part 2

organic
growing basics

Organic Growing Basics

In this section of the resource guide we present a brief description of some of the principles/ methods of organic farming. The requirements for soil, crop and livestock management as well as record keeping and marketing considerations are outlined. For full details on the standards that apply to your farm, we suggest that you obtain a copy of the standards from your certifying body.

Understanding the Soil

The soil is a living entity, an ecosystem containing a wide variety of different flora and fauna which fulfil myriad different roles.

(Organic Farming, Nicolas Lampkin).

Successful organic farming systems are built on a foundation of healthy soils. Organic farmers recognize that the soil itself is a living organism to be nourished and protected. An understanding of soil - its composition, function and care - is essential to achieve success in organic farming. Many authoritative books have been written exclusively on the subject of soil.

Healthy Soil

The basic principle to keep in mind is that the soil is composed of a number of elements which, when in appropriate balance, constitute a healthy growing medium for plant life. These elements include:

- living organisms (micro-organisms, soil-dwelling animals, plant roots)
- minerals
- soluble plant nutrients (e.g. nitrate, phosphate, calcium etc.)
- air
- water
- “new” organic matter (recently incorporated crop residues and manure)
- humus (organic matter which has been converted to a stable form by soil organisms)

Challenges

The challenge for the organic farmer is to manage these components of the soil system so that:

- crop growth is optimized
- pest, disease and weed problems are minimized
- environmental impacts of farming (e.g. soil erosion and nutrient leaching) are minimized
- energy inputs are used efficiently
- soil health is maintained/improved

If any of these goals is not being achieved, this an indication to the farmer that some aspect of the soil management program needs to be adjusted.

Green Manures and Organic Inputs

Green manures, also known as cover crops, are an essential and versatile tool of organic farmers. As opposed to cash crops, green manures are grown simply for their effects on the soil, weeds and pests. These crops are sometimes referred to as plowdown crops, because they are never harvested, but rather are incorporated into the soil. Green manures, compost, mulch, crop residue, seaweed or other organic amendments that increase soil organic matter, improve the diversity of the soil community and improve the overall quality of the soil for plant growth.

Green manures perform several valuable roles in the farm and garden including:

Providing nitrogen

Legume green manures can fix nitrogen from the air, and make this available to following crops. Examples include white clover, field peas and fava beans.

Add organic matter

Fibrous green manures, such as mature cereals and grasses, can increase levels of soil organic matter. Examples include oats, fall rye and annual ryegrass.

Weed control

Fast growing green manures can provide excellent weed control, competing with both annual and perennial weeds. Examples include buckwheat, annual ryegrass and fall rye.

Retain nutrients

Fast growing green manures that act as 'heavy feeders' can take up excess nutrients, prevent the nutrients from being leached out of the soil, and make them available for following crops. Examples include buckwheat, oilradish and fall rye.

Reduce erosion

By providing ground cover, dense stands of green manures can protect the soil from erosion. Examples include white clover, annual ryegrass and hairy vetch.

Reduce pest problems

Green manures can reduce pest problems by disrupting pest cycles, making it more difficult for pests to find crops, and providing habitat for beneficial organisms. Examples include phacelia, buckwheat and sweet clover.

In addition to a huge range of available green manures, there are also many different techniques used to incorporate organic matter into the soil. Green manures can be grown as solid stands, or can be overseeded into cash crops for example. Crops can also be incorporated into the soil while they are growing, or they can be allowed to winterkill, leaving crop residue on the soil surface.

Before deciding which green manure to use, farmers should consider several factors:

- their main objective in using the green manure
- the potential of the green manure to harbour pests or diseases that may affect following cash crops
- their ability to ensure that following crops are not affected by allelopathic suppression
- their ability to control the green manure to avoid competition between the green manure and cash crops
- the cost of seed and labour

Green manures can be used in both gardens and farms. Details about using these valuable crops can be found in many farming and gardening books and websites.

Soil Management Techniques

A variety of management techniques, combined in a variety of ways, promotes the sustainable use of the land for production and the environment, while improving soil quality. Some soil management techniques used by organic farmers include:

- use of compost and composted manure[4]
- use of green manure crops
- use of cover crops (to prevent nutrient leaching and soil erosion)
- use of deep-rooted plants to draw deep-lying nutrients toward the surface
- crop rotations
- additions of slowly available nutrient sources such as rock powders
- avoidance of over-cultivation and excessive use of heavy equipment
- erosion control (including windbreaks, cover crops, mulching)
- soil testing, particularly to monitor soil organic matter levels and pH

The incorporation of most of these techniques into the farm's land management program is essential for the maintenance of a healthy productive soil. Soil management practices are noted in the certification process and poor soil management is a valid reason to deny certification. Many certifying bodies require the 'development and implementation of a conscientious soil building program designed to enhance organic matter and encourage optimum soil health' (IFOAM).

