Organic Gardening — Some Advantages And Disadvantages

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(EDITOR'S NOTE: The manuscript below is a new UI Fact Sheet that came off the presses recently. It is not meant to particuarly advocate "organic gardening," but rather, to point out some of the strengths and weaknesses of this method. While organic gardeners perhaps aren't quite as vociferous and militant as they once were, they are still with us. Therefore, it behooves you to be aware of what's involved when someone chooses to become a disciple of this system, and to be able to offer sound advice about it.)

Organic gardening is practiced by home gardeners who want to grow plants in the most natural way possible, primarily without the use of chemcial fertilizers, artificial pesticides, or man-made growth regulators. Instead, plants are grown in soil enriched with organic matter and only with the benefit of animal and plant residues and naturally-occurring mineral and vegetable substances.

The basic distinction between organic and traditional gardening lies in the use of natural versus synthetic materials. In essence, the organic gardener is really a natural gardener who does not use materials that have been chemically transformed or altered by man from their original states.

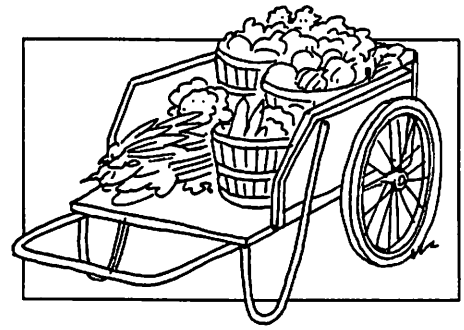
The position of an organic gardener can best be defined by terms of the following goals:

- *Growing food crops without the use of inorganic chemical fertilizer materials.*
- *Maintaining soil fertility by composting organic materials, using mulches, and recycling organic wastes.*
- *Growing crops without the use of synthetic insecticides or other pesticides.*

There is much in these concepts that is legitimate and workable. However, if the recommendations are carried too far, they may reach the limits of feasibility or become contrary to soundly based, scientifically determined facts and principles.

Successful organic gardening depends on following established, recommended gardening practices, which include controlling insects, diseases and weeds. The purpose of this publication is to make you aware of methods of growing vegetables "organically", in view of modern horticultural principles.

Regardless of your gardening methods, there are certain general principals that should be followed in order to have a successful garden. These include:



- *Choosing a good location in full sunlight.*
- *Planning the garden layout on paper so the crops have adequate room and don't shade each other.*
- *Growing varieties adapted to your area.*
- *Obtaining good seeds, plants and supplies.*
- *Planting seeds and transplants properly.*
- *Using mulches whenever possible.*
- *Water properly.*
- *Harvesting crops at the proper time.*
- *Controlling weeds, insects and diseases.*

For further explanation of these major points, consult University of Illinois Circular 1150, *Vegetable Gardening for Illinois,* and other Department of Horticulture Fact Sheets available from the Horticulture Department, 124 Mumford Hall, 1301 W. Gregory Dr., Urbana, IL 61801.

In addition to the points mentioned above, certain practices need to be particularly emphasized when attempting to grow vegetables organically. Some of the more important ones are discussed below.

Choose Disease-Resistant Varieties

According to the typical catalog, nearly every variety offered is described as being absolutely the best. Obviously they are not all of the same superior quality. Here in the Midwest where the season is relatively short, some varieties will definitely grow and produce better than others. Certain varieties also have built-in disease resistance.

One good way to get superior plants is to grow F_1 hybrids. These plants are the result of a cross between two differing but true-breeding parental lines, producting plants displaying desirable characteristics derived from both parents. Such hybrid plants are usually stronger, healthier and more productive than open-pollinated non-hybrid varieties. They are also often earlier blooming, less susceptible to disease, very uniform, and more tolerant to air pollution and weather conditions.

A listing of recommended disease-resistant vegetable varieties for Illinois can be found in Report on Plant Diseases, #900 — *Controlling Diseases in the Home Vegetable Garden,* available from the Department of Plant Pathology, N-533 Turner Hall, 1102 S. Goodwin Ave., Urbana, IL 61801.

Maintain A Fertile Soil With Good Tilth

The success of a garden depends largely on soil structure and fertility. Vegetables prefer to grow in a fertile, well-drained soil with pH between 6.0 and 6.8. Although present in the soil, certain essential mineral elements will not be available for plant growth in soils in which the pH level is above 7 or below 6. Gardeners commonly make an annual application of lime to their gardens. This practice should be avoided because the pH of most garden soils is high, and unneeded applications of limestone can create problems that are not easy to correct. A simple soil test, done by a reputable laboratory, can indicate the pH of the soil and the need for lime (or sulfur) to correct the pH level.

