold, labeled or represented as organic.

205.672 Emergency pest or disease treatment.

1. Allows a prohibited substance to be applied to a certified organic operation as part of a Federal or State emergency pest or disease control program.
2. Prohibits any crop or product that has come into contact with a prohibited substance to be labeled, represented or sold as organic.
3. This section protects consumers by prohibiting any organic crops from having prohibited substances applied to them while also protecting the organic producer from losing their organic certification due to an emergency pest control program outside of their control.

Adverse Action Appeal Process

§205.680 General and §205.681 Appeals.

This section describes the appeals process for person's that believe that they are adversely affected by a noncompliance decision of the National Organic Program, a State organic program, or a certifying agent. The primary difference between the NOP appeal process and the current state process is that appeals would be appealed to a U.S. District Court rather than a State court. This section is currently the subject of an appeal by an accredited certification agent.

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Organic System Plan Overview

Brian Baker, Organic Materials Review Institute

Organic standards not only require that operators maintain and improve the quality of natural resources, but that they must also incorporate practices that implement this goal in their management plans. Every certified organic producer is required to develop a production or handling system plan,[1] also more commonly known and referred to here as the Farm Plan.

The Farm Plan serves several purposes for an organic farm.

(1) The Farm Plan is a *forward-looking management tool* that takes into account future anticipated states and conditions. As such, it helps the farmer to make rational anticipated decisions rather than forcing them to react to crises.

(2) The Farm Plan is *a description of the human and natural resources* that a farm has as its productive capacity. When implemented, the Farm Plan can help a farm more fully develop its potential and use available resources more efficiently.

(3) The Farm Plan is *an economic tool*. A well-constructed Farm Plan can help an operator budget for the coming season's expenses and income, and sustainably fulfill the potential to be viable both economically and sustainably. Finally,

(4) The Farm Plan serves as a *legally binding contract* between the certifier and the certified operation. Breach of that contract can result in denial or loss of certification.

The Farm Plan carries with it a number of implications for management decisions for a certified organic farm. Some operators will require assistance in drafting a Farm Plan. Others will have a Farm Plan in place and—at least in the short run—will need to follow a course of action described in the Farm Plan. Operators will often seek advice only after other planned options are exhausted. Before an agricultural professional can give any advice to a certified organic operator, the professional should find out if the recommended practice will fit into the Farm Plan. Even if a material is registered for a certain crop and complies with organic standards, application outside the Farm Plan can still cause problems with certification. While it is possible to amend the Farm Plan, it is far better to think ahead.

The NOP Rule requires that the organic system plan include…

- Practices and procedures to be performed and maintained;
- A list of each substance to be used as a production or handling input;
- Monitoring practices and procedures to be performed and maintained;
- A description of the record keeping system;
- Practices and physical barriers established to prevent co-mingling with conventional food and contact with prohibited substances; and
- Any additional information needed to document NOP compliance.

1. Description of Practices

Farmers need to describe explicitly how they plan to manage their resources. The Farm Plan should document any soil and water conservation practices intended. A Farm Plan could include a description of tillage practices, irrigation methods, planting of hedgerows, stream buffers, drainage, manure handling practices, composting facilities, crop rotations.

Livestock operations should describe how animals will be provided access to the outdoors, how

[1] Paraphrased and adapted from 7 CFR 205.201.

the land will be managed where animals are kept, any physical alterations, and measures to reduce stress and preventive strategies for maintaining the health of animals.

Descriptions should include the tools and equipment to be used, the estimated frequency of the practice, and the methods that are otherwise used to carry it out. Agricultural professionals can assist in the preparation of Farm Plans by providing farmers with an inventory of tools and equipment available, the best available practices for the field conditions in the region, and estimates or models to help farmers optimize the timing of their practices.

2. List of Substances

A list of each substance to be used as a production or handling input that indicates its composition, source, location(s) where it will be used, and documentation of commercial availability, is required in the Farm Plan. In general, the composition and source of materials requires specific information on brand name products. All ingredients in farm inputs need to comply with the NOP Rule.

The planned locations for the application of fertilizers and pesticides must be described or recorded on a map. As a management tool, the Farm Plan can help to prepare budgets and improve the efficiency of input application. Precise descriptions of planned inputs help to document materials purchases and applications during inspections. The NOP Rule restricts substances not included in the Farm Plan.

Biopesticides, botanicals, or allowed synthetic substances can be applied only if they are contained within the Farm Plan and other measures prove ineffective.[2] Therefore, it is crucial that all inputs used during a season are included in the Farm Plan prior to their application and the conditions for their application are clearly documented. Unanticipated production problems that result in the application of restricted materials will require revision of the Farm Plan, and may result in difficulties during inspection if not well documented.

Livestock operations must document feed ingredients, health care products, and production aids in the Farm Plan. The Farm Plan should include the projected sources of organic livestock feed. Operators should be able to predict how much feed and forage will be produced on the farm, the dietary contributions of pasture and range, how much feed will need to be purchased, and what backup sources are available in case of crop failure, drought, or tight future market conditions. Farms that use non-organic feed additives and feed supplements must document the specific nutritional needs to be met by these non-organic feed ingredients and describe why organic sources are insufficient to meet these needs. The Farm Plan should also document any vaccinations, inoculants, animal drugs, or treatments that will be used in anticipation of common health problems or endemic diseases.

3. Monitoring Practices

Maintaining the quality of the environment and meeting certain application standards requires that the operation describe how to measure and document compliance with required practices. For example, operations that make compost need to describe how they will take temperatures. A number of synthetic substances require testing either for a deficiency before a given nutrient can be applied (e.g. micronutrients) or for environmental degradation after the substance is applied (e.g. potassium chloride or copper fungicides).

If biopesticides, botanicals, or allowed synthetics are applied, the operator should define the minimum pest thresholds that are used to determine if and when specific crop protection materials

[2] 7 CFR 205.206(e).

will be applied and describe how pests will be scouted. If copper fungicides are used, the operator needs to document how and when soil accumulation of copper will be measured.

Livestock operations would provide information on how nutritional needs are met and how health care is maintained. For example, the Farm Plan would include fecal examination schedules to document the need for internal parasiticides.

4. Recordkeeping System

Certification is based not only on compliance with the standards, but also on the ability to document that compliance. The Farm Plan contains a description of each recordkeeping document. Operators must demonstrate how they were able to produce what they market as organic. During an audit, an operator must track the product all the way back to the field and how it was managed for at least three years prior to its production. Every input applied to soil, crop, or animal needs to be documented, with detailed information on the ingredients and brand names. Field operations, planting dates, harvest dates, yield records, sales, and chains of custody are all important documents for crop certification. Each animal must be tracked in a livestock operation, except in the case of poultry where recordkeeping is required of each flock. The recordkeeping system must record (1) all feed, including all feedstuffs, additives, and supplements; (2) all animal drugs, treatments, biologics, remedies, and parasiticides administered; (3) all alterations made and the steps taken to reduce stress, pain and suffering in conducting those alterations; and (4) the final sale or other fate of every animal, up to an animal's sale for slaughter, sale of that butchered animal's meat products or death. The recordkeeping system of handling operations also need to take into account organic agricultural commodities that are purchased, brokered, or otherwise handled on commission. Product in and product out must be balanced.

5. Contamination Prevention

Any operation faces potential loss of certification due to contamination resulting (1) from the mixing of non-organic and organic products (commingling); or (2) from the contact of organically grown crops, organically managed soils, or organically raised animals with prohibited substances. An operator needs to be able to demonstrate that the operation takes reasonable precautions to prevent contamination by prohibited substances from occurring. Operations that grow organic and non-organic crops are of particular concern. If contamination of a crop is subsequently discovered, a well-designed plan and clear documentation will be crucial to demonstrate that the contamination was the result of circumstances beyond the farmer's control. Unavoidable residual environmental contamination beyond the farmer's control should not result in loss of certification of an operation, although a specific crop may lose certification if the level of contamination exceeds 5% of the EPA tolerance.

6. Additional Information

The certifying agent may require additional information about certain aspects of the operation. If a grower has any doubt about a practice or procedure that the certifying agent may question, it is best to include it in the Farm Plan. This can help resolve any doubts about the status of a practice and its acceptability in an organic system before the inspection. The ATTRA workbooks and compliance lists offer helpful further guidance for developing Farm Plans. The ATTRA forms offer a suggested format. Most certifiers have their own formats.

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Materials Used in Organic Farming

Brian Baker, Organic Materials Review Institute

Organic farming is a systems approach that consists of more than simply the substitution of natural inputs for ones that are synthetically produced. Organic production practices must maintain or improve the natural resources of an operation, including the soil and water quality. A number of positive management practices are required for soil fertility management and crop protection. Synthetic substances are generally prohibited, with exceptions that appear on the *National List*. Natural substances are allowed unless they appear as prohibited on the *National List*. This requirement applies to all substances, not just to active ingredients. Synthetic inert ingredients are permitted only in pesticides, and must be classified as minimum risk (EPA List 4). The NOP Rule also prohibits without exception genetically modified organisms, ionizing radiation, and sewage sludge. A crop cannot be sold as organic for a minimum of three years following the application of a prohibited substance.

Materials Used by Organic Farmers

The results of a national survey of over 1,000 organic farmers conducted by the Organic Farming Research Foundation (OFRF) supported that organic farmers follow the principle that organic farming is a management system by applying inputs to supplement cultural practices. Most organic farmers rely on a combination of cover crops and compost to provide the fertility and soil conditioning needs. Uncomposted manure and compost tea are used by a much smaller number of organic farms.

Supplementation with mineral sources of calcium is also a common practice, used frequently or occasionally by most organic farmers. In areas where pH is high and sulfur is low, gypsum (calcium sulfate) is commonly used. Soils that have low pH are generally treated with limestone (calcium carbonate). Animal by-products-such as fish emulsion, fishmeal, blood meal, bone meal, or meat meal are other common soil amendments. The majority of organic farmers also use kelp and mineral amendments either on occasion or frequently.

Organic farmers rely primarily on cultural strategies, such as crop rotations, beneficial habitat, and classically bred resistant varieties to manage pests, diseases, and weeds. *Bacillus thuringiensis* (Bt) is reported as the most commonly used insecticide, followed by insecticidal soap. These pesticides are the only ones used by more than half of all farmers responding. Sulfur and copper are the most commonly used fungicides, used by 40% and 34% of responding farms respectively. Less than 10% of the farmers surveyed by OFRF said that they used botanical insecticides regularly, with over half saying that they never used them at all.

While organic livestock producers use minerals and vitamins as feed additives, most rely on cultural practices to maintain animal health. Most veterinary medicines are prohibited. Animals treated as a rule must be diverted to conventional channels.

Compliance Issues

When making recommendations to organic farmers, it is important to be sure that the input recommended is allowed. Certification agencies are charged with the responsibility of verifying that brand name products used by farmers meet the requirements of the National List. They must review both the active and non-active ingredients for compliance. Many certifiers use the services of the Organic Materials Review Institute (OMRI), a non-profit initially established as an offshoot of two western certification programs to provide this service of product review. Those that use OMRI services also often provide some in-house review of products as well, but in all cases a certified farmer must be sure that any products used on the farm are approved by his/her certification agency for use in organic production. The Washington State Department of Agriculture (WSDA) also publishes a list of brand name products reviewed according to NOP requirements.

The farmer has the responsibility to inform the certification agent, and the certification agent is the one who decides in most cases whether or not the use of a given input complies with organic standards. Inputs will often need to be in the farm plan before they can be used on an organic farm. The OMRI and WSDA lists are provided for guidance.

Farmers and agricultural professionals are reminded that any material used on an organic farm must be reviewed and approved by the certifier of that farm for that use and application. Any decisions made must be cross-referenced to the NOP Rule, and are ultimately subject to interpretation by the NOP and the Federal government.

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Organic Seed and Seed Sources

I. Organic Seed Info

Seeds, annual seedlings, and planting stock must be organic except in the following cases: when organic seed and planting stock are not commercially available; when untreated organic seed and planting stock are not commercially available and there are nonorganically produced seeds and planting stock that have been treated with a substance included on the National List of synthetic substances allowed for use in organic crop production; when a temporary variance has been granted allowing nonorganically produced annual seedlings to be used to produce an organic crop; when nonorganically produced planting stock has been maintained under a system of organic management for no less than 1 year and is to be used to produce a perennial crop; and when the application of prohibited substances to seeds, annual seedlings, and planting stock is a requirement of Federal or State phytosanitary regulations.

II. Selected Organic Seed Sources in the United States

This listing was compiled in part using the information found on the website of the Appropriate Technology Transfer for Rural Areas (ATTRA) and the Organic Materials Review Institute (OMRI). ATTRA is a national sustainable agriculture information service managed by the National Center for Appropriate Technology and funded by the USDA. For more information visit their website at http://attra.ncat.org/. OMRI is a 501(c)(3) non-profit organization started in 1997 to benefit the organic community and the general public. Its primary mission is to provide professional, independent, and transparent review of materials and compatible processes allowed to produce, process, and handle organic food and fiber.

For more information log on at www.omri.org. ATTRA, OMRI, or the authors have confirmed sources listed to be certified organic seed producers at the time of publication. The listings are not intended to be comprehensive. Other resources for sourcing organic seeds are the Non-GMO Source at www.non-gmosource.com, and the Organic Seed Alliance at www.abundantlifeseed.org. For organic seeds available outside the US, please check www.OrganicXSeed.com.

