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Producing Garden Vegetables with Organic Soil Amendments[1]

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Organic gardening is a term for combining some basic gardening procedures with an ethical philosophy of environmental preservation.

The distinguishing feature of organic gardening is that it uses only naturally-occurring materials for all phases of the growing operation—from improving the soil, fertilizing, and liming, to preventing and solving pest problems. The 1990 Florida legislative definition of **organic** excludes the use of **synthetic chemicals** on vegetables and other products grown **for sale**.

WHY GARDEN ORGANICALLY?

Since the "organic law" does not apply to home gardens, why would any gardener give up all synthetic fertilizers? And why not use synthetic pesticides, when just one application could eliminate even the most devastating ravages of a crop insect or disease? Why work so hard handling large quantities of organic soil amendments and manures, when synthetic fertilizers of every description and purpose are so quickly available and easy to use?

Early gardeners did it to preserve a way of life that reduced pollution and environmental decay, thus creating a more ecological society. Organic enthusiasts are extremely health-conscious, and hope that working vigorously outdoors and eating foods free from pesticides just might lead to better nutrition and health. Today's organic gardeners are even more ecologically aware due to the accelerated deterioration of the environment from all forms of man-made intrusions. They can see waste-disposal sites filling up due to an ever-increasing population and proliferation of technological litter. Organic wastes must go somewhere, and organic gardeners see the soil and its capacity to recycle as the best place for them.

Today's organic followers include not only purists but also individuals who see it as their small contribution to conserving resources and energy. It's their way of rebelling against the passage of the

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agrarian way of life and the arrival of chemical agriculture that is now necessary to feed a population increasing at alarming rates. Rather than ignoring this preference, the scientific community is increasing its efforts to reduce the need for chemicals.

SOIL IMPROVEMENT WITH ORGANIC MATTER AND NATURAL MATERIALS

One of the major concepts of organic gardening is the liberal use of organic materials to build up the soil and add needed nutrients for plant growth.

The improvement of soil with abundant amounts of organic materials and natural mineral supplements is of great importance to your success as an organic gardener.

Organic Matter

In general, organic matter is the remains of plants and animals. The organics you apply to the soil are most often in the form of bird and animal manures, plant (green) manures, cover crops, compost, sea products, and mixed organic fertilizer.

Benefits of added organic matter

- Improves tilth, condition, and structure of soil, providing better aeration and temperatures.
- Supports living soil-organisms.
- Improves ability of soil to hold water and nutrients.
- Helps dissolve mineral form of nutrients.
- Buffers soil from chemical imbalances.
- Maintains a steady supply of plant nutrients.
- May contribute some degree of biological control of certain soil pests.
- Helps recycle organic wastes, thus keeping them out of landfills and waterways.
- Cheap energy source, replacing manufactured nitrogen.

Breakdown of organic fertilizer in soil

With suitable conditions, organic matter is broken down by organisms living in the soil, such as fungi, bacteria, algae, molds, insects and earthworms. In the process, nitrogen and other nutrients are converted to forms a plant can use. **Nitrification** is the term used for the conversion of organic nitrogen to available forms. Since nitrogen is the nutrient most often limiting plant growth, you must make sure that the following conditions exist in your soil (or compost pile) for good nitrification to occur:

- Nitrogen-rich materials
- Proper acidity (pH): 5.8 to 7.0
- Proper temperature—over 50°F
- Good aeration
- Adequate soil moisture.

Animal-Derived Products (Manures and Composted Products)

Bird and animal manures are generally available to home gardeners, either as processed, composted products in bags, or in some raw form. Generally, manures from animals that eat vegetation are preferred to that from meat-eating animals, for sanitary reasons.

Animal manures vary greatly in their content of fertilizing nutrients, depending on type, age, and condition of animal; kind of feed used; age and decomposition of manure; moisture content; and the litter accompanying the manure. Some manure

products are composted or mixed with various plant products to achieve a preferred formulation.

Most animal and bird manures in the raw form have an analysis in the range of 0.5 to 4.5% N; 0.2 to 2.0% P; 0.4 to 2.0% K. Since they also contain micro-nutrients, bird and animal manures may be used as the sole fertilizer source in the garden. However, due to their high moisture content (60 to 90%) and relatively narrow carbon to nitrogen ratio, they are less useful for building humus in the soil than are the plant-residual materials. Thus, animal manures have great value as a nutrient source for micro-organisms in compost piles, and when mixed with plant-derived compost for direct soil application. Some of the most common types of animal and bird manures found in Florida are listed in Table 1 . All are beneficial as organic fertilizers.

Other Animal-Based Products

Other animal products sometimes used by home gardeners are:

- **Bloodmeal and animal tankage** products derived from slaughter or meat processing plants (suitable for gardens).
- **Leather meal** products derived from leather tanning and may contain chromates (unsuitable for gardens).
- **Fish meal/emulsions** (suitable for gardens).
- **Crabwaste** crab remnants, generally composted (suitable for gardens).
- **Raw meat** can cause sanitation problems by drawing flies or scavengers, and causing odors (unsuitable for gardens).
- **Mushroom compost** waste product from the Florida mushroom industry; contains 20% chicken litter (suitable for gardens).