Compost and Manure Use on Organic Farms

I have the highest regard for composted organic matter as a long-term soil builder...Well-made compost has been shown to have plant-growing benefits far in excess of its simple "nutrient analysis" and to be an active factor in suppressing plant diseases and increasing plant resistance to pests.

(The New Organic Grower, Eliot Coleman)

Compost is the basis of many organic farmers' soil management program. Compost is organic material which has been converted to a stable form by micro-organisms. The resulting product resembles soil humus. It can be added directly to the soil and provides many benefits.

The benefits of compost

- it acts as a slow release nutrient source
- it improves soil structure thereby improving resistance to soil erosion
- it improves soil aeration and drainage
- it improves soil water holding capacity by acting as a "sponge"
- it provides food for soil organisms
- it inoculates the soil with a population of healthy micro-organisms

4. There are some restrictions on the use of manure, check your standards for details.

The composting process has often been referred to as more of an art, than a science. Organic materials are mixed together and formed into a pile or a windrow. Micro-organisms present in the material, or added to the pile as starter cultures or in handfuls of soil, go to work digesting the organic matter. The energy released by the organisms creates heat, which can raise the internal temperature of the pile up to 60°C. This heat serves to sterilize the pile's contents: weed seeds, parasites and pathogens in the raw organic material are neutralized. It has also been suggested that the composting process can neutralize pesticide residues in the organic material. Eventually the temperature of the pile cools down. If the materials are mixed again, and the outer portions of the pile moved to the centre, the heating process can be repeated. This may occur two or three times before this phase of composting is complete. The final product should smell "earthy" and bear no resemblance to the initial raw materials.

Key elements of a successful compost system

- a suitable mix of raw organic matter to ensure good porosity, structure and particle size
- a suitable carbon:nitrogen ratio in the compost ingredients
- adequate moisture
- regular aeration of the pile, to stimulate microbial activity and prevent nutrient loss from overheating

Because well-made compost is free of harmful pathogens, weed seeds and parasites, it is considered a relatively safe product for use directly on the soil. Most of the soluble nutrients which may be found in the raw materials used to make compost, will have been converted to more stable, organic forms. This reduces the likelihood of environmental pollution from the use of compost.

Compost can be made from any organic material. Common inputs used by organic farmers are fresh manure, livestock bedding, vegetable wastes, leaves and straw, etc. When producing compost from off-farm inputs, it is wise to obtain approval for the inputs from the certifying body before proceeding. There are also a number of composts available in the marketplace. Some of these products are certified organic and would be suitable for use on an organic farm. Municipal solid waste compost is often available for free; however, this material is restricted and its use on an organic farm is subject to approval by the certification body. Applications of sewage sludge are prohibited.

Manure Use

There is often confusion surrounding the use of manure in organic farming systems. Ideally, all manure used on organic farms should be composted. If manure has been turned and free of internal frost for at least six months prior to application, most certifying bodies allow its unrestricted use.

Occasionally, farmers may use "fresh" or "raw" manure, but stringent restrictions are placed on its use. These are due to the presence of high levels of soluble nutrients in fresh manure and also concerns about pathogen and parasite levels in the manure.

Restrictions on manure use include:

- for known nitrate accumulators such as leafy greens, radishes, and beets, manure may not be applied less than four months before planting and the soil must be sufficiently warm and moist to ensure active microbial digestion
- manure use is permitted on perennials or crops not for human consumption
- manure can be applied to crops for human consumption if the crop is not to be harvested until at least four months after application
- the soil temperature must be at least 10°C and moist when the manure is applied to ensure active microbial digestion

The recently published Canadian National Standard only allows fresh manure from certified organic sources to be used. All other manure used on the farm must be composted. It is best to check with your certifying body for specific requirements relating to the use of non-composted manure. If at all possible, a system should be developed for composting manure before using it on your farm or garden.

Crop Rotations

Rarely are the principles of crop rotation applied as thoroughly as they might be in order to garner all of their potential benefits. To my mind, crop rotation is the single most important practice in a multiple-cropping program.