Supplier:

Abundant Life Seed Foundation
P.O. Box 772
930 Lawrence St.
Port Townsend, WA, 98368
360-385-5660
Fax: 360-385-7455
email: abundant@olypen.com
www.abundantlifeseed.org

Albert Lea Seed House
1414 West Main Street
P.O. Box 127
Albert Lea, MN 56007
800-352-5247
Fax: 507-373-7032
email: mac@alseed.com
www.alseed.com

Allen Kapular/Peace Seeds
2385 Thompson SE
Corvallis, OR 97333
541-752-7421

Bejo Seeds
1972 Silver Spur Place
Oceano, California, USA 93445
(805) 473-2199
info@bejoseeds.com

Blaine's Best Seeds
6020 22nd Avenue
Rugby, ND 58368
701-776-6023 (phone/fax)
701-208-0061 (cell)

Bountiful Gardens
18001 Shafer Ranch Road
Willets, CA, 95490
707-459-6410
Fax: 707-459-1925
email: bountiful@sonic.net
www.bountifulgardens.org

Buckwheat Growers Association of Minnesota
20415 County Road 2
Aldrich, MN 56434
218-445-5475
Fax: 218-445-5673
Email: deebilek@wcta.net
www.buckwheatgrowers.com

Environmental Seed Producers
P.O. Box 2709
Lompoc, CA, 93438
805-735-8798
www.espseeds.com

Fedco Seeds
PO Box 520
Waterville, ME 04903
207-873-7333
www.fedcoseeds.com/

Filaree Farm
182 Conconully Hwy.
Okanogan, WA 98840-9974
509-422-6940
email: filaree@northcascades.net
www.filareefarm.com

Fungi Perfecti
P.O. Box 7634
Olympia, WA, 98507
360-426-9292
Fax: 360-426-9377
www.fungi.com

Garden City Seeds
P.O. Box 204
Thorp, WA, 98946
509-964-7000
Fax: 800-964-9210

Great Harvest Organics
6803 E. 276th St.
Atlanta, IN, 46031
317-984-6685
317-984-8798
david@greatharvestorganics.com

Hermosa Valley Garden Seeds
P.O. Box 1409
Santa Maria, CA, 93456
877-834-7333
Fax: 805-925-4140

High Altitude Gardens/ Seeds Trust
4150 Black Oak Drive
Hailey, ID, 83333
Phone: 208-788-4363
Fax:208-788-3452
email: mcdorman@seedsave.org
www.seedsave.org, www.seedstrust.com

High Mowing Seeds
813 Brook Road
Wolcott, VT 05680
phone: 802-888-1800
fax: 802-888-8446
www.highmowingseeds.com

Horizon Herbs
P.O. Box 69
Williams, OR, 97544
541-846-6704
Fax: 541-846-6233
email: herbseed@chatlink.com
www.chatlink.com/~herbseed/

Irish Eyes, Inc.
P.O. Box 307
Thorp, WA, 98926
509-964-7000
800-964-9210
email: potatoes@irish-eyes.com
www.irish-eyes.com

Johnny's Selected Seeds
955 Benton Ave.
Winslow, ME, 04901
800-854-2580
Fax: 800-738-6314
staff@johnnyseeds.com

Landis Valley Assoc. Heirloom Seed Project
2451 Kissel Hill Road
Lancaster, PA 17601-4899
717-569-0401
Fax: 717-569-2147

Mooarhill Farm and Greenhouses
Mooar Hill Road
RR 1 Box 5510
Mt. Vernon, ME 04352
207-293-2268
Fax: 207-293-4346
www.mooarhillfarm.com

Mountain Valley Growers
38325 Pepperwood Road
Squaw Valley, CA, 93675
559-338-2775
www.mountainvalleygrowers.com

The Natural Gardening Co.
P.O. Box 760776
Petaluma, CA , 94975-0776
707-766-9303
Fax: 707-766-9747
email: via website
www.naturalgardening.com

Native Seeds/ SEARCH
526 N. 4th Ave
Tucson, AZ , 85705
520-622-5561
Fax: 520-622-5591
email: nss@azstarnet.com
www.nativeseeds.org

NC+ Organics
3820 North 56th Street
P.O. Box 4739
Lincoln, NE 68504
800-279-7999
email: organics@ncplus.com
www.ncorganics.com

Nichols Garden Nursery
1190 No. Pacific Hwy. NE
Albany, OR, 97321
541-928-9280
866-408-4851
800-422-3985
Fax: 541-967-8406
email: nichols@gardennursery.com
www.nicholsgardennursery.com

Paradise Gardens Rare Plant Nursery
RR 1, Box 488-B
Bonners Ferry, ID, 83805
Fax:253-981-1506
email: paradisegds@yahoo.com

Peaceful Valley Farm Supply
PO Box 2209
Grass Valley, CA 95945
530-272-4769
888-784-1722
Email: (through website)
www.groworganic.com

Plants of the Southwest
Agua Fria Road
Route 6, Box 11A
Santa Fe, NM, 87501
800-788-7333 (orders)
505-471-2212 (cust. service)
Fax: 505-438-8800
email: via website
www.plantsofthesouthwest.com

Rebecca's Garden
10601 Vista Road
Columbia, MO 21044
410-531-5144 (phone/fax)
email: rebsorggarden@aol.com

Redwood City Seed Co.
P.O. Box 361
Redwood City, CA , 94064
650-325-7333
www.batnet.com/rwc-seed

Seeds of Change
P.O. Box 15700
Santa Fe, NM 87506
888-762-7333 (orders)
email: gardener@seedsofchange.com
www.seedsofchange.com

SemTec
P.O. Box 418
Center, CO 81125
719-754-2940
719-754-2946
email: via website
www.semtecseed.com

Sourcepoint Organic Seeds
1220 2640 Road
Hotchkiss, CO, 81419-9456
970-872-4941]

Sow Organic Seed
PO Box 527
Williams, OR 97544
Toll Free: (888)709-7333
organic@organicseed.com
www.organicseed.com

Sunnyland Seeds
P.O. Box 385
Paradox, CO, 81429
970-859-7248

Superior Organic Grains
N 7076 Hwy. C
Seymour, WI 54165
920-833-6953
Fax: 920-833-2751
email: superiororganics@aol.com

Territorial Seed Co.
P.O. Box 158
Cottage Grove, OR 97424
541-942-9547
Fax: 888-657-3131
email: via website
www.territorial-seed.com

Texas Rice Improvement Association
1509 Aggie Dr.
Beaumont, TX 77713
Phone: 409-752-2741
Fax: 409-752-5560
e-mail:rweather@taexgw.tamu.edu

Threshold Seeds Sowing Circle
95084 Cherry Ridge Lane
Myrtle Point, OR, 97458
541-572-3317

Thunderfoot/Earthworks-Sow Organic Seeds
P.O. Box 527
Eugene, OR , 97544
888-709-7333 (orders)
email: organic@organicseed.com
www.organicseed.com

Tinmouth Channel Farm
Town Road 19 Wallingford
Box 428 B
Tinmouth, VT 05773
802-446-2812

Victory Seed Co.
P.O. Box 192
Molalla, OR, 97038
503-829-3126 phone/fax
email: safeseed@victoryseeds.com
www.victoryseeds.com

Wild Garden Seed
P.O. Box 1509
Philomath, OR, 97379
541-929-4068

Wood Prairie Farm
49 Kinney Road
Bridgewater, ME 04734
800-829-9765
800-631-8027
Fax: 800-300-6494
email: jim@woodprairie.com
www.woodprairie.com

The National Organic Program (NOP): What Agricultural Professionals Need to Know

The USDA has established a National Organic Program (NOP) Rule for the production and handling of agricultural and processed food products labeled as 'organic.' The NOP Rule sets uniform production standards for crops and livestock, handling and processing standards for how products are handled post-harvest. Included in the NOP Rule is a *National List* of synthetic substances approved for organic production and non-organic substances used in handling and processing. State and private organic certification programs accredited by USDA certify organic crops, livestock, and handling operations that comply with the program's requirements. State and Federal authorities share enforcement responsibilities. Labeling requirements for organic products and products containing organic ingredients are also spelled out in the NOP Rule.

The final rule is available on the National Organic Program web site at www.ams.usda.gov/nop. A downloaded copy of the final rule has been included in this binder. Additional, official copies can be purchased from the Federal Register by calling (202) 512-1800.

Selected Key Provisions of the NOP Rule

(Appropriate sections of 7 CFR are given in parentheses)

- Most producers and handlers must be **certified** by a USDA accredited certifying agent. (*205.100)*
- Producers with sales **under $5,000 are exempt** from certification. *(205.101)*
- Most synthetic **fertilizers, pesticides, animal drugs, feed additives, and ingredients** are prohibited; those that are allowed may be used only with **restrictions.** *(205.105)*
- Organic producers and handlers must prepare an **Organic Systems Plan** that the certifier must review, evaluate and approve. *(205.201)*
- Land cannot be certified as "organic" until **three years** after the date of the application of the last prohibited material. *(205.202)*
- The use of **raw manure** is restricted, and manure that is made into **compost** must meet specific process requirements. *(205.203)*
- **Organic seeds** must be planted unless they are not commercially available. (205.204)
- Most **seed treatments** are prohibited. *(205.204)*
- Producers and handlers need to implement and document **proactive and preventative management practices** before they can use pesticides. *(205.206)*
- Animals must meet most of their nutritional requirements from **organic feed.** *(205.237)*
- **Animal drugs** cannot be applied in the absence of illness. *(205.238)*
- **Antibiotics** are prohibited. *(205.238)*
- Livestock must have **access to the outdoors**, with only temporary exceptions. *(205.239)*
- Ruminants must have **access to pasture.** *(205.239)*
- Residues of prohibited pesticides that result from unavoidable contamination are limited to **5% of EPA Tolerance.** *(205.671)*

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International Standards

Brian Baker, Organic Materials Review Institute

Organic farming is practiced throughout the world, with an estimated 23 million hectares (56.83 million acres) now under organic management. Australia and Argentina have the largest production areas with extensive land devoted to grazing livestock. Europe has over five million hectares (12.35 million acres) under organic management, with Germany, the United Kingdom, France, and Italy accounting for the largest shares of that acreage. Italy also has the largest number of organic farmers in the world. When working with producers who are selling into export markets, one must be aware that standards vary around the world. Not all importers accept the USDA National Organic Program (NOP) Rule as equivalent.

European Union Regulations

EU member states follow European Union Council Regulation 2092/91. Each member state has a national law that conforms to the regulation and a competent authority responsible for implementation. Once in the EU, imported product has free movement within the borders. Also, the EU recognizes a number of countries outside the EU as having equivalent organic regulations, including Australia, Argentina, and Israel. Products shipped to these countries and processed also need to meet EU regulations. The US does not, at this time, have an equivalency agreement with the EU. Thus, the EU does not automatically and may not necessarily accept for importation products certified by an NOP-accredited certifier.

Japanese Agricultural Standards

The Japanese Ministry of Agriculture, Fisheries, and Forestry established the Japanese Agricultural Standard (JAS), accredits certifiers, and enforces organic labeling laws. The Japanese government and U.S. have established an equivalency arrangement for the trade in products labeled organic with a few specific exceptions. However, some buyers still insist on full JAS compliance rather than accept equivalence.

Codex Alimentarius

The United Nations Food and Agriculture Organization and World Health Organization have developed a set of guidelines for organically produced food as part of an overall international project known as Codex Alimentarius. The Codex guidelines for organic food labeling are used to help various countries establish a consistent set of laws and to help harmonize different existing national standards. In the event of an international dispute, the World Trade Organization is expected to treat the Codex Alimentarius guidelines as neutral and consensus based.

IFOAM
The International Federation of Organic Agriculture Movements (IFOAM) is a non-governmental organization that has established a set of Basic Standards. IFOAM has contracted with the International Organic Accreditation Service (IOAS) to accredit certifiers to these voluntary standards. Several large retailers in Europe rely on the IFOAM standards and IOAS accreditation as the basis for their certification rather than any particular national standard.

For export markets, U.S. certified organic producers must understand the organic standards of the country to which they sell in order to successfully capitalize on marketing opportunities.

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Organic Farming Research in the Pacific Northwest: Challenges, Opportunities, and Outlook

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[1]Washington State University; [2]Oregon State University; [3]University of Idaho

Organic farming has grown rapidly in the Pacific Northwest (Oregon, Idaho, and Washington) during the past decade. Certified organic acreage in Washington alone increased eight-fold between 1993 and 2002. Yet the 145,000 certified acres in the three states still comprise less than 1% of the total farmland base. With the growth of the organic sector has come a commensurate expansion of research, education, services, and product development for organic farmers. In this paper, we discuss the current situation, trends, and key lessons learned about organic farming research in the region.

Current Status of Organic Farming in the Pacific Northwest

Based on the most recent USDA data (Table 1), there were 145,000 certified organic acres in the Pacific Northwest in 2001 (USDA-ERS, 2002). Nationally, Idaho has been one of the top states for certified acreage. In 1997, over 50,000 certified acres (47% of the total) were for wildcrafted plants, and the decline in certified acres in Idaho in 2001 was largely due to a reduction in St. Johnswort acreage, a wildcrafted plant. Currently, forages and barley are the largest organic crops in Idaho. Oregon is a major producer of organic nursery plants, and was home to nearly 50% of the national acreage of organic herbs/nursery in 2001. In contrast, Washington is a clear leader in organic acres of apples, pears, and cherries, and 37% of the organic apple acreage in the U.S. and over 20% of that in the world is in Washington (Granatstein and Kirby, 2002). Thus, while the three states have many agricultural similarities, the evolution of organic farming is somewhat distinct in each one (Table 2).

Historically, organic farming in the Pacific Northwest had its roots on small farms that were commonly located near population centers. As the organic market has expanded, larger farms in the major agriculture production areas have become more common and more prominent. For example, western Washington has provided the philosophical, political and consumer base for the growth of organic farming in the state. However, in 2001, 82% of the certified organic acres and 98% of the acres in transition were in eastern Washington (Granatstein, 2002), which is the dominant commercial farming region in the state. In contrast, one-third of the organic farms were in western Washington, and two-thirds were in eastern Washington. Farms in western Washington tend to be smaller than farms in eastern Washington. The two regions have quite different populations and biophysical environments, and correspondingly distinct research needs. The research community will need to track the demographic nature of organic farms in order to effectively serve them.

History of Organic Farming Research in the Pacific Northwest

Prior to the introduction of agrichemicals in the pre- and post-WWII period, much of the research at Land Grant Universities (LGU) in the Pacific Northwest was essentially “organic.” Soil organic matter management, crop rotation, and cover crops were common research topics. All three LGUs in the region, Washington State University (WSU), Oregon State University (OSU), and University of Idaho (UI), had numerous long-term systems studies of soil quality, crop rotation, alternate crops, and cover crops in the first half of the 20th century (Granatstein, 1992). However, these types of studies became less frequent after the 1950s and shorter-term reductionist research projects became the norm.

In the “modern” organic era (post-1970), the main proponents of organic farming research in the Pacific Northwest, as in the rest of the country, were often farmers on the fringes, such as the “back-to-the-landers” commonly found in all three states. These individuals tended to view the LGU, its researchers and extension agents, as antagonistic to their point of view, and they were often outspoken on this subject.

Organic Practice Guide

Brian Baker, Organic Materials Review Institute

Land Requirements

Soil management forms the foundation of an organic system. Organic farming can be summed up by the aphorism, "Feed the Soil to Feed the Plant." The NOP Rule requires that (a) the soil fertility, seeds and planting stock, crop rotations, and pest management practices all meet the organic standards requirements; (b) prohibited materials cannot be applied for a minimum of ***three years*** prior to the harvest of any crop sold as organic; and (c) that the organically managed area be clearly identified.[1]

Soil Fertility

Organic producers are required to maintain or improve the soil that they manage.[2] The soil is a living system that requires proper maintenance of balanced soil ecology to farm sustainably. Organic farmers regenerate the fertility of the soil through renewable resources. For most farms, operators build the soil through the increase of the partially decomposed biological fraction of the soil, known as organic matter. Increased organic matter makes nutrients more available, buffers and neutralizes soil pH, improves soil structure, raises biological activity, enhances water field capacity and drainage, and decreases erosion. While organic farmers may supplement soluble sources of various nutrients for crop deficiencies, such practice is in conjunction with a soil building program.