GREEN MANURES

Green manures are derived from plants, either as ground-up plant products, whole plants, or as cover crops. Green manures have a higher carbon to nitrogen ratio than most animal manures (except manures with a lot of bedding material), and thus are excellent for improving soil structure. Additions of the more woody materials, such as wheat straw, sawdust, wood shavings, and composted yard waste, should be accompanied by addition of more nitrogenous materials, such as animal manures or leguminous crops.

COVER CROPS

Plants (crops) seeded, grown, then plowed into the garden soil to provide green manure are called cover crops. By cover cropping, you can provide all of the benefits of adding organic matter, plus help recover/recycle nutrients from past seasons. And, by planting a legume as your cover crop, you can actually supply additional nitrogen. Legumes form nodules on their roots; inside the nodules, bacteria convert atmospheric nitrogen to forms of nitrogen that the plant can use. To be most beneficial to the garden, the cover crop must be plowed down (or added to a compost pile) so that this "captured" nitrogen can be released by the process of nitrification. Allow a few weeks time between plow-down and planting in your garden. Early investigations proved that the greatest benefit was achieved when the green manures were incorporated at the half-grown stage. At this stage there is more nitrogen available and fewer problems related to soil-borne diseases (see Table 2).

Living Mulches

One old organic practice is the use of a living mulch. The idea is to first sow a green manure crop (leguminous preferred) on the plot, followed by the

setting of vegetable plants throughout the plot and into the established living mulch. The expectations were that the legumes would crowd out weeds while contributing nitrogen to the vegetable crop.

Our experience with living mulches (vetch and ryegrass combined) has shown a negative effect on the growing crop unless sufficient organic fertilizer is also applied at planting time. This observation supports earlier findings that a green manure crop is most effective when plowed down prior to planting a crop.

Composting

Composting is the microbial decomposition of organic wastes under controlled conditions. The end product should be artificial manure, acceptable for use in the garden as a soil amendment and nutrient source (fertilizer).

In today's environment, all gardeners should make and use compost to help recycle yard waste, thus producing a free-energy source while keeping these wastes out of over-burdened landfills. In Florida, about 19 million tons of solid waste is generated and collected annually, of which 15% is yard waste.

Making Compost at Home

There are many systems for constructing and managing a compost pile. Instructions for these systems are available from various other publications, including many available at your county Extension office. To make ideal compost, the composter should strive to reach a correct balance of air, water, and temperature in the compost pile.

A small compost pile measuring 3'x3'x3' (1 cubic yard), called a "compost unit," is easily made.

- Build larger piles by putting together several units into a single bin.

- Construct a bin with sides made from untreated lumber, concrete blocks, wire or other durable materials.

- Make successive 12 thick layers of plant waste such as leaves, lawn clippings, shredded branches, and wood chips.

- Distribute one cup of dolomite and 1 qt chicken litter per unit onto each layer.

- Moisten each layer, then keep pile moist.

- Thoroughly mix the compost pile after 3 to 4 weeks, and every week thereafter.

- Compost should be ready for use in 2 to 12 months, or when plant parts are decomposed.

Municipal Composting

Several municipalities in Florida are composting leaves, branches, tree trunks, and lawn clippings which otherwise would be clogging our landfills. The usual procedure is to first sort out undesirable materials, grind up the acceptable waste, then manage the pile until it is suitably decomposed and composted.

The end product may vary from one recycling plant to another, but the best grades are similar to potting soil. The coarser grades have maximum benefit as mulches. In our trials, we have observed these composted yard wastes to be useful both as a mulch and as a soil amendment. Due to a low nitrogen content (less than 1.0%), their value as an organic fertilizer is limited. When composted yard waste is used as a soil amendment in the vegetable garden, it should be accompanied by an application of nitrogen-rich organic fertilizer such as animal manure. Otherwise, the available nitrogen will be utilized by the micro-organisms breaking down the carbonaceous materials, leaving very little for the growing plants.

How to Apply Organic Soil Amendments

Animal manures, fresh with minimum litter

- **Annually** spread 1 lb/sq ft within the bedding area, mix in soil to 6 depth. Wait 10 to 14 days before planting.

- **Semi-annually** if a garden is to be planted in a successive season, reapply at the reduced rate of 1/2 lb/sq ft; mix and wait as before.

- **Side-dressing** Add the solid form or manure tea as a side-dressing at mid-season on long season crops like tomato. Manure tea is made by mixing up to equal amounts of poultry manure and water.

- **Plant hole application** For single plant application, thoroughly mix the manure in the planting hole 10 to 14 days before planting to prevent burning the roots. Adjust amount according to size of plant grown; for example, tomatoes - 4 lbs per hole; herbs - 1 lb per hole.

Note. Plant injury due to fertilizer root burn may be greatly reduced or eliminated by mixing the animal manure with compost prior to planting (1:1 ratio). In this manner, you may apply and plant immediately.