(The New Organic Grower, Eliot Coleman)

The "rotation of non-perennial crops in accordance with accepted regional organic practices" is listed as one of the required practices in 'organic standards'. It would be impossible for a farm using monoculture practices to qualify for organic certification. In many cases the two or three year crop rotations commonly used on a conventional farm, will not work effectively in an organic system. Five to ten year rotations are commonly used on organic farms, often involving three to five years of forage crops.

Crop rotation is necessary in organic systems for the following reasons:
Breaks pest and disease cycles

Rotating crops breaks pest and disease cycles. It is one of the primary components of a pest management strategy on organic farms.

Weed control

A well-designed crop rotation breaks weed cycles by alternating planting times, e.g. winter cereals alternate with spring cereals, and every few years perennial forages will be planted for 3-5 years.

Promotes a diverse, healthy ecosystem

A healthier soil ecosystem exists when a variety of crops are grown. Different crops promote the growth of different types of soil organisms. This results in greater diversity in the soil ecosystem and reduces the likelihood of a pathogen, nematode or fungus from becoming detrimental to crop growth.

Soil building

Soil building crops can be included in crop rotations. These crops include hay and pasture, especially when nitrogen-fixing legumes are planted. Green manure crops, grown solely for their soil building capacity, can be included in rotations.

Nutrient conservation

Nutrients can be conserved when crop rotations which include "catch crops" and "cover crops" are used. The catch crops are grown after harvest of the main crop, for the sole purpose of "mopping up" any excess nutrients remaining in the soil. Cover crops, which are grown sometimes for a whole season, also reduce losses of nutrients from the soil system, while at the same time competing with weeds.

Balancing nutrient uptake

Crops with different nutrient needs can be grown, for example deep-rooted crops which access nutrients from the lower soil horizons can be rotated with shallow- rooted crops. Crops also have different levels of nutrient demand, so that "light feeders" can be planted after "heavy feeders".

Economic stability

Greater economic stability can be achieved when a variety of crops are grown for the market. Even if one crop does not grow well in a given year, there are other crops available for market.

There is no single formula which organic farmers use when designing their crop rotations. Consideration must be given to all of the reasons for crop rotation listed above, so that a workable system for each individual farm or garden is produced. Consult with your certifying body, other organic farmers, and the references listed at the end of this manual, when designing a crop rotation for your farm or garden.

Weed Control

Dealing effectively with weeds is probably one of the biggest challenges facing organic farmers. When weeds get ahead of the crop, competition for light, nutrients and water can result in significant reductions in crop yield. Yet, if the crops are ahead of the weeds, weeds can actually benefit crops in many cases. To quote an old adage "know your enemy". Knowing what the drawbacks are and knowing the benefits can help an organic farmer decide what the best course of action is to give the most benefit to the crop, the environment and the soil.

The first line of defence in weed control is maintaining healthy plants and healthy soil. Healthy plants can often successfully compete with weeds.

Positive attributes of weeds

While organic farmers recognize that weeds can be a problem on their farm, they also recognize their positive attributes:

- they act as indicators of soil health
- they protect the soil from erosion and leaching
- they help provide shade and retain moisture

- they contribute organic matter to the soil or compost system when uprooted and recycled
- some weeds have long tap roots which bring up nutrients from deep in the soil
- some fix nitrogen
- some are edible
- some are medicinal
- they act as habitat for beneficial organisms, increasing biodiversity

Preventative Measures

The key with weed control, as with so many other aspects of organic production, is to maintain balance. The objective is not to have a completely weed free farm, but rather to ensure that crop growth is not hindered by weed competition. Weeds are best managed using a preventative approach. This includes the use of:

Crop rotation

Different crops favour different weeds and changing crops alters growing conditions for weeds. For example, weeds which thrive in carrots (e.g. Queen Anne's lace) are rarely found in mesclun mixes.

Cover crops (green manures)

Out compete weeds for light, water and/or nutrients, e.g. buckwheat, oats, rye and rye-grass are all excellent at competing with weeds.

High seeding rates

This is done to achieve a high density of plants.

Competitive cultivars

Particularly taller varieties of crops.

Mulching

The area is covered with mulch or a sheet of black plastic for up to two months, thereby killing the weeds from lack of sunlight. It can also protect the soil and prevent weeds from establishing to begin with.

Intercropping

Also called companion planting, overseeding or underseeding - reduces the amount of light and nutrients available for weeds.

Allelopathic crops

These are plants that produce a compound that inhibits the growth of another plant, e.g. fall rye suppresses many weeds.