Tillage and cultivation

Field preparation practices used by organic operators must conserve soil and water. While tillage and cultivation are an important part of organic farmers' weed management, it must be done in a way that maintains soil and water quality. Surveys show that most organic farmers use what is usually considered minimum tillage equipment, such as chisel plows, disks, spaders, and harrows. While organic farmers will use moldboard plows, ganged plows, and rippers, these are often reserved only for cases where a field has been fallow or has a compaction layer, and are not regularly used equipment. Some organic farmers have adopted various permanent bed systems that do not involve disturbing entire fields. Beds are tilled and cultivated individually by lighter equipment. A growing number of organic farmers are experimenting with no-till systems, at least with specific crops in their rotations.

Cultural practices play an important role in producing favorable conditions for beneficial soil biota. Tillage systems that mix subsoil with surface soil, and cause compaction that leads to poor drainage and air circulation, create conditions favorable to disease-causing organisms. Adequate organic matter in the rhizosphere provides a food source for organisms that cycle nutrients and suppress diseases.

Nutrient Management

Management by neglect is not sustainable and cannot be certified as organic. Organic farmers must replenish what is harvested primarily by relying on renewable resources. Operators are required to have a soil-building program that consists of plant or animal materials. Various crop residues, food processing wastes, blood meal, bone meal, and manure all are available options for organic farmers. The use of manure is tightly restricted.

Most synthetic fertilizers are prohibited by OFPA—in particular, synthetic nitrogen, phosphorous, potassium, and calcium sources.[3] The NOP Rule also explicitly prohibits sewage sludge.[4] Plant foods labeled 'organic' may contain materials prohibited in organic production because fertilizer-labeling laws

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[1] 7 CFR 205.202.
[2] 7 CFR 205.203(a).
[3] 7 USC 6508(b)(2); see also 7 CFR 205.105(a) and 7 CFR 205.203(e)(1).
[4] 7 CFR 205.105(g).

in almost every state in the Western US are not consistent with the NOP Rule. Therefore, it is important to know that all of the ingredients in a blended fertilizer comply with the NOP Rule before recommending that it be applied to an organic farm.

For many farms that transition from conventional to organic production methods, nitrogen management is the greatest difference in nutrient management and perhaps the entire farm operation. Rather than rely on synthetic soluble nitrogen sources obtained from the combustion of natural gas, nitrogen is recycled primarily from two sources: nitrogen-fixing cover crops and animal manure usually applied as compost. Nitrogen applied in this way is stable and slowly released. While organic nitrogen is less likely to leach or volatilize, it is also not as readily available to the plant. As a result, organic crops have physiological differences related to slower growth rates, lower free nitrogen, and less lush green vegetation.

Compost and Manure Management

Manure is a valuable source of nutrients for organic farms. However, manure also contains relatively high levels of human and plant pathogens; soluble or volatile nutrients that may cause water or air pollution; and weed seeds. Manure from conventional farming sources also includes antibiotics, parasiticides, pesticides, hormones administered for growth promotion, and other prohibited substances. Organic farms are thus required to manage manure in a way that protects the crop from potential environmental, health, and food safety risks. The NOP Rule requires that manure either be composted or that the operator observes a minimum interval between the application of manure and harvest of crops for human consumption. The NOP Rule provides a strong incentive to use composted manure and places stringent restrictions on uncomposted manure.

Composting is the decomposition of organic matter through a controlled microbiological process. The use of compost has long been considered a defining feature of organic systems. Organic farmers are strongly encouraged to use compost because it reduces human, plant, and livestock pathogens; destroys weed seeds; decomposes organic matter; and makes nutrients more available to plants. Soluble or volatile nutrients are stabilized when microorganisms consume them. These organisms can also help make relatively insoluble nutrients more soluble by the production of humic acids and other means.

According to organic standards, manure and plant material used as a feedstock must have a carbon to nitrogen (C:N) ratio of between 25:1 and 40:1 prior to composting.[5] Feedstocks must meet a thermophilic temperature range of 131° and 170°F for a minimum time period that varies according to the method used. In-vessel or aerated static pile systems have a minimum thermophilic period of three days. In-vessel systems hold the manure and other feedstocks in a building, reactor, or container with sufficient capacity for the feedstock to reach thermophilic temperatures. In aerated static pile systems, the feedstock is stacked and either passively aerated through tubes inserted into the pile and baffles underneath, or actively aerated through a ventilation system that blows air through perforated pipes. Windrow systems require five turnings over fifteen days. Windrow composting stacks feedstocks in long, relatively narrow, low rows with a large surface area.

If manure is applied without being composted, then it must be incorporated in the soil, and cannot be left on the soil surface.[6] Crops that have edible portions in contact with soil—usually considered root crops and edible greens—the minimum interval is 120 days.[7] Other crops intended for human consumption must be harvested at least 90 days following incorporation of manure into the soil.[8] Manure that is not composted according to these standards require a minimum interval between application and harvest of crops destined for human consumption. Crops that do not meet these standards cannot be sold as organic.

[5] 7 CFR 205.203(c)(2)(i).
[6] 7 CFR 205.203(c)(1)(ii) and 7 CFR 205.203(c)(1)(iii).
[7] 7 CFR 205.203(c)(1)(ii).
[8] 7 CFR 205.203(c)(1)(iii).

Operators should still manage fields used to grow crops for livestock in a way that breaks the life cycle of parasites and reduces transmission of potential human pathogens.

Mined Minerals
Another nutrient source used by organic farmers is the application of mined minerals. The mined minerals that are most commonly applied on organic farms are rock phosphate, gypsum, limestone, potassium sulfate, and magnesium sulfate.

After compost, the most widely applied source of phosphate in organic farming is rock phosphate from apatite ore that has not been acidulated or otherwise chemically treated. Hard rock phosphate is the most common in the Western US, and is a dense, non-porous mineral that contains between 59% to 75% tri-calcium phosphate. The main apatite deposits in the Western US are found in Idaho of which some may be high in arsenic, lead, and cadmium. When washed, the dried slurry from rock phosphate mining is a finely divided raw mineral phosphate or phosphatic clay that contains between 50% to 58% tri-calcium phosphate and is marketed as colloidal phosphate. Soft rock phosphate is a powdery clay source that contains between 40% to 60% tri-calcium phosphate.

The addition of rock phosphate to compost can improve the phosphorous content of the compost and make the phosphate more readily available by providing exchange sites for the calcium. Compost's biological activity appears to make the phosphate more readily available, particularly through the production of humic acids and the symbiotic activity of vesicular-arbuscular mycorrhizae (VAM).

Gypsum and limestone are applied for their calcium content, and to help balance the pH of soil. In many alkaline or sodic soils, application of mined gypsum is a common practice to displace sodium from the soil. The sodium must be leached, usually by irrigation sufficient to wash the salts into the drainage system.
In the Western US, natural potassium sulfate obtained from the Great Salt Lake in Utah offers one of the most commonly used sources of natural potash used by organic farmers in the Western US. A number of the less soluble natural potassium silicate sources are also applied, such as basalt and granite. These latter minerals have long been observed as providing a measurable crop response, particularly when combined with organic matter. However, they are generally out of favor with conventional farmers and are not recognized as having fertilizer value by fertilizer control officials.

Some mined minerals are restricted because of their high solubility, high salt index. Sodium nitrate and potassium chloride are on the National List of prohibited natural substances with specific restrictions that allow limited use. Because they are prone to leach, can pollute water, and degrade soil quality when abused, organic operators are discouraged from using these fertilizers. The NOP Rule restricts their use by requiring documentation in the Farm Plan and evidence that the restrictions placed on their use are met. Sodium nitrate cannot provide more than 20% of the total nitrogen added to a crop.[9] Use is particularly discouraged on high sodium desert soils. The nitrogen contribution of compost, cover crops, and other sources of these nutrients either need to be documented by laboratory analyses or estimated conservatively to avoid certification problems. Potassium chloride must be applied in a manner that minimizes chloride accumulation in the soil.[10]

Ashes
Ashes from wood ash and other crop residues offer a readily available, economical source of nutrients, particularly for calcium and potash. Ashes can be blended with a compost to balance their nutrient levels. However, ashes are usually alkali and can have adverse effects on soil pH and structure when applied repeatedly. Also, some sources of ashes have been reported high in arsenic and lead, particularly when

[9] 7 CFR 205.602(h).
[10] 7 CFR 205.602(g).

pressure treated lumber or demolition wastes have been incinerated. Manure ash is prohibited due to the environmental impact of its manufacture and its adverse impact on soil quality when compared with compost and raw manure.

Synthetic Crop Nutrients
Finally, growers may use synthetic substances that are on the National List if their use is planned and they comply with the NOP Rule annotations for those substances. These are described below.

Fish that has been hydrolyzed or emulsified can be an effective source of crop-available nitrogen. However, it must be stabilized to prevent putrefaction and potential food safety problems, with phosphoric acid as the preferred stabilizer and sulfuric acid an acceptable substitute.

Aquatic plant products such as *Ascophyllum nodosum* can be applied either to soil or foliage as a source of trace minerals. They also contain relatively concentrated amounts of plant auxins, growth regulators and stimulants – such as indole-3-acetic acid (IAA), gibberellic acid and cytokinins. Such natural plant hormones can help promote rooting in transplants and cutting, and also help to delay senescence and decay in mature crops. Aquatic plant products are often extracted using potassium hydroxide in order to increase their solubility.
Elemental sulfur offers a means by which alkali soils can be acidified. While gypsum will help to reduce sodium, it will not lower pH appreciably in most situations. Sulfur will have a more immediate effect on lowering pH. However, sulfur is not buffered and can damage soil structure. Also, in soils where available calcium is limited, application of soil sulfur instead of gypsum may cause calcium deficiencies by tying up the available calcium.

Magnesium sulfate from synthetic sources may also be used as a foliar feed or to deal with specific soil conditions. Also known as Epsom salts, magnesium sulfate is available from some natural sources, such as keiserite and langbeinite. However, the synthetic form is more readily applied as a foliar feed.

Synthetic micronutrients—cobalt, copper, iron, manganese, molybdenum, selenium, and zinc—can be applied to correct a deficiency provided that they are from sulfate, carbonate, oxide, or silicate sources. Nitrate and chloride forms of these micronutrients are explicitly prohibited. Synthetic soluble sources of boron can also be applied. The micronutrients cations (copper, iron, manganese and zinc) are less available in soil than the primary and secondary cations, potassium, calcium and magnesium.

Available micronutrients depend on the pH of the soil; total nutrient levels alone will not provide enough information to document sufficiency. In many high pH soils, crop deficiencies are more likely to be diagnosed by leaf or petiole samples than by soil tests. Organic matter is another factor that influences micronutrients availability. Micronutrients attached to inorganic soil particles will not be able to readily contribute to plant nutrition. Use requires documentation of soil deficiency through testing. The NOP Rule does not specify sampling the soil matrix, and professionals may use plant tissue testing to estimate soil deficiencies with models that correlate availability and plant tissue levels of the specific trace minerals intended to be applied. Over the long run, producers are expected to increase the amount of essential trace elements through the application of compost and natural mined minerals, and increase their availability by adjusting the pH and increasing the cation exchange capacity.

Chelating agents are compounds to which an element in its ionic form can be attached. Micronutrients can be made more available to plants by chelation with various compounds. Naturally occurring chelating agents such as citric acid may be used. Synthetic chelating agents on the National List such as lignosulfonic acid and its salts; and humic acids are more commonly used. Synthetic chelating agents not on the National List such as EDTA and DTPA are prohibited.

Seeds and Planting Stock

The NOP Rule requires that organic farmers plant organic seed, but allows nonorganic seeds to be used, if the operator can document that organic seeds are not commercially available. ‘Commercially available’ is defined by the NOP Rule as “[t]he 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.”[11] A growing number of sources for organic seeds are now available. Annual planting stock must be organically produced in any case. Perennial stock from a nonorganic source may be transitioned to organic production after twelve months. The standards permit seeds and planting stock treated with prohibited substances as the result of Federal or State phytosanitary requirements.

Crop Rotation

Crop rotation is the cultivation of different crops in temporal succession on the same land. Diversifying crops cultivated over time in the same field improves the efficiency of nutrient cycling, particularly if leguminous green manures that fix nitrogen are added to the rotation. Crop rotations can break host cycles for pests and diseases. Alternation of crops with different seasonal patterns and growth habits can also help to suppress weeds. Properly managed rotations can also increase microbiological diversity and activity; raise organic matter content; conserve soil; and enhance soil structure. Even simple rotations over a short time period significantly improved soil quality in controlled experiments.[12]
The Farm Plan should include details for which crops will be rotated in a given field. Simply including a fallow period could be a start, but a sustainable rotation will require more diversity over the long run. Assisting farmers to plan rotations will require knowledge of the complimentary nutrient requirements. Organic production systems will have difficulty meeting crop nutrition needs if crops that require high levels of fertility are grown frequently. Heavy feeders produce more when rotated with light feeders and nitrogen-fixing legumes. Transitions to organic production are often best begun with a nitrogen-fixing green manure. Hay crops such as alfalfa or clover can also be successful transition crops.

Rotation and diversification are important strategies to reduce pests and diseases, and improve a diverse balance of organisms in the field. Continuous cultivation of the same crop year after year allows the population of pest organisms that feed on that particular crop to steadily increase. By planting a non-host crop, one can reduce the amount of food available to specific pests and pathogens. Complicating the system by intercropping or planting buffer strips can also reduce soil-borne pest and disease pressure. Completely clearing a field of weeds may actually promote nematodes and soil-borne diseases by reducing the diversity of the habitats for competitive microorganisms and the natural enemies of pests.

Pest, disease, and weed management also depends heavily on rotations. Breaking host cycles requires more than avoiding the same crop planted back-to-back in a given field. Crops that host common pests must also be avoided in succession. Economics ultimately determine the success of crop rotations. Planting a green manure or leaving land fallow carries both operating expenses and opportunity costs, and is particularly difficult to manage on leased land. Farms that produce high value heavy feeders without rotating other crops often face increased production costs and decreased yields over the long run. Operators faced with mounting infestations of pests, diseases, and weeds, and declining fertility may be faced with the choice of either withdrawing from organic production or farm failure.

Pest, Disease, and Weed Management

Crop protection is based on a systems approach that is founded upon the premise that healthy plants are protected by natural defenses and immune systems. Experience backed by research indicates that crops that are nutritionally imbalanced can have a greater potential to be infested with opportunistic pests and

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[11] 7 CFR 205.2.
[12] For example, see the literature review by M. Liebman and E. Dyck. 1993. Crop rotation and intercropping strategies for weed management. *Ecological Applications* 3(1):92-122.

diseases. Thus, proper, balanced nutrition is the cornerstone of organic pest management. Crop rotations, sanitation, planting of resistant varieties, and other preventive measures offer a planned, strategic approach that minimizes the use of interventions. Operators may resort to the use of a limited number of pesticides only if biological, cultural, and mechanical means prove ineffective, and only if they are included in the Farm Plan. It is important to know that the standards apply to formulations and not simply active ingredients. Inert ingredients must also be nonsynthetic or appear on the National List. The National List includes all inert ingredients that the EPA has determined to be minimum risk (List 4) and was recently amended to allow specific inerts of unknown toxicity (List 3) to be used with passive pheromone dispensers.