A soil that is loose, well-drained and well aerated ensures good root growth and will reduce seedling blights and root rot diseases. Soils that are clayey or poorly drained can be improved by adding organic soil conditioners such as compost, peat moss, straw, hay, grass clippings, or planting green manure crops. Annual applications of organic matter are necessary to keep the soil in good tilth.

Plants need 16 elements in order to grow. Of these, nitrogen (N), phosphorus (P), and potassium (K) are the most important ones a gardener can add to the soil to increase fertility. Carbon (C), hydrogen (H), and oxygen (O) are provided by air and water and are seldom a limiting factor in plant growth. Calcium (Ca) and magnesium (Mg) are supplied by liming. Sulfur (S) is obtained by the plant from decomposing organic matter and as a constituent of rain water.

The remaining elements, referred to as micronutrients or minor or trace elements because they are required in such small amounts, include iron (Fe), copper (Cu), boron (Bo), chlorine (Cl), managanese (Mn), molybdenum (Mb), and zinc (Zn). These micronutrients are usually found in sufficient quantities in Illinois soils and rarely need to be added. However, if any one of the major elements is lacking or deficient, growth and yield are usually limited.

Although plants cannot determine the sources of their nutrients, whether organic or inorganic, both types have their advantages. Generally speaking, organic fertilizers have relatively low nutrient contents, but they do contain other compounds, derived from organic matter, which help improve the soil. Inorganic fertilizers are also advantageous in several ways. Their nutrients are usually available as soon as they are added to or leached into the soil. Based on total nutrient content, the inorganic forms are definitely the most economical.

Organic material can be used instead of inorganic fertilizers to supply the N, P and K necessary for good plant growth. Bacteria and fungi break down the organic matter into nutrients the plants can use. Natural sources of nutrients include manure, compost, steamed bonemeal, greensand, dried blood, fish meal, cottonseed meal, rock phosphate, muriate of potash, and wood ashes. Sewage sludge is not recommended because of the high levels of cadmium and other heavy metals that may be present.

For more information on soil fertiility as it relates to organic gardening, consult Horticulture Fact Sheet VC-5-85, *Organic Gardening and Soil Fertility.*

Use Manures, Compost And Other Soil Building Materials Wisely

Animal manure is still one of the most popular materials used in gardens, not only for fertility but also to improve the organic matter content of the soil. Although the amount of N in manure varies according to its source, most fresh cattle or horse manure contains only about 0.5% N. This is about 1/20th of the N found in an equal amount of 10-10-10 fertilizer; therefore, about 20 times more manure than 10-10-10 would be needed to supply about the same amount of N.

The table below lists common organic soil-building/fertilizer materials and their approximate

APPROXIMATE NUTRIENT VALUES OF SOME ORGANIC FERTILIZERS

Material	Amount to apply (lbs./1000 sq. ft.)	Approximate amount of: (in percent) Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)
Cattle manure, fresh	500	0.5	0.2	0.5
Cattle manure, dried	180	1.5	2.0	2.3
Chicken manure, fresh	280	1.5	1.0	0.5
Chicken manure, dry	100	4.5	3.5	2.0
Horse manure, fresh	500	0.7	0.3	0.5
Swine manure, fresh	500	0.7	0.6	0.7
Sheep manure, fresh	285	1.4	0.7	1.5
Sheep manure, dry	100	4.2	2.5	6.0
Dried blood	10	13.0	1.0	---
Bonemeal, steamed	50	2.0	22.0	---
Cotton seed meal	20	6.0	3.0	1.0
Rock phosphate	500	---	20.0	---
Greensand	500	---	1.5	6.0
Wood ash	100	---	1.0	5.0
Fish meal	15	10.0	5.0	---

nutrient contents.

Because animal manure is often unavailable, especially in urban areas, a good substitute is compost. Compost can be considered a type of artificial manure. Before building a compost pile, check local ordinances to be sure it is legal to do so. A compost pile can easily be constructed from wood, concrete blocks, wire or snow fencing, either built above ground or in a pit below ground. Since the compost pile will be a semi-permanent structure, it is best to place it in an area away from view or in the back part of the yard.