Judicious scheduling of planting times

Timing is a crucial component of weed control. While it is relatively easy to control weeds at the seedling stage using hand or mechanical cultivation, when they have grown to full size, removal becomes much more time consuming. Never leave the weeds until they have reached the seed stage. The weed seed bank in the soil needs to be steadily reduced with each year of cultivation. Allowing a crop of weeds to drop its seeds on the soil can set your weed control program back by years.

Further intervention with weeds

While the above-mentioned cultural practices should be the first line of defence against weeds, in some cases, more intervention is required to control weeds. Some other permissible methods include:

- mechanical cultivation (turning over the soil kills most existing weeds, while avoiding excessive cultivation)
- hand-weeding
- flame weeding (which burns weed seedlings above ground before the crop seedlings appear and at certain stages of crop growth)

Remembering the Good in Weeds

As said, the farmer is well off to remember the benefits of weeds. Weeds provide habitat for beneficial organisms, provide ground cover and improve soil quality. Leguminous plants, like clover, add nitrogen to the soil, while others add organic matter. Weeds can carry nutrients from deep in the soil to the surface and can help prevent erosion, improve soil structure and fertility. Finally, many weeds can be used as food and for medicinal purposes and are cultivated in their own right for just these purposes.

Pest Control

Organic farmers tend to have few problems with pests. Many of the strategies used by organic farmers for weed control are also useful for pest control. The objective, as with weed control, is not to completely eradicate plant pests, but rather to ensure that the crops are vigorous and healthy enough to withstand mild insect infestations. It should be recognized that pests are food sources for beneficial organisms such as birds, frogs, toads and bats, all of which are vital components of a healthy farm ecosystem.

A diverse agro-ecosystem is the best way to ensure that crops are not plagued by pest problems. Organic farmers use a combination of various preventative measures to attain this beneficial diversity and to give crops the upper hand when pests do appear.

Measures to increase biodiversity and decrease pest problems:

- using crop rotations to break pest cycles
- using physical barriers such as floating row covers to protect the crop
- intercropping or strip-cropping using crops with different pest families
- including wildlife habitat on the farm which can act as a breeding ground for beneficial organisms and birds

- judicial timing of planting so that vulnerable stages of plant growth do not coincide with peak populations of pests
- avoiding excessive levels of soluble nutrients in the soil (which leads to increased vulnerability to pest problems)

In the case of severe pest infestations, certain pest control products are allowed. These include insecticidal soaps and botanical insecticides, rotenone, dormant oil and diatomaceous earth, and microbial insecticides such as Bt (Bacillus thuringensis). It should be noted that rotenone and botanical insecticides are only used under certain restrictions. Over-reliance will lead to loss of certification. See your certifying body's materials list for allowable pest control practices.

Disease Control

No single strategy is likely to be successful on its own...disease control relies on the effectiveness of interactions between many factors...rather than 'What substance can I use against such and such?'

(Organic Farming, Nicolas Lampkin)

As with weed and insect control, high biodiversity on the organic farm and the slow release of nutrients from compost produce crops that tend to be more resistant to and/or have fewer problems with disease than conventional crops. Most of the measures used to prevent disease in organic farming are matters of general practice for a variety of other reasons, such as soil health.

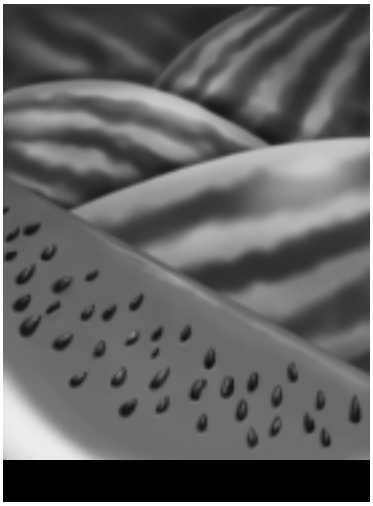
Plant diseases are caused by bacteria, fungi or viruses. They can be spread by insects, the wind, the soil, mechanical means, the plants themselves, or even the grower. Bacterial diseases are most prevalent during hot, humid weather when bacteria in the soil multiply freely. Fungal diseases are responsible for most problems in northern locations, generally preferring cool, damp weather. Viral diseases are highly infectious and are often spread by aphids and beetles.