Pests

Organic farmers need to protect crops from various pests without the use of most chemical insecticides. The few exceptions that are made to this rule are based on criteria that take into account considerations of human health and the environment. Classical biological control—the release of the natural enemies of pests—is another strategy that helps to control insect and arachnid pests. Various predators and parasites can help to reduce the population of insects if their release is properly timed and they are released in sufficient quantities. Their effectiveness can be enhanced through the management of a community of plants that provide shelter and alternate food sources. Various mechanical controls are also available. Finally, there are a number of non-toxic repellants that are exempt from registration as pesticides. These can also serve to discourage insects from feeding as well as form physical barriers that protect crops from pests.

A number of mechanical and physical devices are available to protect crops from insects, mites, and other pests. Some of these tools involve various baits. Ammonium carbonate can be used as bait in insect traps, provided there is no direct contact with crop or soil and is primarily used to bait traps used to control various flies (diptera). Lures, traps, and repellants are also allowed for pest control. For example, various adhesive bands may be wrapped around trees to repel ants in citrus. Copper bands are used to protect various crops from mollusk pests such as snails and slugs.

Mating disruption with pheromones is an important tool for many organic farmers to manage caterpillar (lepidoptera) pests found in the Western US, such as codling moth, oriental fruit moth, and pink bollworm. Various sticky traps and barriers can also help to prevent the movement of insects. Copper bands can prevent molluscs from moving up the trunks of citrus trees. Adhesive bands used on trees can form a barrier for ants in citrus. Boric acid is allowed as a structural pest control, provided there is no direct contact with organic food or crops and is primarily used to control ants and cockroaches.
Only a few synthetic insecticides are allowed for foliar application. One is soap—widely used for soft-bodied insects such as aphids. Elemental sulfur and lime sulfur are also used on foliage. Both are used more for disease control, but are also labeled for other pesticide uses. Sulfur is used as an acaricide; lime sulfur can be used to control scale as well as mites. Oils that are within the narrow range—a 50% distillation point of between 415° and 440°—can be applied as a dormant spray. Petroleum distillates in the narrow range are also applied to foliage as suffocating oil. In some areas, petroleum distillates are only recently accepted for use in organic production. Historically, organic farmers have been discouraged from applying petroleum distillates to the edible parts crops.

Two natural insecticides are on the list of prohibited nonsynthetic substances: sodium fluoaluminate from the mineral cryolite and nicotine from tobacco. The potential risks these insecticides posed to the environment and human health led to their prohibition. Given their limited production and availability, reduction in their registered uses, and declining use based on the introduction and distribution of superior alternatives for the few remaining crop / pest complexes allowed on their labels, tobacco and cryolite were not widely used by organic farmers in the Western US prior to their prohibition.
Organic farmers rely on traps, physical barriers, and cultural practices to reduce vertebrate pest pressure. In the Western US, the principle vertebrate pests of concern are gophers and ground squirrels. Deer can

be repelled using ammonium soaps, provided they are applied without no contact with soil or edible portion of crop. Newly planted trees can be painted on the trunk. Sulfur smoke bombs can only be used underground to control rodents. The natural botanical strychnine from *Nux vomica* is banned as a rodenticide because of its high toxicity and potential risk to non-target species. The only synthetic rodenticide allowed is vitamin D3, also known as cholcalciferol.

Diseases and Plant Pathogens

Organic farmers have a number of cultural and biological tools to protect the health of plants in addition to nutrition, rotation, and variety selection. Removal of diseased plant tissue, and roguing seriously or systemically infected plants offers another cultural means to reduce pressure from pathogenic organisms. Compost has been shown to have disease-suppressive capability, particularly for soil-borne pathogens. While there are fewer natural substances that are available for disease control than for pest management, there are still a few options. These include various clays, such as kaolinite and diatomaceous earth, certain EPA registered biological pesticides such as *Trichoderma* spp. and botanicals such as garlic and neem.

Fixed coppers exempted from the requirement of a pesticide residue tolerance by EPA can be applied as long as they are used in a way that minimizes copper accumulation in the soil. Among those that are allowed include copper sulfate, copper hydroxide, copper oxide, and copper oxychloride. Copper sulfate is often combined with hydrated lime to make Bordeaux mix. Sulfur and lime sulfur are two other fungicides allowed for use in organic production. Narrow range oils used as dormant, suffocating, and summer oils can be used for disease control as well as for insects and other pests. Hydrogen peroxide and potassium bicarbonate are two familiar substances that are relatively new as fungicides. Finally, growers with fire blight can use streptomycin, (in apples and pears only) and tetracycline (oxytetracycline calcium complex). Antibiotic resistance is a concern, so growers with fireblight are advised to prune and rotate antibiotics with other tools, such as copper.

Weeds

In survey after survey, organic farmers have identified weed management as their single greatest production problem, and the highest priority for research. Most organic farmers build a weed management program around tillage and cultivation practices. Most operations rely on hand weeding for at least some measure of control. For many intensive vegetable operations, labor for hand weeding will be the single greatest expense that an organic farm incurs. Crop rotation and planting competitive varieties are strategic management measures used to reduce weed pressure. Mowing is practiced mainly in perennial systems. More extensive operations can use livestock. Flame, heat, or electrical control are other options, but these methods generally require special equipment. Mulching with straw, leaves, or other fully biodegradable materials can smother weeds. Finally, the NOP Rule permits plastic or other synthetic mulches for weed control, with the provision that they are removed from the field at the end of the growing or harvest season. In general, synthetic substances are not permitted for weed control. The National List explicitly forbids a number of substances such as copper products and other micronutrients to be used as herbicides.

Wild Harvest

Wildcrafted herbs and wild-picked berries, and gathered mushrooms are the main crops that are wild harvested in the Western US. Plants gathered in the wild can be marketed as organic, provided that (1) the land from which they are gathered has not had a prohibited substance applied for three years prior to harvest, (2) the gathering of the crop is not destructive to the environment, and (3) the growth and production of the wild crop is sustainable. Throughout much of the Western US, wild harvested crops are mostly harvested from public lands. Agricultural professionals can assist wildcrafters by identifying and facilitating contact with the responsible public agency. Certification is a particular challenge given the vast areas covered and the lack of control that the operator has over the management of the land.

Livestock

Organic livestock production has four basic parameters: (1) organic livestock sources; (2) organically produced feed; (3) holistic health care; and (4) humane living conditions.

Stock Sources

The NOP Rule specifies the conditions under which dairy and breeding stock can be converted from conventional to organic production, and when an animal can be sold organically, depending on both its origin and the products produced.[13] In principle, organic animals are raised organically from birth. The NOP rule requires that non-poultry slaughter stock must come from organic breeding stock and be raised organically from the last third of gestation.[14] In the case of poultry, stock may come from any source and are raised organically beginning day one.[15]

Animals that produce milk or dairy products sold as organic must be under continuous organic management for at least one year. The rule contains an exception for entire new herds to be converted to organic production.[16] Breeder stock may be brought into the organic operation at any time before the final trimester of gestation.[17] The NOP rule prohibits livestock, edible livestock products, breeder, or dairy stock from being represented as organic if the animals are not under continuous organic management for the specified time requirements.[18]

Feed

Organic animals are required to receive a complete, balanced ration composed of organically produced agricultural products, including forage and pasture.[19] Organic livestock production is best integrated into the whole organic farming system and requires a connection of livestock to the land and surrounding vegetation.

Range and Pasture

One possible strategy used by mixed crop-livestock operations is to rotate pasture with crops. Organic producers have found that pasturing animals improves nutrition and health care. Rotation that includes a well-managed pasture for grazing animals can also help to cycle nutrients and control weeds for subsequent crops. While the NOP Rule specifically requires access to fresh pasture only for ruminants,[20] producers have also found nutritional, health, and crop benefits to pasturing non-ruminant animals as well. Most of the research on pasture-based systems has taken place in temperate humid climates. More research in animal nutrition is needed to find which grass and clover mixes offer the best forages on irrigated pasture for various Western climates.

Feedstuffs

The common operating assumption in much of the Western US is that animals are maintained in drylots and fed concentrated rations and dry hay, rather than pastured. The opportunity to rotate organic feed and forage crops is a potential benefit for the Western environment, given the extensive production of animal feed and forage. Wheat, barley, triticale, and berseem clover may all be more appropriate concentrates and hays than corn, soybeans, and alfalfa in the arid and hot regions of the Western US.

Additives and Supplements

[13] 7 CFR 205.236(a).
[14] 7 CFR 205.236(a).
[15] 7 CFR 205.236(a)(1).
[16] 7 CFR 205.236(a)(2).
[17] 7 CFR 205.236(a)(3).
[18] 7 CFR 205.236(b).
[19] 7 CFR 205.237(a).
[20] 7 CFR 205.239(a)(2).

A balanced diet requires that all nutrient requirements be met. However, it is often difficult in arid regions and areas with short growing seasons to consistently meet vitamin and mineral requirements. In general, all feed, feed additives, and feed supplements must comply with FDA regulations. Natural feed additives and supplements are permitted.[21] For example, mined minerals, enzymes, and probiotic organisms may be used in animal feeds. Synthetic vitamins and minerals also appear on the National List as feed additives, provided FDA approves them.[22] Such feed additives must be included in the Farm Plan, and the amounts fed must be for adequate nutrition and health maintenance for the species.[23]

A number of feeding practices are explicitly and categorically prohibited. Organic livestock producers must not use animal drugs, including hormones, to promote growth. Animals provided feed supplements or additives in amounts above those needed for adequate nutrition and health maintenance for the species at its specific stage of life are not eligible for organic certification. Plastic pellets cannot be fed as a source of roughage.[24] Feed formulas that contain urea or manure are also prohibited.[25] Given the concerns about BSE, organic mammals and poultry cannot be fed mammalian or poultry slaughter by-products.[26]

Health Care

The organic paradigm for health care relies on (1) the selection of appropriate breeds and types; (2) proper balanced nutrition; (3) appropriate housing, access to the outdoors, and sanitation; (4) stress reduction by the allowance of natural behavior and exercise; and (5) preventive measures such as vaccines and other inoculants. Prophylactic treatments, hormones, and antibiotics are categorically incompatible with organic practices.

Animals are treated with medications only when they are sick—indeed the standards make it illegal to withhold treatment from an ill animal. However, animals treated with a prohibited substance cannot have their products sold as organic. The animal must be diverted from organic production and the products must be sold through conventional channels. Veterinarians and other professionals who work with organic producers need to be aware that the Food, Drug, and Cosmetic Act (FDCA) takes precedent over OFPA for medications and internal parasiticides, and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) takes precedent over the NOP for external parasiticides.

Vaccinations are helpful preventive measures against such endemic diseases as bovine diarrhea and vibrio-lepto. No matter how well a producer manages a herd, animals still get sick in spite of all the preventive measures taken. Holistic veterinarians specialize in alternatives that do not rely on synthetic chemicals for treatment of animal illnesses. Traditional **herbal medicine, homeopathy**, **acupuncture, chiropractic,** and **probiotics** all offer alternative modes to veterinary treatments administered in conventional livestock production to counter the effects of illness, also referred to as <u>allopathic</u> medicine. These modes of animal health care need not be mutually exclusive. Each deserves consideration, criticism, and further exploration. However, organic animal husbandry has far more questions than answers. Organic standards go beyond food safety concerns. They also include issues of consumer acceptance, animal welfare, and resource management. In general, organic consumers expect organic animals to be both treated humanely and not treated with drugs. Organic producers may need to resort to allopathic methods in order to save the life of an animal. However, an animal treated with a prohibited substance loses its organic status.[27]

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[21] 7 CFR 205.237(a).
[22] 7 CFR 205.603(d).
[23] 7 CFR 205.237(b)(2).
[24] 7 CFR 205.237(b)(3).
[25] 7 CFR 205.237(b)(4).
[26] 7 CFR 205.237(b)(5).
[27] 7 CFR 205.238(c)(7).

Traditional **herbal medicine** is based on the use of botanical preparations to cure ailments. Many plants have healing powers that are documented and recognized by both practitioners and skeptics of modern Western medicine. Many farmers and their veterinarians have come to recognize the prophylactic and therapeutic benefits of many of the plants that commonly grow in pastures, on the edges of fields, and in rangeland. Animal husbandry throughout the world makes use of readily available local herbs to treat sick animals. Much of this lore has been lost with the development of Western medicine. Herb-based medicines have been used throughout recorded history, and show great healing potential. While organically produced herbs comply with the NOP rule when used as feed or feed supplements, it is important to recognize that commercial preparations that are marketed with health claims may not be sanctioned under the FDCA and thus their regulatory status may be questionable.

Homeopathy is the use of remedies that would produce the symptoms of the disease being treated in healthy animals. This is referred to as the principle of *"Similia Similibus Curentur"* or "like cures like." Homeopathic remedies are based on plants, minerals, drugs, viruses, bacteria, or animal substances that are diluted to the point where they are rendered harmless. When a large dose of a toxic substance is swallowed, it can produce death, but when a homeopathic, diluted, minute dose of the substance is given, it can save an animal's life. While the mode of action is not entirely understood, homeopathic remedies are thought by some to contain vibrational energy essences that match the patterns present in the diseased state within an ill animal. Homeopathy is a well-established field of veterinary practice commonly accepted in the organic community. However, professionals should be aware that the FDA officially regards homeopathic medicine to be a 'nontraditional' form of veterinary practice, and the legal status of various remedies is not always clear.

Acupuncture is also a long-established practice, based on traditional Chinese health care. Needles are inserted into the patient in a way intended to stimulate the body's adaptive–homeostatic mechanism. Treatment is viewed as complimentary with other forms of treatment. The physiological responses to the insertion of needles in various sites of the surface of the body have long been documented in both animals and humans. However the specific action remains to be fully understood. The primary aim of veterinary acupuncture is to strengthen the body's immune system. Acupuncture is also used as a technique to relieve pain and to stimulate the body and improve the function of organ systems.

Chiropractic can be used to treat a broad spectrum of conditions in animals through the manipulation of their spine, bones, joints, and muscles. The practitioner makes specific adjustments to vertebra in order to restore homeostasis.

Organic producers may treat their animals with **probiotics** consisting of a number of naturally occurring live microorganisms. Many probiotic organisms help to boost immunity, while others produce substances that are closely related to antibiotics, but in much lower concentrations. Some also appear to act as antagonists to pathogenic organisms. The FDA has been receptive to probiotics, and a number are FDA registered. As long as the organisms contained in these products are not genetically engineered, there is general agreement that prophylactic use is allowed without probiotics appearing on the National List.

