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 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

[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).

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. 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

Some non-renewable resources may be used as a supplement to nutrient cycling. 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

[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).

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 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

[9] 7 CFR 205.602(h).

[10] 7 CFR 205.602(g).

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

[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.

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 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 as of August 2004 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. Other options include flame, heat, or electrical control 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

Wild crafted 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 wild crafters 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

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

[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).

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 allopathic 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]

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.

[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).

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.

A number of synthetic allopathic medications appear on the National List, but these are subject to restrictions. None may be used to treat an animal in the absence of illness.[28] Several require withdrawal times longer than the label instructs.[29] Where Federal law restricts use by or on the lawful written or oral order of a licensed veterinarian, the NOP also requires use by or on the lawful written order of a licensed veterinarian.[30] Excipients must Generally Recognized As Safe (GRAS) by the Food and Drug Administration (FDA), used in food, or are part of a New Animal Drug Application or New Animal Drug Application (NADA) that is approved by FDA.[31]

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.[32] Slaughter stock treated with parasiticides is not eligible to be sold as organic.[33] 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.[34] Like all other parasiticides, ivermectin is prohibited 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.[35] Milk or milk products from a treated animal cannot be labeled as organic if it is taken within 90 days following treatment with ivermectin.[36] 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

[28] 7 CFR 205.238(c)(2).
[29] 7 CFR 205.603(a), entries for Atropine, Butorphanol, Tolazine, and Xylazine.
[30] 7 CFR 205.603(a). Entries for Atropine, Butorphanol, Magnesium hydroxide, Tolazine, and Xylazine.
[31] 7 CFR 205.603(f).
[32] 7 CFR 205.238(c)(4).
[33] 7 CFR 205.238(c)(5).
[34] 7 CFR 205.603(a)(12).
[35] 7 CFR 205.603(a)(12).
[36] 7 CFR 205.603(a)(12).

with ivermectin during the lactation period.[37] 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.[38]

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.

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* (Bt) 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.

[37] 7 CFR 205.603(a)(12).
[38] 7 CFR 205.238(c)(7).

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.[39] The NOP Rule requires that all animals have access to the outdoors.[40] Ruminants are also required to have access to pasture.[41] Animals are also required to have access to shade and shelter, as well as exercise areas, fresh air, and direct sunlight.[42] The shelter must be designed to accommodate the natural maintenance, comfort behaviors, and opportunity to exercise.[43] 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.[44]

Animals may be confined only on a *temporary* basis and then only for the following reasons:[45]

(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.[46]

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.

[39] 7 CFR 205.239(a).
[40] 7 CFR 205.239(a)(1).
[41] 7 CFR 205.239(a)(2).
[42] 7 CFR 205.239(a)(1).
[43] 7 CFR 205.239(a)(4).
[44] 7 CFR 205.239(a)(3).
[45] 7 CFR 205.239(b).
[46] 7 CFR 205.239(c).

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.

Handling Requirements

Operations that pack, ship, store, and sell crops other than their own are considered *handlers*.[47] *Commingling*[48] 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*[49] 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 nonsynthetic active 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.[50] 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.[51] 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.[52]

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[47] 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.

[48] 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.

[49] 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.

[50] 7 CFR 205.271(d).

[51] 7 CFR 205.671(a).

[52] 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%*[53] 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.[54] 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.[55] 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.[56]

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

[54] 7 CFR 205.105(c).

[55] 7 CFR 205.301(f)(4).

[56] 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.