Organic farmers use a variety of strategies aimed at 'preventing' diseases from occurring to begin with. Once a disease outbreak occurs in a crop, the range of options for treatment in organic farming systems is limited. Some of the preventative measures used by organic farmers include:

- choosing disease-resistant plant varieties
- breaking up the disease cycle through crop rotations
- removing plant debris, especially diseased plants, and properly disposing of this material by burial, composting or feeding to livestock
- building soil fertility and promoting a healthy soil ecosystem
- using physical barriers to deter disease-carrying insects (e.g. floating row covers for aphids)
- applying compost tea and plant extracts (usually as a foliar spray)

As with the general principles of organic farming, none of these techniques is a 'one off' solution to a problem but rather are matters of general everyday practice that improve the health of the agro-ecosystem and, in turn, aid in the health of the crop. In fact, most organic farmers have fewer problems with plant disease than conventional growers who are not using these preventative measures.

Seed and Transplant Sources



Even when soil, compost, water and other matters are taken care of, a good crop still relies on good seed and transplant material. It is important for the farmer to be vigilant in obtaining the best material for growing.

Organic producers must verify the sources of the seed or other live plant material (including seed potatoes, transplants, grafting and rootstock) obtained from off-farm. Only untreated seeds may be used on organic farms and transplants should be grown by the producer, or purchased from a certified organic source. The most economical route is for farmers to save seed grown on their own farm but this can be time-consuming, particularly for vegetable growers.

Care should also be taken to select potting mixes that meet organic standards. Mixing your own is the best option. Otherwise, a certified organic potting mix should be purchased. Many products on the market have the word "organic" on their label, but may not meet the standards of your certifying body. You should be certain to check for certification and for the standards used under that CB.

Organic certification standards worldwide prohibit the use of GMO plant material. Even accidental contamination will result in decertification of the affected acreage. In this case, not only should the seed or transplant source be investigated, but the region should also be monitored on an on-going basis to identify use of GMO crops by other farmers.

The use of Rhizobela inoculants for legume seed is permitted and encouraged. However, farmers should check with the manufacturers to ensure the inoculant is not genetically modified. Non-genetically modified microbial soil inoculants and biodynamic preparations are also allowed.

Equipment

Organic farmers must pay special attention to the equipment they use and its maintenance. By keeping equipment in good repair, farmers can help to avoid problems of contamination of crops, soil and water. Organic inspectors make a point of checking farm machinery for leaks of potentially dangerous chemicals, particularly hydraulic fluid. Machinery must also be kept clean to help prevent the spread of diseases and weeds, and especially to prevent contamination of organic crops by non-organic crops (when the same machine must be used for both). It is a good idea to keep records of equipment maintenance and cleaning so that an inspector can verify these processes.

Farmers should attempt to recycle, reduce and reuse as much as possible and should keep this in mind when using plastics, for example in both glazing and seedling flats. In keeping with reducing energy expenditure, farmers should also try to avoid excessive use of fossil fuels to heat greenhouses.

Certain cleaning materials may be prohibited for organic use (for example, in the case of milkhouse and processing equipment) and alternatives must be found. In other cases, a prohibited material may be used if a procedure to use extra rinses is implemented.

Farmers should check with their certifying body for information about permitted materials and their uses and refer to them for sources of information regarding possible alternate strategies and equipment. Other organic farmers are also a wealth of information regarding equipment use and alternatives. Farmers often are, after all, quite ingenious and resourceful.

Water Quality

Protecting and improving water quality are some of the essential mandates of organic agriculture as a part of environmental stability. Farmers use a number of methods to ensure the protection of this resource.

There are two aspects of water quality that must be considered by the organic farmer:

Quality of water used in production

First, the quality of the water used on the farm for irrigating crops, washing produce and watering livestock must be assured. This is usually accomplished by obtaining a water test for bacteria and minerals, including nitrates. Water used for washing produce and watering livestock should meet the national standard for drinking water quality. Irrigation water can be of lesser quality, but will also be subject to review. The source of the water should be investigated to determine if it might be contaminated with chemicals not normally tested for, such as heavy metals or pesticide residues. Specific water tests may be recommended by the organic inspector or certifying body. It should be noted that water may not be chlorinated.

Protection of water sources

The second water quality consideration for the organic farmer concerns protection of water quality. Farming practices can be a source of contamination for groundwater when excessive levels of soluble nutrients are found in the soil. This is possible even in organic systems if manure is applied; before a crop is growing, after crop harvest if a high application of manure or compost was applied to the crop, or even late in the fall if a leguminous green manure has been ploughed into the soil. The farmer should be conscious of the risk to groundwater, especially in sandy soils. Surface water is also at risk of contamination from runoff of organic amendments, such as manure or compost, when they are applied to sloped land prior to heavy rainfall. Manure piles and livestock loafing areas can also be sources of surface water contamination if these areas are not managed appropriately.