Parasite Management

Parasite management and health care pose the greatest barriers to organic livestock production in the Western US. Parasites are generally managed by cultural methods. Routine use of parasiticides is prohibited.[28] Slaughter stock treated with parasiticides is not eligible to be sold as organic.[29] At present ivermectin is the only FDA registered internal parasiticides allowed for use in organic farming in the US, and that use carries with it a number of restrictions.[30] Like all other parasiticides, ivermectin is prohibited

[28] 7 CFR 205.238(c)(4).
[29] 7 CFR 205.238(c)(5).
[30] 7 CFR 205.603(a)(12).

for use on slaughter stock. Ivermectin is only allowed as an emergency treatment for dairy and breeder stock when organic system plan-approved preventive management does not prevent infestation.[31] Milk or milk products from a treated animal cannot be labeled as organic if it is taken within 90 days following treatment with ivermectin.[32] Breeder stock must be treated with ivermectin prior to the last third of gestation for their progeny to be sold as organic and young stock may lose their certification if nursing on an animal treated with ivermectin during the lactation period.[33] As with diseases, heavily infested animals are required by the NOP Rule to be treated and if treated with a prohibited substance must be diverted to conventional channels.[34]

Given the limited access to conventional parasite management tools, cultural and biological means are essential for successful animal production. Because of growing resistance of parasites to anthelmintics, even conventional producers cannot necessarily rely entirely upon parasiticides. Local concerns for parasite management vary widely and need to be taken into account. Breeding stock and fiber-producing animals–in particular sheep for wool–appear to have the greatest need in the Western US. Cattle, goat, and sheep production in warmer and wetter climates, such as the coastal areas may prove to be more difficult to manage without the use of parasiticides than is the interior.

Understanding the ecology, phenology, morphology, and genetics of parasitism in a broader context is crucial to develop a classical biological control program for internal parasites. Livestock host a broad array of organisms: many, if not most, are beneficial, a great number innocuous or obscure in their biological function, and only a few clearly pathogenic or parasitic to domesticated animals and humans. A wide variety of micro-arthropods, protozoa, viruses, bacteria, and fungi are potential biocontrol agents for nematode parasites of farm animals. The evolution of host-parasite relationships are believed to be the result of immunological phenomena.

The most promising alternatives to internal parasiticides require methods that disrupt the life cycle of the target organism outside the host. Rotational grazing, fecal examination, culling heavily infected animals, selection of resistant breeds, biological control at susceptible (usually free-living) stages in the life-cycle are all components of an overall strategy to break parasite-host cycles and maintain parasite loads to tolerable levels.

Producers can break the life-cycle of parasites by providing a sufficient host-free period. Strategies to break the host cycle include rotational grazing, spelled pastures, alternating sheep and cattle on pasture, or alternation between irrigated and non-irrigated pastures. Three systems of systems grazing that are commonly used to break the host cycle are characterized as (1) deferred grazing; (2) alternate grazing; and (3) alternate use.

Deferred grazing is a form of pasture rotation in which the pasture is rested for 6 months during the cool season and 3 months in the warm part of the year. Pastures are then tilled and replanted with infective larvae succumbing to the effects of UV light and desiccation.
Alternate grazing depends on the two or more species of grazing animals ingesting different parts of the forage and coincidentally ingesting each other's parasite larvae. To be effective, it is important for the animals to not serve as alternate hosts, and to have supplemental strategies when those species share common parasites.

[31] 7 CFR 205.603(a)(12).
[32] 7 CFR 205.603(a)(12).
[33] 7 CFR 205.603(a)(12).
[34] 7 CFR 205.238(c)(7).

Alternate use relies on intensive grazing of the pasture for a short period of time, leaving that pasture to the production of harvestable hay that when baled and removed takes away most of the parasite burden, and returning animals to the original pasture when new growth emerges after haying.

In conjunction with pasture management, there is evidence that organic farming practices such as green manuring and decreased emphasis on anthelmintic (dewormer) use increase the abundance and variety of coprophilic micro-organisms and arthropods in the dung of pasturing animals that, in turn, act to control fecal forms of intestinal parasites.

Cultural practices, such as fecal examinations of all incoming stock, routine fecal examinations of all animals, and culling heavily infested animals can help maintain levels of parasites within tolerable levels. Selection of livestock resistant to parasites is a long-term strategy that is limited in the short run by the availability and suitability of eligible breeding stock.

Live organisms applied outside of the animal are not considered drugs. Hyperparasites of the infective stage of nematodes can reduce fecal counts of nematodes of animals grazed on treated pastures. New methods are being developed in which new antiparasitic agents such as certain *Bacillus thuringiensis* (B.t.) isolates, *Penicillium* spp., *Streptomyces* species, among others are used. Such substances may not necessarily be considered nonsynthetic depending on how they are derived or if a synthetic analog of a natural compound is commercialized from the natural compounds that are the original subject of research.

While some claim that nonsynthetic herbal remedies, botanicals, and mined minerals have anthelmintic properties, most of these materials have not had their efficacy substantiated in controlled experimental trials. Pharmaceutical companies are in the process of screening a number of natural compounds derived both from plants and from micro-organisms. Whether traditional or novel, most of these alternatives are not FDA registered and may not be legal to prescribe or use for the purpose of controlling internal parasites.

Certain nonsynthetic and allowed synthetic materials are registered with EPA for parasite management. Botanical ectoparasiticides, such as pyrethrum, are nonsynthetic and are allowed for external application to livestock subject to the restrictions that they appear in the Farm Plan and not be used on a routine basis. Pyrethrum, copper sulfate, hydrated lime, and mineral oil also are used as synthetic external parasiticides. External parasiticides used on organic animals must be formulated with only natural or minimum risk (List 4) inert ingredients.

Hygiene and Sanitation

In general, teat dips and udder washes must be natural or on the National List. A number of commercial teat dips contain synthetic antimicrobials that are prohibited for use in organic production. Among those that are allowed are iodine, glycerin, and lanolin, as well as a number of vegetable oil bases. Chlorohexidine is allowed for use as a teat dip only when alternative germicidal agents and/or physical barriers have lost their effectiveness

Pain and Stress Reduction

Physical alternations are performed as needed to promote the animal’s welfare and in a manner that reduces pain and stress. Local anesthetics lidocaine and procaine are on the National List to help reduce pain. Chlorohexidine is also allowed for surgical procedures conducted by a veterinarian, as are a number of other topical disinfectants.

Living Conditions

Organic livestock producers are required to provide living conditions to accommodate the health and natural behavior of the animals that they raise.[35] The NOP Rule requires that all animals have access to the outdoors.[36] Ruminants are also required to have access to pasture.[37] Animals are also required to have access to shade and shelter, as well as exercise areas, fresh air, and direct sunlight.[38] The shelter must be designed to accommodate the natural maintenance, comfort behaviors, and opportunity to exercise.[39] In general, animals are expected to have adequate space to be able to stand up, lie down, turn around, groom, and engage in other behavior that is natural. Tie stall are generally considered inappropriate. Shelters are required to maintain a temperature level, ventilation, and air circulation suitable to the species. Equipment and facilities must reduce the potential for livestock to be injured. These must be suitable to the species, its stage of production, the climate, and the environment. Animals must have clean,dry bedding, and if the bedding can be eaten, then it is required to be organically produced.[40]

Animals may be confined only on a *temporary* basis and then only for the following reasons:[41]

(1) Inclement weather;
(2) The animal's stage of production;
(3) Conditions under which the health, safety, or well being of the animal could be jeopardized; or
(4) Risk to soil or water quality.

Manure Management

Organic farms maintain stocking densities, rotate grazing lands, and manage manure to sustain the resource, nourish the animals, and maintain soil and water quality. As with crop producers, the NOP Rule also requires that organic livestock operations manage manure to prevent contamination of crops, soil, and water and optimize the recycling of nutrients from manure.[42]

Cleaning Compounds

The materials used to disinfect livestock facilities must either be nonsynthetic or appear on the National List and used consistently with any restrictions. At present, the chlorine products sodium hypochlorite, calcium hypochlorite, and chlorine dioxide; hydrogen peroxide, and phosphoric acid are the only synthetic equipment and facility cleaners allowed.

Handling, Processing, and Labeling

Once the crops are grown or the animals are raised, they are ready for the organic market. Growers, packers, shippers, handlers, and processors must meet the standards for handling, processing, and labeling organic food. Organic food processing is beyond the scope of this practice guide, but as a general rule, agricultural products that are labeled as ‘organic’ must meet organic standards. While it is not possible to make non-agricultural products organic, it is very possible to make organic products nonorganic. This can be done by commingling organic and nonorganic agricultural products, or by contaminating an organic product with a prohibited substance.

[35] 7 CFR 205.239(a).
[36] 7 CFR 205.239(a)(1).
[37] 7 CFR 205.239(a)(2).
[38] 7 CFR 205.239(a)(1).
[39] 7 CFR 205.239(a)(4).
[40] 7 CFR 205.239(a)(3).
[41] 7 CFR 205.239(b).
[42] 7 CFR 205.239(c).

Handling Requirements

Operations that pack, ship, store, and sell crops other than their own are considered *handlers.*[43] *Commingling*[44] is generally a problem on split operations—ones that handle both conventional and organic products at the same facility. Split operations require a much greater degree of caution in handling commodities. Harvest equipment, packing lines, and storage facilities all need to be thoroughly cleaned before being used to handle organic products.

Materials such as floating aids used when post-harvest handling unprocessed agricultural commodities must be either nonsynthetic or appear on the National List. Packaging materials and storage containers are not permitted to contain synthetic fungicides, preservatives, or fumigants. Container, bins, and bags need to be made of food grade material that does not migrate into food. Reused bags and containers must be thoroughly cleaned. Organically produced products or ingredients cannot come into contact with prohibited substances remaining in the container from previous uses.

Post-harvest Pest Control

As with production in the field, *handlers*[45] are expected to rely first on management practices to prevent pest infestations that threaten stored crops. Exclusion or prevention of the pests from having access to the handling facility is one such practice. The pest habitat, food sources, and breeding areas all need to be removed. Environmental factors, such as temperature, light, humidity, atmosphere, and air circulation, all must be managed in a way that prevents pest reproduction. Any subsequent action taken to control pests is predicated on all of these positive management steps taking place.

Handlers may use lures, repellents and other materials with either nonsynthetic ingredients that are not prohibited or synthetic ingredients allowed for such purposes on the National List. Such products may be applied in direct contact with food provided they are labeled for such use and are not present as an ingredient in the final product. If allowed materials are not effective, a handling operation is then permitted to use any synthetic substance provided that the operator and certifying agent agree on the substance, the method of application and the measures taken to prevent contact with organic ingredients or products with the substance used.[46] Pesticide applicators and other professionals need to realize that synthetic pesticides that do not appear on the National List are prohibited, even if their use in a post-harvest handling facility does not automatically result in decertification. The operator is responsible to prevent pesticides from contacting the commodities. Products contaminated by prohibited substances may still lose their organic status if the levels exceed 5% of EPA tolerance.[47] Even residues that fall below that level may trigger an investigation and an operator who failed to take sufficient precautions to prevent contamination may also lose certification. Finally, any pest control materials required by Federal, State or local laws and regulations are permitted, provided that the handler take measures to prevent contact with organically produced products or ingredients.[48]

[43] The NOP Rule defines to handle as "[t]o 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." 7 CFR 205.2.

[44] Commingling is defined as "[p]hysical contact between unpackaged organically produced and nonorganically produced agricultural products during production, processing, transportation, storage or handling, other than during the manufacture of a multiingredient product containing both types of ingredients." 7 CFR 205.2.

[45] A handler is defined as "[a]ny person engaged in the business of handling agricultural products, including producers who handle crops or livestock of their own production, except such term shall not include final retailers of agricultural products that do not process agricultural products." 7 CFR 205.2.

[46] 7 CFR 205.271(d).

[47] 7 CFR 205.671(a).

[48] 7 CFR 205.271(f).

Labeling

Organic food ingredients that are labeled as 'organic,' or are used in products labeled '100% Organic' must be organic. Ingredients that comprise at least *95%*[49] of a product that is labeled as 'Organic' must also be organically produced. All non-agricultural substances used in or on organic food, whether synthetic or nonsynthetic, must be included on the National List of Allowed Synthetic and Prohibited Nonsynthetic Substances. Otherwise, any non-agricultural substance is prohibited.[50] Products with a minimum organic content of 70% can make a claim that the product contains specific organic ingredients, provided that the label does not make the claim that it is an organic product.

The NOP Rule applies not only to ingredients that are required to appear on the label, but also to any substance used in or on organic food. Processed products labeled as '100% Organic' must be processed only using processing aids that are organically produced.[51] Solvents, filtering aids, and other substances that have a technical functional effect are required to appear on the National List. All ingredients in products that bear an organic label—including the nonorganic ingredients in a 70%+ 'Made with Organic [specified ingredients]' claim—must not be produced or handled using Genetically Modified Organisms (known as 'excluded methods' under the rule), sewage sludge, and ionizing radiation.[52]

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[49] The 95% figure is calculated based on the net weight of the nonorganic ingredients excluding water and salt. 7 CFR 205.302(a).

[50] 7 CFR 205.105(c).

[51] 7 CFR 205.301(f)(4).

[52] 7 CFR 205.301(c) and 7 CFR 205.301(f)(1), 7 CFR 205.301(f)(2), and 7 CFR 205.301(f)(3) respectively.

Grass-roots organizations such as Oregon Tilth and Washington Tilth (both formed in 1974) pushed for more public research support for organic farming and often ended up conducting their own on-farm research in the absence of public support.

During the Carter Administration, Secretary of Agriculture Bob Bergland began to notice the organic farming movement, in part due to several studies done on the energy implications of organic farming in the wake of the 1974 oil embargo (Lockeretz, 1978). He commissioned a USDA study on organic farming by a team of scientists from across the country (USDA, 1980). The team was led by Dr. Robert Papendick, a USDA-ARS soil scientist based at WSU in Pullman, Washington. Dr. Papendick's team produced the "Report and Recommendations on Organic Farming," the first official acknowledgement that "modern" organic farming was viable and warranted serious research support. His presence at WSU helped to create an early foundation for faculty interest in organic farming at WSU. With the change in White House administration in 1981, the nascent organic farming attention within USDA was diverted elsewhere.

Yet the effect of the USDA report did not end there. The report provided important scientific legitimacy for organic farming, and this helped pave the way for the first symposium on organic farming at a scientific society meeting. The symposium on "Organic Farming" at the 1981 American Society of Agronomy Annual Meeting was the first of its kind and resulted in ASA Special Publication No. 46, "Organic Farming: Current Technology and Its Role in a Sustainable Agriculture" (Bezdicek et al., 1984). Several scientists from WSU were involved, and they began to attract graduate students to work on organic farming projects. One project, a paired farm study in the Palouse region (Reganold et al., 1987), was published in *Nature*, sending an important signal to fellow researchers that organic farming research was scientifically legitimate and acceptable to the leading peer-reviewed journals. At WSU, organic research projects and students were mostly found in the WSU Crop and Soil Sciences Department during the 1980s and 1990s. Scientists in other disciplines are now actively involved in organic farming research, including horticulture, entomology, and agricultural economics (Table 3).