Composted yard waste

- **Annually** spread and mix well into soil up to 2 lb/sq ft. Supplement with animal manure at rate of 1 lb/sq ft. You may plant immediately or wait a few days.

- **Semi-annually** if a garden is to be planted in a successive season, a second application of composted yard waste may be applied, but at the reduced amount of 1 lb/sq ft. Supplement with animal manure as before (1 lb/sq ft).

- **Side-dressing** not suggested for adding to a growing crop.

Note If composted yard waste is used alone, plant stunting will occur. Following 2 to 3 years of "aging" in the soil, however, plant growth should improve noticeably. For best results, always supplement your composted yard waste with organic garden fertilizer.

Oak leaves.

Certain plant residues may be mixed into the garden soil as a soil improvement practice. Woody residues such as sawdust rot very slowly and are low in nitrogen content. For every cubic yard of sawdust applied, add 150 lbs of animal manure. Oak leaves constitute a fairly large portion of yard waste in central and north Florida. For that reason, the use of oak leaves as a soil amendment was observed over a 4-year period. The conclusion was that seasonally raked oak leaves may be piled onto the garden site, mixed with the soil, and allowed to decompose. Shredding speeds up breakdown and results in better growth and yields of vegetables. Add animal manure (1 lb/sq ft) to hasten decomposition and minimize nitrogen depletion. Even without manure supplementation, good yields of such crops as cucumbers, tomato and greens can be expected after 2 to 3 years of applications of at least 20 tons per acre annually.

Mulching

A mulch is any material, usually organic, which is placed on the soil surface around plants. Most commonly used mulches are bedding straw, leaves, pine needles, pine bark, and wood chips. Coarse-ground composted yard waste makes an excellent mulch. A mulch is helpful in many ways: 1) it conserves soil moisture and nutrients, 2) it prevents weed growth, 3) it reduces fruit rot; and 4) it moderates soil environment.

Many types of organic mulches may be plowed into the soil at crops end, thus benefitting as a soil amendment. Keep in mind that mulches are high in carbon content, so need to be supplemented with

manure to facilitate decomposition and prevent nitrogen depletion of the plants.

Plastic film (usually black to exclude light) is one of the most popular mulches used in vegetable gardening and farming. However, because it is energy-based, it should be discouraged in an organic garden.

CONCLUSION

For centuries mankind has been feeding itself through organic gardening. Recent technological advances have made considerable improvements in those primitive ways, greatly enhancing the likelihood for successful gardening endeavors. As non-renewable energy based resources and water resources are disappearing at an alarming rate, better, more efficient ways to grow foods organically need to be found. Fortunately, environmentally-polluting waste materials such as animal manures and yard trash have great value for amending soils and can be recycled through gardening and farming.

In Florida, 7,000 acres were in vegetable gardens in 1992. Additionally, the Florida Department of Agriculture reports that 418,000 acres of commercial vegetables were grown in Florida in 1992. If only yard trash and animal manures were used in Florida in vegetable gardens, between 25,000 tons and 50,000 tons of 6-6-6 inorganic fertilizer would be replaced. Each pound of nitrogen fertilizer manufactured from natural gas would use 31,870 Btus. Each ton of manufactured nitrogen fertilizer that is replaced by yard trash and animal manures represents a savings of 456 gals of diesel fuel equivalent. Yard trash contains about 0.6% nitrogen, wet weight basis. The potential for replacing 25,000 tons to 50,000 tons of 6-6-6 commercial fertilizer with yard trash and animal manures presents the potential for replacing 1,500 tons to 3,000 tons of manufactured nitrogen per year. Based on 456 gals of diesel fuel per ton of manufactured nitrogen, the potential savings in diesel fuel could be in the range of 684,000 gals to 1,368,000 gals per year.

***Organic Gardening Demonstration*:** In the spring of 1990, an Organic Gardening Research and Education Park was established at Fifield Hall, University of Florida. Information gathered from studies and observations made at this park have been used extensively in the preparation of this fact sheet.

Table 1.

Table 1. Beneficial animal-product organic fertilizers.

Birds	Furry Animals
Chicken, caged layers	Cow, dairy
Chicken, meat	Cow, beef
Poultry, composted	Horse
Turkey, composted	Hog
Sea-bird guano	Sheep
	Llama
	Rabbit
	Bat

Table 2.

Table 2. Some green-manure crops appropriate for Florida with the approximate nitrogen content on a dry basis.

Crop	Percent Nitrogen	Season
Alfalfa	3.0 - 4.0	cool
Clover	2.8 - 3.2	cool
Clover, Red Crimson	3.0 - 3.3	cool
Cowpeas	2.5 - 3.0	warm
Lupine, Blue	2.0 - 2.5	cool
Vetch	3.0 - 4.0	cool
Oats	1.3 - 1.4	cool
Ryegrass	1.2 - 1.3	cool

Table 2.

Austrian winter peas	-	cool
Hairy Indigo	-	warm
Sesbania	-	warm
Velvet beans	-	warm
*USDA Yearbook 1957, p. 253.		