The organic inspector will carefully review water tests from the farm and also look critically at field crop and manure management to determine if water quality is at risk. Recommendations for improvement may be stipulated before certification is granted.

Livestock Management

As a general principle in organic farming, livestock must be cared for in ways that promote their health and behavioural needs. Livestock production makes an ideal complement to crop production in an organic system. The livestock provide manure that can be composted and used to improve the soil. They also demand a variety of crops, particularly forages if they are ruminants, requiring that crop rotations be used on the farm. Livestock also provide weed control if pastures are part of the crop rotation.

Production of certified organic livestock requires that the following criteria be met:

A certified organic diet

Livestock must be fed a diet of 100% organic feed, in most cases from the time they are born. This includes all grain, hay and pasture. If feed is not produced on the farm, certified organic feed must be purchased.

Health care reliant on organic husbandry practices

In keeping with the principles of organic crop production, the emphasis for organic health care is preventative medicine. Health problems in organic livestock are viewed as indications of management problems. The immediate problem is treated, and then the root cause is investigated and addressed appropriately. Acute problems are treated using alternatives such as herbal remedies, acupuncture and homeopathy. The key to raising healthy animals is to provide them with access to fresh air, exercise and of course a healthy diet. Parasite control is probably the biggest challenge faced by organic livestock producers. A combination of good pasture management, herbal remedies and the use of hardy stock is used to reduce parasite problems. Some certifying bodies allow the use of parasiticides with certain conditions, e.g. longer withdrawal periods. Check with your certifying body for their standards for antibiotic and parasiticide use.

Minimizing interference with natural behaviours

Respect for animal welfare is an important component of organic livestock production. Organic farmers assume that animal welfare is optimized when the animals can behave in their natural manner as much as possible. As much freedom of movement as practical is allowed e.g. poultry can not be kept in cages and animals can not be tethered. Animals that are allowed to exhibit their natural behaviours may be less stressed and less susceptible to health problems.

Access to the outdoors when weather permits

Access to the outdoors is required, along with adequate housing to provide shelter from sun, cold, wind and wet weather. The housing must be spacious and clean with ample fresh bedding.

Organic livestock management can be particularly challenging for the farmer who has raised livestock using conventional methods in the past. Since we are dealing with living animals, it is important that the conversion to organic is not made before adequate management skills have been acquired, as this may lead to unnecessary suffering by the animals. While many certifying bodies generally prohibit antibiotics and most allopathic treatments, their use is advisable if the animal's health is threatened. This simply requires that the animal be identified and not sold as organic in the future. By no means should conventional treatments be withheld from livestock in order to maintain their organic status, if they are suffering from health problems.

Product Handling

The raw product from an organic system must retain its integrity "from field to fork," that is, right through the system from beginning to end. Consideration must be given to the following procedures:

Storage

Care must be taken to prevent accidental mixing and contamination of organic crops stored in the same facility as non-organic crops. Storage standards address the preservation of crop integrity and quality. This requires a high level of repair and cleanliness; physical segregation of crops; clear labelling of storage bins; and pest prevention or control methods that are compliant with organic standards.

Washing

As with any other activities involving the use of water, the water source should be investigated.

Bagging and Packaging

In order to ensure the ongoing integrity of organic products in transit from the field to the consumer, care must be taken that the product is properly packaged and labelled. Even when using recycled containers, organic growers must take great care to ensure that these have not been contaminated from some previous use.

Labelling

Labelling which is unmistakable to handlers off the farm is a must.

Transportation

The producer is responsible for checking out the credentials of the transportation company and ensuring that they are aware of the standards required for transport of organic goods and will conform to them. Where government regulations exist (such as disinfection of potato trucks), organic standards permit farmers to comply with them without loss of certified status.

Processing

Processing facilities handling organic products can also be "certified organic." This simplifies life for the grower who can safely entrust the primary product into their hands. As with all other links in the chain of progression from farmer to consumer, the processor must maintain audit trail documentation. When facilities also process non-organic product, the producer must make sure the processing facility faithfully segregates the organic line from the non-organic. This may involve starting the workday with the organic product, so it is first through the machinery, or using a separate set of processing equipment in a separate area.