In addition to research with an explicit focus on organic farming, considerable work has been done in the region on topics that directly benefit organic farmers. A good example is organic apple production, where control of the codling moth (*Cydia pomenella* L.), the key pest of apples in the region, was not very successful with available organic methods. The general move towards more Integrated Pest Management (IPM) induced researchers to look at the use of the codling moth sex pheromone to disrupt mating. Without mating, there are no eggs, and thus no larvae to make the "worms" in apples. Researchers at WSU and OSU did extensive work on the field development of this technique for IPM purposes (Brunner et al., 2001). It became commercially available in the early 1990s, and organic growers were some of the first adopters. The success of pheromone mating disruption is probably the single most important production breakthrough for the expansion of organic apple production in the region (Granatstein, 2000). Thus, it is difficult to accurately characterize how much public research was directly helping organic farmers when the term "organic" may not have been in the project description.

Current Body of Knowledge on Organic Farming

The historical research on organic farming helped pave the way for the rapid expansion of organic farming research today. Many more faculty have organic research projects today than five years ago. In a recent survey of WSU faculty (Miles et al., 2002), over 50 faculty responded and cited 90 projects (research and education) that were directly focused on organic farming or were applicable to organic farms. Pest management was the most common category, followed by soil management. This is a reflection of the extensive work on IPM and biological control, particularly for insect pests, that is of direct relevance to organic growers, and of the early work of soil scientists in organic farming research (e.g., soil health, organic matter management).

Soil and Water. The National Organic Standards (NOS) require growers to "maintain or improve soil and water quality." Extensive research in the region on soil quality, soil conservation, organic matter management, nutrient dynamics, cover crops, and management of organic amendments (e.g., Bary et al., 2000) provides a solid base for soil management on organic farms. Organic growers can find common ground with other growers around the strong interest on soil biology research, as evidenced by the 350 people who attended a one-day symposium on the topic in 2002 (http://www.puyallup.wsu.edu/soilmgmt/SoilbiologyWS.htm).

In Idaho, on-farm research on organic potatoes systems has been underway for over six years, focusing on nitrogen mineralization from compost, rapeseed meal, radish as a green manure crop, and commercially available humic substances (Seyedbagheri, 2000; Seyedbagheri, 2003). Studies at Oregon State University looked at the potential for minimum or no-till organic vegetable production (Luna, 2003).

Topics requiring more research include the transferability of fertilizer recommendations (based on commercial fertilizers) to organic farms, accuracy of tissue test critical levels, predictability of N release from numerous organic sources, and development of successful direct-seed organic systems. Organic farmers need to follow good management practices in utilizing organic fertilizer sources, as they can inadvertently contribute to water pollution without careful attention. Practices to protect water quality are well-developed in the Pacific Northwest based on numerous research and extension projects over the past two decades (e.g., Pacific Northwest Regional Water Quality Program, http://www.pnwwaterweb.com/).

Pest Management. Pest management remains a high priority for additional research, given the numerous crops grown in the region and the diversity of agroclimatic conditions. Organic insect pest management is well-developed for the tree fruit sector, and disease control is relatively simple in the irrigated regions. Alternatives to the reliance on sulfur as a fungicide are needed. Matching crop and location for inherently low insect and disease pressure represents an important strategy for organic farms, and thus organic growers in some areas have little problem with a given pest while growers in another area desperately need controls. The diversity in the region can dilute the critical mass for research on organic pest controls, especially given the declining research funding at the LGUs. However, more private companies are recognizing the market potential for organic pest management products and are investing in their own research and development. For example, Dow Agrosciences developed a spinosad insecticide in the late 1990s with a naturally occurring active ingredient. The commercial formulation, Success®, contained inert ingredients that are not allowed under the NOS. This product showed great promise for organic growers, and Dow reformulated it to meet the organic standards and introduced the product Entrust® in 2003.

The most widespread need in pest management is weed control on organic farms. Many organic farms struggle to find effective and affordable weed control strategies. Perennial weeds such as quackgrass (*Agropyron repens*) are particularly troublesome, and the traditional control method of intensive tillage is in conflict with the soil quality requirements in the NOS. More research is needed on strategies to reduce the soil weed seed bank, and to utilize cover crops and allelopathy effectively. Documentation is needed for the successful use of the many old and new mechanical and thermal weed control devices, including their adjustment, timing, and economics. Effective and commercially available biocontrol agents, such as insects and pathogens, are needed for key weeds, particularly perennials.

University of Idaho researchers (Brown and Morra, 1995; Brown and Morra, 1997; Eberlein et al., 1998) have studied the effects of several mustard varieties in rotations, as green manures and as applied meal in traditional wheat cropping systems of the Palouse. While the research was not originally geared toward organic systems the basic research has implications for weed and disease control in wheat systems and organic vegetable production. (Johnson-Maynard and Morra, 2002).

Entomologists at the University of Idaho have been leaders in both weed and insect biocontrol research for more than a decade. Many biocontrol agents for weeds in pastures and rangeland have been tested and released (McCaffrey, 1998; Cheyney, 2001). Again the research was not aimed at organic production but clearly applies where the particular weeds are a problem.

Numerous local, on-farm studies such as a 1999 project on weed control for organic basil (Idaho) often don't get published in scientific journals but contribute to the body of knowledge on alternative weed control strategies in organic systems (Parker-Clarke, 1999).

Knowledge of vertebrate pest management in organic systems is another weak area. No LGU faculty member in the region currently works on these pests. In particular, rodents can cause major economic loss in grain fields, hay fields, vegetable crops, and orchards. Organically approved control methods for rodents are few.

<u>Plant Breeding</u>. While much of our current knowledge of agronomic and horticultural management of crops is transferable to organic systems, there has been little plant breeding specifically for the conditions on organic farms. This work is just beginning, with vegetable breeding at OSU, wheat breeding at WSU, and regional blight resistant potato development. The increased emphasis on organic seeds in the NOS is encouraging development of organic seed production in the Pacific Northwest, a region already heavily involved in seed production. Organic seed production brings new challenges, particularly with seed-borne pathogens, seed quality, and seedling diseases. With an increase in organic seed production, we expect more interest and work on development of varieties and seed treatments tailored for organic farms.

<u>Mechanization</u>. Research on agricultural mechanization has often received less attention over the past decades as other technologies have taken precedence. However, organic growers can benefit from some aspects of precision farming, including water management, precision guidance for cultivation, and potential robotic assistance for certain labor-intensive tasks. Organic growers tend to be equipment innovators like most farmers, but often have more impetus to develop new tools due to the lack of other options.

University of Idaho has taken a lead in variety development and technology advancements supporting the use of biodiesel fuels (Peterson et al., 2002; Thompson and Peterson, 2002). This holds potential for future organic cropping systems in the PNW, especially in light of the simultaneous research focus on canola and mustard varieties as cover crops and green manures with both disease and weed allelopathic effects (Brown et al., 1991).

<u>Livestock</u>. The most overlooked area of research in the region is organic livestock production. Expansion of organic livestock in the Pacific Northwest has not been as dramatic as the expansion of cropland and has not drawn as much attention. However, with the NOS in place, demand for organic meats and dairy products is growing rapidly, and the need for organic livestock information, particularly health care, is strong. Veterinary medicine faculty in the region have had little involvement to date with organic livestock health care. Small acreage producers in southwestern Idaho have completed initial studies on developing a pastured poultry industry in Idaho. The findings indicate high grower and consumer interest, but state regulations on livestock processing remain a hurdle. The University of Idaho currently has little expertise to help these producers with poultry production issues, especially in the area of organic or pastured poultry systems.

<u>Food Quality</u>. Beyond production issues, there is tremendous public interest regarding the impacts of organic production on the nutritional and health-promoting qualities of foods. Well-designed studies are needed to begin to understand this topic and validate or refute the many claims in the media and

marketplace. There is ample evidence that organic production can lead to biologically meaningful changes in food composition (Heaton, 2001) but the effects are not consistent. Studies are needed to separate the combined variability of soil, fertility, crop variety, weather, and location from the core effects of organic management.

Systems Research. Discussion of organic research often includes an emphasis on systems studies conducted on certified organic land that has gone through the typical “transition” period (OFRF, 2003). WSU hosted a national conference on “Science and Sustainability” in 1994 to explore the opportunities and constraints for systems research. There are many more systems studies in the region today, particularly looking at direct seeding, and organic studies are now beginning. Several dryland grain systems studies focus on erosion control and may have limited transferability to organic farms. Recent new systems include direct seeding, organic, and perennial crops (Pullman, WA), and reduced tillage vegetable systems with rotation, cover crops, and water management (Prosser, WA). A current on-farm orchard systems study (apples) in the Yakima Valley, established in 1994, compares conventional, integrated, and organic production (Reganold et al., 2001). Tree growth, crop yield and quality, economics, energy use, and soil quality have all been monitored. A quantitative soil quality index was developed that shows the benefits of organic amendments and the losses due to tillage (Glover et al., 2000). An organic sweet cherry systems study was established at the OSU research center in Hood River in 2003.

The UI Parker Farm (Moscow, ID) has 2 acres in transition to certified organic status. Research will focus on diverse crop rotations that include mustard, which will in turn be used as a meal on vegetable crops and for biodiesel production. Similar research funded through the Organic Farming Research Foundation (OFRF) related to brassica meal application in organic systems was initiated last year on a certified organic farm near Moscow (Johnson-Maynard and Morra, 2002). WSU now has 13 certified acres and 6 transition acres at three research facilities, and several other locations are beginning organic systems studies as well.

Looking at the kinds of organic research projects that have been established, both component and system type studies, it is common to find a focus on “input substitution.” Such work is important in meeting immediate needs, particularly for the larger farms that are transitioning into organic production for the first time. But for the long term viability of organic farming, there needs to be more emphasis on agroecology and redesigning of agroecosystems to make them more self-regulating and less in need of intervention, be it for pest control or fertility enhancement. This is the frontier of organic farming research, and researchers in the PNW are just beginning to explore it. Organic farms can deliver certain benefits to society, such as improved soil quality, increased energy efficiency, less reliance on non-renewable resources, and reduced pesticide impacts. Which of these are inherent to organic systems? What mechanisms from organic systems can be utilized by all farms? Can organic systems be intentionally blended with integrated crop management to produce a more sustainable system? These kinds of questions should help drive future public research on organic farming.

Lessons Learned in Developing Organic Farming Research

While hindsight is often “20/20,” many of the early organic farming advocates and researchers had excellent acuity in their foresight. They could see some of the emerging issues related to modern agriculture and the potential for organic systems to mitigate them. However, their zeal often created significant friction with the mainstream research community. Researchers who had spent their careers as public servants solving problems in agriculture to provide safe, affordable, and abundant food were hearing how they were “poisoning the planet.” This “culture clash” clearly slowed the development of interest in organic farming research at LGUs. The lesson learned might be to begin the dialogue from a base of common values, of which there are many (e.g., protecting soil and water, maintaining rural community health), rather than from judgmental criticism that is bound to alienate the participants.

A few organic growers were able to interest researchers in the unique biological opportunity that their organic farms provided. This approach led to a number of successful collaborative projects in the Pacific Northwest that were effective in shifting research programs in a direction more supportive of organic farmer needs. Furthermore, the gradual acceptance of sustainable agriculture during the 1990s by the research community and agricultural industry also opened doors for organic farming research, as the parallels were easier to see. However, as organic farming advocates pushed public researchers for more attention to organic farming, they often failed to recognize the on-going work at the LGUs that was of direct benefit to organic farming. Parallel research in fields such as IPM, conservation tillage, and sustainable agriculture all helped expand the knowledge base of practices that were useful to organic farmers. Organic advocates sometimes failed to recognize research relevant to their needs (e.g., biological control studies) if the same researcher was also conducting studies on topics that did not fit the organic regime (such as chemical pesticides).

Another lesson relates to funding and impact, two important motivators for what researchers study. Money drives much of the research agenda at LGUs, and the USDA SARE program provided an early source of funds to begin supporting organic research. Other sources, such as the Organic Farming Research Foundation and the USDA organic transitions program, have expanded the base and the opportunity for researchers to start organic projects. The mandated IPM/biocontrol funds for the Washington Commission on Pesticide Registration also provided an important new source, and some commodity commissions are more open to organic projects.

Researchers were slow to work on organic farming in part because the land base was so small. It may have been hard to justify dedicating time and resources to a sector where the potential impact seemed very limited. With the expanded acreage, organic farming has a higher profile and the results of research have higher impact potential. A missed opportunity in the past was the understanding of potential benefits to all farms that can accrue from organic research.

A lesson we can continue to learn from is the tremendous crossover between organic and "conventional" farming systems. The crossover works in both directions. Practices pioneered on organic farms, such as compost and cover crops, are implemented on conventional acres, especially by growers who farm both conventionally and organically. Conversely, practices developed in the conventional arena, such as pheromone mating disruption for codling moth in apples, can play a critical role in solving problems on organic farms. Organic and conventional farmers both stand to benefit from research on both systems. Growers and researchers need to avoid polarization and "zero sum" thinking (if we fund organic, it robs from conventional) and see the mutual benefit from each type of research.

While systems studies are needed, we have learned more about their challenges. Organic systems studies face the same constraints as in other farming systems. Systems studies tend to be very costly due to larger plot size, numerous personnel for the various disciplines and parameters to measure, and the need for longer time frames. Thus, they are usually conducted in one location only, which can limit the extension of results across a region as agroclimatically diverse as the Pacific Northwest. There is and will be a continuing need for component studies to solve discreet problems faced by organic growers. With the trend of declining public research dollars, innovative research approaches are needed to help serve organic growers. Use of more on-farm documentation of existing organic farms can be a cost-effective and statistically valid approach, particularly when the research question requires a farm to have reached an equilibrium under organic management. New systems studies often spend the first three to five years, and the accompanying fiscal resources, going through the biological transition, which may not be relevant to the research question at hand.

We have learned that one-size research does not fit all needs. Systems and component studies can produce complementary results. The former may answer questions about the impacts of farming on the environment, usually over a long time frame. The latter may provide short-term help for growers with a specific production problem. Comparison studies (organic vs. conventional) can shed light on system performance but may do little to develop new practices for growers. How we allocate resources to these differing efforts is an important choice that needs broad-based input to serve the greatest need.

Outlook

Organic farming research appears to be gaining momentum in the Pacific Northwest. The number of researchers involved and projects funded is increasing. It is harder to predict how the organic acreage trends will change, and how this will impact research. There appears to be a leveling off of the expansion of larger-scale organic fruit and vegetable production in Washington, probably due to production increases outstripping demand increases, as well as competition from other regions and countries. In contrast, the number of small farm, direct market organic growers continues to increase, but a number of these growers are choosing not to certify due to dissatisfaction with the National Organic Program and thus they are less visible in the statistical profile of organic farming in the region.