A compost pile basically consists of layers of plant materials that have been mounded and allowed to decompose to a point where the final product is dark in color and breaks up readily. It can be added to the soil to improve tilth and structure. Almost any type of non-woody plant material can be added to the pile; however, avoid adding cheese, eggs, meat, or fat because these decompose slowly and may attract rodents and dogs. Avoid pet wastes that can transmit diseases to humans.

Disease-causing fungi and bacteria will survive composting unless the decomposition of the crop residues is "complete," a situation that seldom occurs. Therefore, we suggest that no diseased plant parts be placed in the compost pile.

Some disease organisms will even survive so-called "complete" composting, including corn smut; clubroot of cabbage, broccoli, cauliflower and other crucifers; Verticillium wilt of potato, tomato, pepper and eggplant; and root-knot nematodes.

For more information on building and maintaining a compost pile, consult Horticulture Fact Sheet VC-6-80, *Making Compost for the Garden.*

Insect Control Is Essential

It is nearly impossible to grow a garden without insects being present. However, some garden vegetables can be grown with little or no danger from insect pests. These include radish, lettuce, onion, leek, shallot, chive, beet, chard, mustard, Chinese cabbage, parsnip, pea, spinach, sweet potato, turnip, and most herbs.

Certain other crops are difficult to grow without effective chemical control of insect pests. Some of these crops, along with their insect enemies, are: cucumber (cucumber beetle); squash (cucumber beetle); eggplant (flea beetle); muskmelon (cucumber beetle); sweet corn (earworm); pumpkin (cucumber beetle); bean (bean leaf beetle); cabbage (cabbage worm); cauliflower (cabbage worm); broccoli (cabbage worm); and potato (potato beetle).

"Companion planting" refers to the method in which certain vegetables, flowers and herbs are planted together, presumably for mutually beneficial purposes. It is sometimes believed that certain plants emit an odor or exudate that provides protection from insects and even diseases; also, that companion plantings improve the growth of certain vegetables. However, much of this is based on unfounded testimonials and hearsay; research at the University of Illinois has shown no benefits from "companion plantings."

Natural Pest Control. Organic gardeners encourage the use of natural pest control methods whenever possible, such as the hand-picking of insects and using beneficial predatory insects. Nevertheless, the release of beneficial insects such as ladybugs, praying mantids and lacewings for biological control is no guarantee of success. Although the preferred food of lady beetles is aphids, they will also eat the eggs of several other insects. Note, too, that they do not kill grubs, Japanese beetles or caterpillars which are sometimes pests in the garden. If there is not an ample supply of live aphids on plants when the lady beetles are released, they will simply eat each other or leave the area. Praying mantids are poor searchers for food, usually waiting for their prey to come to them. They also prefer grasshoppers, crickets, bees, wasps and flies, thus do destroy some beneficial insects.

In brief, natural control methods should be encouraged but not depended upon for adequate insect control in the vegetable garden.

Biological control. Biological control is effective against some insects. This is the use of living organisms to reduce the number of damaging insects below a level of economic importance. The most common biological product, *Bacillus thuringiensis* (a bacterium), is available in several commercial formulations, such as Biotrol, Dipel, Thuricide and Bactur. This material controls bagworms, cabbage worms, tomato hornworms, and fruitworms quite effectively. With this type of biological control, you can now successfully and organically grow cabbage, kale, collards, Brussels sprouts, broccoli and cauliflower.

Despite organic precautions against insects, pest epidemics may still become a threat. At this point, an insecticide is needed to reduce the pest populations to a tolerable level. Insecticides of botanical origin, such as pyrethrins, rotenone, and nicotine may be used; however, they are more toxic to humans than some suggested synthetic insecticides such as carbaryl and malathion. Both carbaryl and malathion are low in toxicity to the user, are not persistent, are relatively safe in the environment and do not accumulate in the food chain. Many gardeners find these materials very useful.

At the end of each growing season, always destroy crop residues by removal or incorporation into the soil. Many insects spend the winter inside plant stems, on weeds, or on the crop refuse. Crop rotation is also important in preventing insects problems the next season.

Disease Control Also Important

Certain diseases can become a problem on vegetables, especially in gardens when the same general area is planted up year after year. Attempts to control plant diseases can be frustrating, expensive, and often unsuccessful if you do not choose the best

method for the particular disease. Eradication is seldom possible. A more realistic approach is to minimize the problem. There are several methods the organic gardener can employ to reduce losses due to disease:

Grow disease-resistant varieties and hybrids. Many new varieties have been bred to include disease resistance. It is advantageous to select and grow these, especially for crops that are very susceptible to certain diseases. A good example of this is Fusarium and Verticillium wilt of tomato; one should grow a variety that is resistant to these diseases.