Retail Display

With increasing consumer demand for organic produce, many more retail stores now include an organic section in their fresh produce department, as well as other primary and processed organic foods. Unfortunately, store personnel may not be aware of the requirements for organic food handling to maintain certified organic integrity. The grower should therefore work with store management and staff to ensure the store's performance will live up to the standards set by consumers. This might include investigating the water source for the "misters" used on fresh produce. The use of good signage, clear labelling and information brochures will greatly contribute to public education.

Record Keeping and Audit Trail

Whatever the requirements of the certifying organization you choose, proper record keeping is a must....Taking great care with paperwork not only avoids possible doubt or misunderstanding, but creates a valuable resource for your own planning and management."

(The Soul of Soil, Grace Gershuny and Joseph Smillie)

Good record keeping is a requirement for certification of organic crops and livestock. Record keeping ensures maintenance of the "audit trail". This is the system whereby organic products in the marketplace can be traced back to their farm of origin, and all details of their production reviewed. Record keeping needs to make sense not only to you, but to the inspector as well, so keep records clear and orderly. The necessary components of the audit trail are:

For crop production

- a farm map with all fields numbered
- an annual record of field management that includes: crop planted (date and seed source), amendments applied (when and how much), any pest control products used (date and product name), harvest (date and yield), lot number assigned to the product, where was it stored and/or sold
- receipts for all inputs purchased including seeds, soil amendments, pest control products (it is a good idea to keep samples of the labels from products used)
- sales receipts for all product sold with lot number included on the receipt
- copies of recent soil and water tests

For livestock production

- identification system for individual animals, except poultry, which should be identified by lot
- health records for each animal or lot noting any health problems and treatments used, vaccinations, de-worming, breeding dates, parturition dates, identity of offspring
- receipts for any purchased feed and verification that it is certified organic (keep samples of labels if available)
- receipts for purchase of breeding stock or day-old poultry indicating source
- sales receipts for all products sold including individual or lot identification numbers
- copies of livestock drinking water tests

Although many farmers find record keeping tedious, it can be a valuable tool for assessing performance of livestock and crops, and making management decisions. Consult your certifying body or an experienced grower for examples of effective record keeping systems.

The audit (documentation) trail is the only way the organic grower can provide the consumer with a guarantee that they are purchasing genuine organic products. For this reason, a break in the documentation at any point along the trail will render this guarantee meaningless. The product label - the final step in the audit trail - should include producer ID information. The importance of maintaining the integrity of the audit trail cannot be overemphasized.

Glossary

Agro-ecosystem
The interaction of organisms and their environment in the farm setting.

Allelopathy
Utilizing one plant species to inhibit the growth of another plant species through the release of phytotoxins.

Audit Trail
This is the system whereby organic products in the marketplace can be traced back to their farm of origin, and all details of their production reviewed.

Beneficial Organism
Any organisms, such as a bird, insect or bat, which benefits the farm in some way, such as pollination or pest control.

Catch Crop
A crop grown late in the season for the purpose of taking up excess plant nutrients remaining in the soil after the main crop has been harvested.

Certification (Organic)
To give assurance, by a certifying body, of the authenticity of organic production methods.

Certifying Body
A certification body refers to a producer operated, non-profit group, or a fee-for-service certification agency. The Canadian Organic Advisory Board lists a total of 43 certification bodies in Canada on their web site (www.coab.ca), although some of these are chapters of the same organization, e.g. the Organic Crop Improvement Association (OCIA) has over 10 chapters in Canada.

Compost
Organic material which has been converted, under a managed process, to a stable form by microorganisms.

Conventional Farming
Farming which does not strictly follow organic production methods.

Cover Crop
A crop planted for the primary purpose of protecting the soil from erosion and put into the soil to improve the health of the soil. Cover crops are also grown to suppress weeds. Also called green manure or plowdown crop.

Crop Rotation
The rotation of crops.

Cultivation
To loosen soil around plants for the purpose of destroying weeds.

Ecology
A branch of biology that deals with the interaction between organisms and their environment.

Erosion
The process by which earth is worn away by the action of water and wind.

Fallowing
The process of plowing a piece of land and leaving it unseeded or uncultivated for at least one growing season.

Farm Cash Receipts
The gross income derived from the sale of farm products.

Fertilizer
Any substance used to increase the capacity of the soil for plant growth and development.

Free-Range
Refers to a system of livestock production in which animals are given access to the outdoors whenever seasonally appropriate.

Genetic Engineering
The transfer of genes or genetic material from one species into another species, usually using a viral vector.

Green Manure
A crop planted for the primary purpose of improving soil fertility; usually a leguminous crop. Grenn manure crops may also function as cover crops. Also called plowdown crop.