The outlook for organic research in the region is positive, based on a number of recent developments. OSU faculty have formed an organic working group and are meeting with growers to determine research needs. OSU and WSU joined with Oregon Tilth and Washington Tilth (organic grower groups) to sponsor the first organic farming research symposium in the region in November 2002. Over 220 people attended, and fifty research and education projects were showcased during the successful poster session. WSU received a USDA special grant for organic cropping research which will hopefully continue for five years. Organic orchardists worked with WSU and the Washington Tree Fruit Research Commission to develop a set of research priorities, and several organic growers sit on the Commission. A B.S. degree in organic agriculture is planned for fall 2004 at WSU, an effort to train a future generation of organic researchers, educators, and practitioners. UI's Sustainable Ag Program and three UI faculty members have been partnering with the Idaho Organic Producers (now the Idaho Organic Alliance) to offer educational conferences and workshops for both sustainable and organic producers for the past five years. Many of the farmers involved in this organization are helping the University to identify potential organic research needs and directions.

Organic livestock has great potential for expansion in the Pacific Northwest, and there are significant research opportunities in support of this sector. The newly formed Center for Organic Education and Promotion, a part of the Organic Trade Association, will be pushing for more research on the relationship between growing practices and food quality in an effort to establish defensible claims about organic food benefits, and they are looking for research programs to partner with. With the implementation of the Conservation Security Program in the 2002 Farm Bill, there will be new opportunities to quantify the environmental benefits of organic farms in order to qualify for payments.

In closing, a final lesson we can continually learn is humility. For all our knowledge, we really cannot say whether organic farming is the evolutionary endpoint for contemporary agriculture, and researchers and the public should not assume this. Certainly, organic farming IS part of a major paradigm and practice shift in agriculture today. But as the noted sustainable agriculture leader and farmer from Iowa, Dick Thompson, likes to say, "The best way to farm has not yet been invented, and I reserve the right to change my mind tomorrow." Sustainability is the more defendable goal for all of agriculture. Research that furthers the sustainability of organic systems is needed. Public research that simply revolves around compliance with organic rules may be harder to justify. We should make sure our research probes the sustainability of all farming systems, including organic, so we can learn their strengths as well as their weaknesses, and strive to continually improve.

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Table 1. Acreage trends for certified organic land in the Pacific Northwest (USDA-ERS, 2002).

	1997	**2000**	**2001**	**% change 1997-2001**
Idaho	111,430	108,609	84,048	-25
Oregon	16,984	26,958	27,501	+62
Washington	11,459	37,731	34,238	+199
Pacific Northwest	139,873	173,298	145,787	+4
U.S.	1.347 mil.	2.029 mil.	2.344 mil.	+74

Table 2. Certified organic cropland in Oregon, Idaho and Washington in 2001 (USDA-ERS, 2002).

Crop Category	U.S. Total	ID	OR	WA
Grain	454,598	16,809 (20)[1]	1,100 (4)	2,739 (8)
Bean	211,405	840 (1)	nil	342 (1)
Oilseed	43,722	nil	nil	nil
Hay	253,641	41,184 (49)	4,400 (16)	5,136 (15)
Vegetable	71,677	nil	2,475 (9)	7,190 (21)
Fruit	55,675	840 (1)	1,925 (7)	9,244 (27)
Herb/nursery	14,599	nil	7,976 (29)	3,424 (10)
Other crop	197,085	5,043 (6)	4,125 (15)	3,081 (9)
Pasture	1,039,090	19,331 (23)	5,500 (20)	3,081 (9)

[1] Number in ( ) is the % of the total organic land in this category in each state. 'Nil' is used for crops less than 1%.

Table 3. Early "modern" organic farming studies in the Pacific Northwest.

1979	Kraten, Holland. Economic and energy performance, dryland grain farms, organic and conventional. WSU Agricultural Economics.
1982	Patten, Papendick. N and P flows, organic vs. conventional grain farms. USDA-ARS, WSU Crops & Soils.
1982	Moulton. Organic foods market study, Seattle. WSU Cooperative Extension.
1986	Goldstein. Alternative crops, rotations and management (conventional, organic, biodynamic) for dyrland farming. WSU Crops & Soils.
1987	Reganold, Elliott, Unger. Long-term effects of organic and conventional farming on soil erosion. Nature. 330:370-372. WSU Crops & Soils, USDA-ARS.
1992	Painter, Young, Granatstein, Miller. Alternative crop rotation enterprise budgets, including organic. WSU Agr. Economics, Crops & Soils.
1993	Reganold. Soil quality and financial performance of biodynamic and conventional farms in New Zealand. Science. 260:344-349. WSU Crops & Soils.
1995	Stark, Thornton. Sustainable potato production, rotations, cover crops, pest management, economics, organic farming practices. UI Aberdeen, WSU Horticulture.
1995	Carpenter-Boggs, Kennedy, Reganold. Compost comparison, organic and biodynamic. USDA-ARS, WSU Crops & Soils.

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Selected Books and References

Books

From the Sustainable Ag Network (www.sare.org):

- Managing Cover Crops Profitably.
- Building Soils for Better Crops.
- Steel in the Field: A Farmers Guide to Weed Management Tools.
- The Real Dirt: Farmers Tell about Organic and Low-Input Practices in the Northeast.

From University of California Agriculture and Natural Resources (http://anrcatalog.ucdavis.edu/):

- Organic Apple Production Manual.
- Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control.
- IPM handbooks (alfalfa, apples, citrus, cole crops, lettuce, potatoes, rice, stone fruit, small grains, tomatoes, walnuts).

From Canadian Organic Growers (www.cog.ca):

- Organic Field Crop Handbook. Canadian Organic Growers.
- Organic Livestock Handbook. Canadian Organic Growers.

Organic Farming. 1990. Nicholas Lampkin. 701 pp.

Sustainable Agriculture in Temperate Zones. 1990. C. Francis et al. J. Wiley and Sons, New York. 487 pp.

Ecological Management of Agricultural Weeds. 2001. M. Liebman et al. Cambridge University Press. 544 pp.

Organic Tree Fruit Management. 1998. Linda Edwards. Certified Organic Associations of British Columbia. Available from IFM, 1-800-332-3179.

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Albrecht, W.A. and C. Walters. 1975. *The Albrecht Papers*. Kansas City, MO: Acres.
A compilation of the published and unpublished research of a University of Missouri soil scientist who examined nutrient cycling and natural methods to maintain or improve crop nutrition through rotations and livestock grazing.

Baker, B.P., C.M. Benbrook, E. Groth, and K.L. Benbrook. 2002. Pesticide residues in conventional, IPM-grown and organic foods: Insights from three U.S. data sets. *Food Additives and Contaminants* 19(5):427-446.
Data on residues in fruits & vegetables labeled as 'organic,' foods making other ecolabel claims such as 'Integrated Pest Management,' and foods with no market claims regarding practices were compared using data from government and independent testing organizations. Organically grown foods consistently had fewer residues than the other categories.

Comparison of specific residues on specific crops found residue concentrations in organic samples were consistently lower than in the other two categories, across all three data sets.

Beers, Elizabeth H. Jay F. Brunner, Michael J. Willett and Geraldine M. Warner, eds. 1993. *Orchard Pest Management: A Resource Book for the Pacific Northwest*. Yakima, WA: Good Fruit Grower.
Covers all insect pests of orchards in the Pacific Northwest. Each entry includes common name, scientific name, introduction, hosts, life stages, life history, damage, monitoring, biological control, and management. Illustrated with color photos for most pests and diagrams of life cycle. Contains a section on the key natural enemies, and degree day tables. Probably the best single source of information on insect pests of deciduous tree fruits.

Benson, Laura and Robert Zirkel. 1995. *Organic Dairy Farming.* Gays Mills, WI: Community Conservation Consultants
This is one of the few publications that details organic dairy production, one that is long on practical experience. The majority is devoted to herd health considerations. Written before adoption of the NOP, it may not be current on some of the regulatory and certification issues.

Bezdicek, D.F., J.F. Power, D.R. Keeney, and M.J. Wright. 1984. Organic farming: current technology and its role in a sustainable agriculture. Madison, WI: American Society of Agronomy Special Publication #46.
The American Society of Agronomy sponsored the first ever symposium on organic farming at a professional society meeting in 1981 as a follow up to the USDA Organic Farming report of 1980. The symposium papers were compiled in this publication, and featured leading researchers from land-grant universities and the USDA-ARS.

Boeringa, R.,ed. 1980. Alternative Methods of Agriculture. New York: Elsevier.
From a Dutch report published in 1976: Describes various approaches to ecological agriculture, with a review of techniques, food quality, impact on the environment, yields, and research recommendations.

Bowman, G., ed. 1997. Steel in the Field: A Farmers Guide to Weed Management Tools. 1997. G. Bowman (ed.). Burlington, VT: Sustainable Agriculture Network.
A practical handbook that describes mechanical weed management. Based on interviews of of farmers, agricultural engineers, and university researchers. Describes in detail available equipment and its effective and profitable use while complying with erosion-prevention plans, residue conservation, and moisture loss.

Buck, Matthew and Jennifer Allen, eds. 2000. Sustainable Agriculture . . . Continuing to Grow. Proceedings of the Farming and Ranching for Profit, Stewardship & Community Conference, March 7-9, 2000. Portland, OR: Sustainable Northwest.
Western SARE sponsored a major regional conference to highlight a decade of research and education on sustainable agriculture in the western states from the perspectives of leading growers and researchers, many from organic agriculture. The book captures the diversity of agriculture in the Western US and provides insights regarding key sustainability principles and practices that apply to organic farms.

Burns, T. and C. Campbell, eds. 1979. *Practical Alternatives to Chemicals in Agriculture.* Saskatchewan: University of Regina.

Campbell, C.A., R.P. Zentner, H. H. Janzen and K.E. Bowren. 1990. *Crop Rotation Studies on the Canadian Prairies.* Ottawa, ON: Canadian Government Publishing Centre.
Agriculture Canada has carried out a number of long-term cropping systems experiments in the Canadian prairies, mostly dealing with dryland production. These studies have focused on the effects of crop rotation on productivity, soil conditions, pests, economics, and energy use. They provide invaluable insight for the development of organic dryland production systems that will be sustainable in the long-term.

Cavigelli, M.A., S.R. Deming, L.K. Probyn, and R.R. Harwood, eds. 1998. Michigan Field Crop Ecology: managing biological processes for productivity and environmental quality. East Lansing: Michigan State University Extension.
This publication is a well-crafted, beautiful, and technically and agronomically sound overview of biological agricultural systems management. While the information was primarily generated from research on agronomic cropping systems in Michigan, the principles are relevant to cropping systems in many regions. The information is meaningful to both farmers and agricultural professionals.

Clark, S., K. Klonsky, P. Livingston, and S. Temple. 1999. Crop-Yield and Economic Comparisons of Organic, Low-Input, and Conventional Farming Systems in California's Sacramento Valley. American Journal of Alternative Agriculture 14:109-121.
Results of a long-term farming systems trial with three treatments, including an organic system.

Coleman, Eliot. 1975. Biological Agriculture in Europe. Harborside, ME: Small Farm Research Association.

Cook, R. James and K.F. Baker. 1983. The Nature and Practice of Biological Control of Plant Pathogens. St. Paul, MN: APS

Cook, R. James and Roger J. Veseth. 1991. *Wheat Health Management*. St. Paul, MN: APS Press.
Probably the best single reference on the biophysical demands of wheat production, this handbook is easy to read and technically complete. It proposes the 4 A's of wheat production – Absolute (genetic potential), Attainable (environment constraints), Affordable (economic constraints), and Actual (net after pests, diseases, etc.). In designing biologically based production systems such as organic farming, this book provides the key foundations for success.

Cramer, Craig. 1986. *The Farmer's Fertilizer Handbook.* Emmaus, PA: Regenerative Agriculture Association.
Handbook presents information to evaluate soil fertility and determine amounts of nutrients to add. Contains useful information on nutrient credits from manures and legumes, and tips on how to reduce fertilizer costs by smarter management.

Crop Protection Branch, Alberta Agriculture, eds. 1989. Guide to Crop Protection in Alberta, Part 2, Nonchemical Control of Weeds, Insects, Diseases for Maximum Economic Yield. Edmonton: Alberta Agriculture AGDEX 606-2.
Publication is organized primarily by pest, with information on life cycle, reproduction, hosts, competition, and non-chemical control mechanisms. It applies to crops grown on the Canadian Prairies, similar to those grown in the Northern Plains of the U.S.

Curl, C.L., R.A. Fenske, and K. Elgethun. 2003. Organophosphorus Pesticide Exposure of Urban and Suburban Preschool Children with Organic and Conventional Diets. *Environmental Health Perspectives* 111(3): 377-382.

Drinkwater, L.E., P. Wagoner, and M. Sarrantonio. 1998. Legume-Based Cropping Systems Have Reduced Carbon and Nitrogen Losses. *Nature* 396: 262-265.
Agricultural systems and natural ecosystems differ in how carbon and nitrogen are cycled. This study reports the net balances of carbon and nitrogen from a 15-year study in which three distinct maize/soybean agroecosystems are compared. Quantitative differences in net primary productivity and nitrogen balance ecosystems do not account for observed changes in soil carbon and nitrogen. Use of low carbon-to-nitrogen organic residues to maintain soil fertility, combined with greater temporal diversity in cropping sequences, is suggested to significantly increase retention of soil carbon and nitrogen, which has important implications for regional and global carbon and nitrogen budgets, sustained production, and environmental quality.

Drinkwater, L.E., Letourneau, D.K., Workneh, F., Van-Bruggen, A.H., and C. Shennan. 1995. Fundamental Differences between Conventional and Organic Tomato Agroecosystems in California. *Ecological Applications* 5: 1098-1112.

Edwards, Linda. 1998. *Organic Tree Fruit Management.* Keremeos: Certified Organic Associations of British Columbia.
Written by an organic grower and former field consultant/researcher; contains practical information on management aspects of organic orchards, with numerous references and color photos. Relevant to growing conditions in the semi-arid irrigated regions of the Northwest.

Farrell, Kenneth R. et al. 1992. Beyond Pesticides, Biological Approaches to Pest Management in California. Oakland: University of California Agriculture & Natural Resources.
The University of California commissioned a Study Group to examine the history of pest management in the State's agriculture, both chemical and biological, and the potential to move towards greater reliance on biological control. Examines various pests, emerging tactics for biological control, and the constraints to their expanded use. Well-referenced and represents one of the more bold policy statements on pest management.

Flint, Mary Lou, et al. 1999. *Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control.* University of California IPM Program.
An illustrated guide to beneficial insects and other organisms that parasitize or prey upon various pests of the farm and garden.

Francis, C. 1990. *Sustainable Agriculture in Temperate Zones.* New York: Wiley.

Glover, J., H. Hinman, J. Reganold, P. Andrews. 2002. A Cost of Production Analysis of Conventional vs. Integrated vs. Organic Apple Production Systems. Pullman: Washington State University Agricultural Research Center Publication XB1041.
Seven years of economic data from a side-by-side comparison of conventional, organic, and integrated apple production are compiled in this research bulletin, starting with orchard establishment. The trial was located on a farm in the Yakima Valley in Washington State and was managed cooperatively among the researchers, growers, and consultants. The data allow a rare comparison of organic production to other management at this level of detail.