For further information about disease-resistant varieties, refer to Report on Plant Diseases #900, available from the Department of Plant Pathology, University of Illinois, N-533 Turner Hall, 1102 S. Goodwin Ave., Urbana, IL 61801.

Don't work in garden when plants are wet. Cultivation and harvesting under wet conditions will cause plant diseases to spread in droplets of water from infected to healthy plants, as in the case of bean leaf blight.

Practice crop rotation. Certain diseases overwinter on crop debris and may build up over a period of time if a garden is planted in the same area each year. Therefore, you should follow a crop rotation for at least 3 years. Crops are generally rotated among 4 major plant families: the tomato family (which incudes tomato, potato, eggplant & pepper); the cucumber family (cucumber, squash & melon); cole crops (broccoli, cabbage, cauliflower, Brussels sprouts, & kale); and the onion family (onion, shallot, chive & leek).

A sunny location is best. Eight to 10 hours of sunlight per day are necessary for proper growth, flowering and fruiting of most vegetable crops. The foliage of plants in the sun tends to dry out quicker, thereby eliminating the moisture that is often essential for the spread or buildup of disease organisms.

Destroy crop residues after harvest. If diseases have been a problem, it is best to remove the plants after each crop and place them in the garbage or burn them. This will prevent the disease from overwintering on the debris and being carried over to the next season.

Water properly. Plants suffering from a lack of, or excess of, water will be less vigorous and more susceptible to disease. Water the soil thoroughly by applying 1 inch of water per week when there is not sufficient rainfall. Drip or trickle irrigation, as well as the use of soaker hoses, are good alternatives to overhead irrigation. They can be used with plants that are susceptible to foliar disease problems. If an overhead sprinkler is used, the watering should be done during the early part of the day so the foliage can dry off before nightfall.

Provide for good air circulation. Planting vegetables at the recommended distances apart will provide for adequate spacing to allow air movement and sunlight to dry off the lower foliage, thus reducing the relative humidity around the plants. Staking, caging, trellising, and pruning the plants also allow for more air circulation around the foliage.

Plant in well-drained soil. On soils that are heavy or poorly drained, try planting on ridges, hills, or in raised beds to prevent seedling blights, root rots, or foliage diseases of plants that come in contact with damp soil.

Consider the proper planting dates. Plant seeds in soil that is warm enough for rapid germination. Delaying seed sowing until the soil has warmed allows the young plants to grow faster and thus perhaps avoiding rotting organisms. The minimum, optimum, and maxium soil temperatures for vegetable seed germination are given in the accompanying table:

SOIL TEMPERATURES REQUIRED
FOR SATISFACTORY SEED GERMATION
(°F)

Vegetable	Minimum	Maximum	Optimum	Optimum range
Asparagus	50	95	75	60-85
Bean	60	95	80	60-85
Bean, lima	60	85	85	65-85
Beet	40	95	85	50-85
Cabbage	40	100	85	45-95
Carrot	40	95	80	45-85
Cauliflower	40	100	80	45-85
Celery	40	85	70	60-70
Chard, Swiss	40	95	85	50-85
Corn	50	105	95	60-95
Cucumber	60	105	95	60-95
Eggplant	60	95	85	75-90
Lettuce	35	85	75	40-80
Muskmelon	60	100	90	75-95
Okra	60	105	95	70-95
Onion	60	90	75	50-95
Parsnip	35	85	65	50-70
Pea	40	85	75	40-75
Pepper	60	95	85	65-95
Pumpkin	60	100	95	70-90
Radish	40	95	85	45-90
Spinach	35	85	70	45-75
Squash	60	100	95	70-95
Tomato	50	95	85	60-85
Turnip	40	105	85	65-105
Watermelon	60	105	95	70-95

Provide adeqate soil fertility. Properly fertilized plants are generally more resistant to disease than those that are under nutritional stress.

Successful organic gardening depends upon effectively manipulating the plant environment for optimum growth and studying the interactions of organic and inorganic materials. Although organic gardening is often more work than conventional systems, the rewards of harvesting chemical-free, vine-ripe produce may well be worth the extra effort for some gardeners.

Teacher: "In what country are elephants found?"
Smart-alec student: "Elephants, being large animals with good memories, are hardly ever lost."