Gross Revenue
The monetary return or yield without deductions.

Humus
Dark, organic material in soils produced by the decomposition of plant and animal material and essential to the health of the soil.

Intercropping
To plant different crops together in the same area but in alternating rows or through overseeding.

Leaching (of soil nutrients)
When water, or other liquids and soluble constituents, passes through and leaves the soil, taking nutrients with it.

Legume
Any plant of the family Leguminosae, typically a plant with seed pods. Legumes fix nitrogen, transforming nitrogen from the air into a form of soil nitrogen which other plants can utilize. The process occurs in the roots of legumes, in cooperation with microbes called Rhizobia.

Micro-organism
micro, from the Greek "small" and pertaining to microscopic - any microscopically small plant or animal life.

Mulching
A covering, such as straw or manure, that is spread over the ground around plants to prevent excessive loss of moisture and erosion as well as to enrich the soil.

Nitrogen fixation
The process, performed by certain bacteria (typically found in association with the roots of leguminous plants), of combining atmosphere nitrogen and combining it with other elements into a form that is possible for other plants to utilize.

Organic Matter
Any material derived from animals or plants, whether living or dead.

Overhead Expenses
The general cost of running a farm.

Plowdown Crop
A crop used to cover soil to prevent soil erosion and put into the soil to improve the health of the soil. Also called green manure or a cover crop.

Resistance
The ability of an organism to withstand infection.

Soil amendment
Material which is added to the soil for the purpose of increasing the productivity of the soil.

Soil indicator
Something, usually a chemical constituent or living organism, that indicates, by its presence, the existence of certain conditions in the soil.

Thermal Weeding "Flaming"
A form of weed control in which weed seedlings are killed using a fast-moving flame and crop seedlings are left unharmed.

Transition
The conversion from conventional to organic farming.

Windrow
When crops or hay are laid out into a row, typically to be dried, prior to being baled or picked up. Compost may also be layed out in this manner.

Yield
A product or quantity of product produced or cultivated.

References and Reading

Canadian General Standards Board (CGSB). *National Standard of Canada: Organic Agriculture.* CAN/CGSB-32.310-99. CGSB. Ottawa, ON. 1999.

Cleary, A. and R. Martin. *From Conventional to Ecological Agriculture - A Guide to Transition.* COG Ottawa Reference Series, RS6/90, Canadian Organic Growers, Ottawa, ON. 1990. pp. 8.

Coleman, E. *The New Organic Grower:* A master's manual of tools and techniques for home and market gardener. Chelsea Green Publishing. 1995. pp. 304.

Gershuny, G. and Smillie, J. 1995. *The Soul of Soil: A guide to ecological soil management.* agAccess. 1995. pp. 174.

International Federation of Organic Agriculture Movements (IFOAM). *Basic Standards for Organic Production and Processing.* IFOAM, Germany. 2000.

Lampkin, N. *Organic Farming.* Farming Press. Ipswich, UK. 1990.

Macey, A. (ed). *Organic Livestock Handbook*. Canadian Organic Growers Inc. 2000. pp. 179.

Pulsifer Associates Ltd. *Marketing Opportunities for Export of Atlantic Canadian Organic Produce to New England.* The Canadian Farm Business Management Council and the Provinces of Newfoundland, New Brunswick, Nova Scotia and Prince Edward Island. 1999.

Stonehouse, P. *Economics of pesticide use in Canadian agriculture.* Eco-Farm & Garden, Canadian Organic Growers. Summer Issue. 2000.

Wallace, J. (ed). *Organic Field Crop Handbook*. 2nd ed. rev. and expanded. Canadian Organic Growers Inc. 2001. pp. 192.

Web Sites of Interest

Atlantic Canadian Organic Regional Network (ACORN)	www.gks.com/ACORN
Appropriate Technology Transfer for Rural Areas	www.attra.org
Canadian Organic Advisory Board Inc. (COAB)	www.coab.ca
Canadian Organic Growers Inc. (COG)	www.cog.ca
Ecological Agriculture Projects	www.eap.mcgill.ca
Independent Organic Inspectors Association	www.ioia.net
Maine Organic Farmers and Gardeners Association	www.mofga.org
Northeast Organic Farming Association	www.nofa.org
Nova Scotia Organic Growers Association	www.gks.com/NSOGA
Organic Crop Improvement Association	www.ocia.org
Organic Trade Association	www.ota.com
The Organic Materials Review Institute	www.omri.org
The Canadian Organic Advisory Board	www.coab.ca