Granatstein, David and Elizabeth Kirby. 2002. *Current Trends in Organic Tree Fruit Production.* Wenatchee, WA: Center for Sustaining Agriculture and Natural Resources.

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Successful vegetable farmers do much more than produce vegetables; they also manage money, people, and natural resources effectively. This publication can broaden the knowledge and guide the planning of those who grow vegetables or are considering beginning a vegetable production business. Sustainable Vegetable Production from Start-Up to Market, introduces the full range of processes for moderate-scale vegetable production using ecological practices that minimize the need for synthetic inputs and maximize stewardship of resources. The book includes in-depth profiles of 32 vegetable producers. It provides practical information on such essential matters as selecting a farm site; planning and record keeping; marketing options; and systems for starting, planting, protecting, and harvesting crops.

Hanley, P.,ed. 1980. *Earthcare: ecological agriculture in Saskatchewan.* Saskatchewan: Earthcare Information Centre.

Heaton, Shane. 2002. Organic Farming, Food Quality and Human Health: A Review of the Evidence. Bristol, UK: Soil Association.
A report commissioned by the Soil Association to address conflicting research on the impact of organic food production on various food quality attributes. The author, a professional dietician from Australia, approached the project to learn whether the science supported using the principles with his clients. He evaluated over 90 comparison studies, set a number of criteria for valid comparisons across studies, and then analyzed the findings from this smaller group. Results were more consistent in favor of organic foods than in most previous comprehensive reviews. Yet the need for more rigorous experimental design at the outset is evident, as issues such as soil type, crop variety, and seasonal variation probably still confuse the results.

Hilander, S.K., ed. 1989. Proceedings of Alternative Energy Resources Organization (AERO) 1988 Soil-Building Cropping Systems Conference. Helena, MT: AERO.
Proceedings from a conference to explore what dryland farmers could do to improve their soil and their farm production with the use of more complex rotations, legumes, green manures, and other practices directly applicable to organic farming.

Hilander, S.K., ed. 1991. Proceedings of AERO's Livestock Health and Nutrition Alternatives: A Western States Conference (6-8 Dec. 1990, Bozeman, MT). Helena: Alternative Energy Resources Organization (AERO).
Presentations from livestock producers, researchers, and veterinarians that provide various viewpoints on "natural" animal health care, most of which apply to organic production.

Hoitink, H.A.J. and M.J. Boehm. 1999. Biocontrol within the Context of Soil Microbial Communities: a Substrate-Dependent Phenomenon. *Ann. Rev. of Phytopathology* 37: 427-446.

Howard, Sir Albert. 1947. *The Soil and Health.* N.Y: Devin-Adair.
An early examination of the depletion of the soil organic matter by techniques that rely on soluble salt fertilizers, contrasted with an examination of sustainable production carried out over centuries that rely on composted organic matter as the main soil amendment.

Jackson, W. 1980. *New Roots for Agriculture.* San Francisco: Friends of the Earth.
An ecological approach to prairie agriculture, with an examination of the feasibility of perennial grain production.

King, F.H. 1911. *Farmers of Forty Centuries.* Emmaus, PA: Rodale.

A University of Wisconsin soil scientist examined nutrient cycling and sustainable agriculture in China.

Klonsky, Karen, et al. 2002. Statistical Review of California's Organic Agriculture 1995-1998. Davis CA: University of California Agricultural Issues Center.

Klonsky, Karen, et al. Production Practices and Sample Costs for Organic Crops Series. Davis, CA: University of California Cooperative Extension.

Knorr, Dietrich, ed. 1983. *Sustainable Food Systems.* Westport, CT: AVI.
Proceedings of the sixth international conference on organic agriculture sponsored by IFOAM.

Koepf, H.H. et al. 1976. Bio-Dynamic Agriculture: An Introduction. Spring Valley, NY: Anthroposophic Press.

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Macey, Anne, ed. 2000. *Organic Field Crops Handbook*. Ottawa: Canadian Organic Growers.

Mäder, P., A. Flieβbach, D. Dubois, L. Gunst, P Fried, and U. Niggli. 2002. Soil Fertility and Biodiversity in Organic Farming. *Science* 296: 1694-1697.
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Magdoff, F. and H. Van Es. 2000. *Building Soils for Better Crops.* Burlington, VT: Sustainable Agriculture Network.

Marini-Bettolo, G.B., ed. 1977. Natural Products and the Protection of Plants. NY: Elsevier.

Matheson, Nancy, Barbara Rusmore, James R. Sims, Michael Spengler and E.L. Michalson. 1991. Cereal-Legume Cropping Systems: Nine Farm Case Studies in the Dryland Northern Plains, Canadian Prairies, and Intermountain Northwest. Helena, MT: AERO.
AERO conducted a series of case studies of dryland cereal farms across the Northwest where the growers were using more complex rotations that generally included a legume phase for soil improvement. Each case study described the general rotation along with supporting practices for pest management, moisture conservation, and marketing. The study presents the gross margin budgets (variable costs and gross income) for each farm.

McAllister, J.C. 1983. A Practical Guide to Novel Soil Amendments. Rodale Research Center Technical Bulletin. Emmaus, PA: Rodale Press.
Research on the efficacy of various microbiological inoculants, humic acid derivatives, and other amendments generally not explored in replicated field trials.

National Research Council. 1989. Alternative Agriculture. Washington, DC: National Academy Press.

Includes four case studies of organic farms and is believed to be the first serious examination of organic agriculture by the National Academy of Sciences. Organic farming was found to be profitable and protective of the environment. Research recommendations.

Oelhaf, R.C. 1978. *Organic Agriculture: Economic and Ecological Comparisons with Conventional Methods.* Montclair, NJ: Allanheld, Osmun.
An early study that describes the historic approaches to organic farming with an examination of the relative profitability and environmental impacts of the two different approaches, with a conclusion about the barriers to adoption of organic farming methods.

Parnes, R. 1990. *Fertile Soil, A Grower's Guide to Organic and Inorganic Fertilizers*. AgAccess/Fertile Ground Books.
A practical handbook that describes organic fertility methods, with useful tables that have data on the nutrient content of various fertilizers used by organic farmers.

Pauli, F.W. 1967. Soil Fertility: a Biodynamical Approach. London: Adam Hilger Ltd.

Pickett, Charles H. and Robert L. Bugg, eds. 1998. *Enhancing Biological Control Habitat Management to Promote Natural Enemies of Agricultural Pests*. Berkeley: University of California Press.
Addresses an important gap in the biological control literature by providing the first comprehensive summary of recent findings on habitat manipulation to control pests. Chapters cover habitat modification in such areas as fields, orchards, or vineyards, and along or near the perimeters of fields, including hedges or other uncultivated areas. Generalist and specialist natural enemies are described in full, as are theoretical and practical issues. Experimental designs for studying enhancement include a modeling study that explores how the dispersal of natural enemies interacts with the positioning of refuges.

Porter, P.M., D.R. Huggins, C.A. Perillo, S.R. Quiring, and R.K. Crookston. 2003. Organic and Other Management Strategies with Two- and Four-Year Crop Rotations in Minnesota. *Agronomy Journal* 95:233-244.

Rasmussen, P.E., H.P. Collins and R.W. Smiley. 1989. *Long-Term Management Effects on Soil Productivity and Crop Yield in Semi-Arid Regions of Eastern Oregon*. Pendleton, OR: Oregon State University Agr. Expt. Station Bulletin 675.
The long-term field experiments at the Pendleton, Oregon Research Center are the longest running trials in the Pacific Northwest. They have continuously monitored the impacts of various tillage, residue management, and fertility treatments since the 1930s. This bulletin summarizes the key findings, which provide insight to organic matter dynamics, soil quality, and productivity in a semi-arid wheat cropping system. The principles illustrated in this study are crucial for developing organic dryland cereal production in the region.

Reganold, J. P., J. D. Glover, P. K. Andrews, and H. R. Hinman. 2001. Sustainability of Three Apple Production Systems. *Nature* 410:926-930.

Reganold, J.P., A.S. Palmer, J.C. Lockhart, and A.N. Macgregor. 1993. Soil Quality and Financial Performance of Biodynamic and Conventional Farms in New Zealand. *Science* 260: 344-349.
Biodynamic farming practices and systems show promise in mitigating some of the detrimental effects of chemical-dependent, conventional agriculture on the environment. The physical, biological, and chemical soil properties and economic profitability of adjacent, commercial biodynamic and conventional farms (16 total) in New Zealand were compared. The

biodynamic farms in the study had better soil quality than the neighboring conventional farms and were just as financially viable on a per hectare basis.

Reganold, J. P., L. F. Elliott and Y. L. Unger. 1987. Long-Term Effects of Organic and Conventional Farming on Soil Erosion. *Nature* 330:370-372.

Rynk, Robert, ed. 1992. *On-Farm Composting Handbook (NRAES-54)*. Ithaca, NY: Northeast Regional Agricultural Engineering Service.
Probably the best single reference on composting. The handbook contains many practical diagrams and tables, formulas for creating compost recipes, description of various composting systems, ideas on site development, and more. The Appendices contain invaluable information seldom found in one place.

Santer, Lewis, ed. 1995. *BIOS for Almonds, A Practical Guide to Biologically Integrated Orchard Systems Management.* Davis, CA: Community Alliance with Family Farmers Foundation.
The BIOS (Biologically Integrated Orchard Systems) projects in California were very successful in eliciting grower innovation and adoption of more sustainable practices. This publication captures the learning from the BIOS efforts in almonds, but provides an excellent template for thinking about the system in any crop. Organized by the growing season, starting after harvest one year and ending at harvest the next. Covers many practices that can be used to increase the biological function and self-regulation of a perennial cropping system.

Sarrantonio, Marianne. 1991. *Methodologies for Screening Soil-Improving Legumes.* Kutztown, PA: Rodale Institute Research Center.
A practical guide to using inexpensive and simple techniques to evaluate legumes for their potential soil-improving ability. Appendices contain many useful tables.

Savory, Allan. 1988. *Holistic Resource Management*. Covelo, CA: Island Press.
A systems approach to managing natural resources. Most of the applications have been to animal grazing systems, but the approach can be used to address a wide range of resources and ecosystems.

Shirley, Christopher, Greg Bowman, Craig Cramer, et al. 1998. Managing Cover Crops Profitably. Sustainable Agriculture Network. www.sare.org/handbook/mccp2/index.htm
Detailed charts of cover crop characteristics and management, adaptation maps and essays on soil fertility, crop rotations, pest management and cover crop selection are followed by comprehensive chapters on 18 of the most commonly used and widely adapted cover crops for the continental United States.

Smith, M. et. al. 1994. *The Real Dirt: Farmers Tell about Organic and Low-Input Practices in the Northeast.* Burlington, VT: Sustainable Agriculture Network.
Describes management practices on successful organic farms, including soil, pest, crop, livestock, and marketing. Farmers write many chapters, and all are based on practical farmer experience.

Smolik, James D.,ed. 1993. Agronomic, Economic, and Ecological Relationships in Alternative (Organic), Conventional, and Reduced-Till Farming Systems (Bulletin B718). Brookings: South Dakota State University.
Summarizes one a comprehensive systems research trial that includes an organic farming system. Conducted on the western edge of the Corn Belt, the study found the organic systems to

perform the best over the wide number of parameters studied, including profitability, energy use, and environmental protection.

Sooby, Jane. 2003. State of the States: Organic Farming Systems Research at Land Grant Institutions 2001-2003, 2nd ed. Santa Cruz, CA: Organic Farming Research Foundation. www.ofrf.org/publications/SoS/SOS2/OFRF.SOS2.300dpi.pdf.
The Organic Farming Research Foundation polled the Land Grant Universities across the U.S. for the second time to compile current information on the status of organic farming research and education.Listings for each institution include production and marketing research projects, amount of certified organic research land, extension and education efforts, including various references and web sites.

Stonehouse, B., ed. 1981. *Biological husbandry: a Scientific Approach.* London: Butterworth.

Swezey, Sean L., Paul Vossen, Janet Caprile and Walt Bentley. 2000. Organic Apple Production Manual. Oakland: University of California Agriculture & Natural Resources Pub. #3403.
This is the first university manual on organic apple production, aimed at conditions in California. It is especially useful for harvest, post-harvest, marketing and economics.

Taylor, N. and Zenz, L., Eds. 1999. Organic Resource Manual for Washington, Wyoming, Montana, Oregon, Idaho, Utah (SARE Project EW-96.006) Olympia: Washington State Department of Agriculture, Organic Food Program.
agr.wa.gov/FoodAnimal/Organic/docs/OrganicResourceManual.pdf
Provides a quick introduction and overview to the main elements of organic farming, including the regulations (pre-NOP) and production aspects. Has an excellent collection of references in the Resource Section.

University of California. *IPM Handbooks*. Oakland: University of California Agriculture & Natural Resources.
Each handbook covers Integrated Pest Management techniques for a different crop. Series includes most economically significant crops. Covers cultural and biological control techniques compatible with organic farming systems.

USDA. 1980. *Report and recommendations on organic farming.* Washington: USDA
The first official report on organic farming published by the USDA, after studies showed the potential of organic farms to use less energy. The study team consisted of leading USDA and university scientists from across the country, who conducted case studies, surveys and interviews, reviewed the published literature, and visited organic farms in Europe and Japan. The findings suggested that organic farming was scientifically valid, economically viable, and a modern form of agriculture.

Walters, C., Jr., and C.J. Fenzau. 1979. *An Acres, USA Primer.* Raytown, MO: Acres USA.

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Organic Farming Compliance Handbook: A Resource Guide for Western Region Agricultural Professionals was developed with funding from the Western Region USDA SARE program. Online version of the resource guide available at http://www.sarep.ucdavis.edu/organic/complianceguide/

References for Organic Standards and Related Regulations

Federal

USDA National Organic Program
www.ams.usda.gov/nop/indexIE.htm
Phone: 202-720-3252

National Organic Standards Board
www.ams.usda.gov/nosb/index.htm
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The Center for Food Safety and Applied Nutrition of the Food and Drug Administration
vm.cfsan.fda.gov/list.html

The Center for Veterinary Medicine of the Food and Drug Administration
www.fda.gov/cvm/default.html

US Environmental Protection Agency
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agr.wa.gov/FoodAnimal/Organic/default.htm

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wyomingbusiness.org/home/index.cfm

Other US

The Association of American Feed Control Officials (AAFCO)
www.aafco.org/

The Association of American Plant Food Control Officials (AAPFCO)
www.aapfco.org/

The **US Composting Council (UCC)** is a non profit (501.c.6) national organization dedicated to the development, expansion and promotion of the composting industry based upon science, principles of sustainability, and economic viability.
www.compostingcouncil.org/index.cfm

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