




# COVER CROP GARDENING

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## SOIL ENRICHMENT WITH GREEN MANURES

 A Storey Country Wisdom Bulletin

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# **Cover Crop Gardening**

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# Meet the Green Manures

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Green manuring — the growing and turning under of crops to fertilize and improve the soil — is an age-old practice that is gaining popularity again.

One reason has been the rising costs of chemical fertilizers.

Even more important is the development of equipment that has made the task of turning under crops an easy one. Once gardeners turned these under with spades. It was hard work, and time-consuming, but many gardeners thought it was worth it, even then. Now the gardener can quickly chop up a crop — and that speeds decomposition — and mix it with the soil, using equipment designed for the job.

But why raise green manures? Why plant cover crops, or catch crops? The answer is simple. All these crops will improve the soil. They add something valuable to it, or prevent something valuable from disappearing.

As you read this bulletin, think of these crops as closely related, and having a single purpose — to improve the soil. Green manures add huge amounts of organic material to the soil, cover crops prevent erosion, catch crops prevent the leaching away of nutrients, and all overlap in their contributions.

A Vermont gardener has summed up the benefits he has seen: “Gardening is easier now that I’m raising green manures. It’s easier to get the soil right for planting, easier to keep the weeds out of the garden, easier to get good crops, and easier to clean up the garden and get it ready for winter.”

He and others find these green manure crops are simple to raise, and their contribution to the garden, once turned under, is quickly apparent. Like them, you will find the next crop you raise after green manures will be improved.

Let’s look more closely at the benefits you can expect from these crops. Turn this page and begin reading about them.

## Benefit 1.

### Buy Less Fertilizer

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If you are an experienced gardener, you know that you can't have rich, productive soil unless you put something back into it. For many, chemical fertilizers have been the answer, and an increasingly expensive answer.

By growing green manures you can improve the soil and cut your fertilizer needs in half at the same time.

Green manuring is a way to speed up the natural system of creating rich soil. Soil has been built up over the centuries as natural vegetation died and decomposed. By raising crops, then chopping them up and tilling them under, this same process is accelerated, and the benefits to the soil are much more quickly apparent.

The result is that the amount of fertilizer you have to buy and use can be reduced sharply.

#### ***Green Manures Help Unlock Soil Nutrients***

Large supplies of nutrients may be locked up in insoluble rocks or minerals. Green manures can help unlock some of this supply.

One way that green manures can make more of these nutrients available is by increasing the activity of microbes in the soil.

These microbes produce weak acids that eat away at soil minerals, causing them to release nutrients for plants to use.

Some green manure crops can extract nutrients from insoluble minerals. Rye, buckwheat, and sweet clover can extract phosphorus from some insoluble minerals. When crops like these are grown in poor soil and turned under, the phosphate they mine from the earth is released to plants grown later in the same area.





## Benefit 2.

### Cut Nitrogen Purchases

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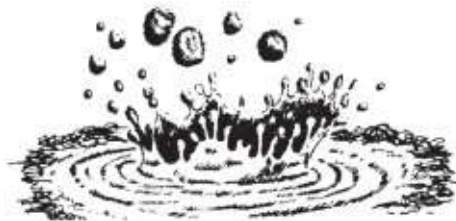
Nitrogen is one of the most plentiful elements. It's in the air we breathe. Tons of it hang in the air over each acre of our gardens, free for use if we can get it down into the soil.

At the same time, nitrogen bought through commercial channels has shot up in price, because production of it demands use of expensive petroleum products.

There is a way to get this nitrogen free, and in large quantities. You can plant legumes as green manures. Legumes — alfalfa, beans, peas, and vetch are some of them — have the ability to host bacteria that can fix nitrogen in the air. The legume seed is inoculated by coating it with a strain of nitrogen-fixing bacteria suited for the particular legume, then planted. This inoculant is widely available in seed stores. When the seeds sprout and grow, the bacteria enter the developing root hairs and take nitrogen from the air and fix it in nodules on those root hairs.

Alfalfa, the best of the nitrogen-fixing crops, can add as much as 200 pounds of nitrogen per acre. That's the same amount of nitrogen you would get from spreading a ton of 10-10-10 commercial fertilizer on that acre. And think of the extra organic material you are adding to the soil and thus enriching it.

### *The Force of a Raindrop Splash*



A drop of rain striking bare soil is like an explosion. Small particles of soil splash into the air and scatter in all directions. On bare ground which has poor soil structure, one hard rain can move tons of soil per acre. On a slope, most of this soil will land downhill from its original location, and it can cause even more erosion than flowing water.

Green manures can help this problem in several ways. They shield the soil from the force of a driving rain. The plants absorb the force of the raindrops and the water flows gently into the ground. The roots help hold the soil in place and there is almost no loss to erosion.

## Benefit 3.

### Stop Those Weeds

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If weeds are your problem, and you think weeding or poisonous, expensive herbicides are the only answer — read on.

Green manures, particularly buckwheat and ryegrass, are effective against weeds by making the weeds know they're not wanted. You till the soil, preparing it for a planting of a green manure. This exposes thousands of weed seeds that have been waiting for light and warmth to begin growing. And begin to grow they do, but so does that green manure crop, and the green manure grows so fast that it soon overpowers the weeds and crowds them out. It's that simple.

Peas and beans, broadcast or planted in wide rows, will do this, too, and they have the advantage of providing a crop for your dinner table.

Thus, every time you grow a green manure crop and till it under, you are reducing the number of weed seeds in your soil. A few such crops and the weeds will no longer be a problem.

#### ***Buckwheat Halts Nut Grass***

Nut grass can be a serious pest in a garden because it grows from little “nuts” or tubers that spread rapidly underground. Hoeing and cultivation won't kill these tubers, and it's difficult to pull them out since the roots break off so easily.



Dick Raymond, a well-known garden specialist, got rid of a heavy crop of this weed this way: first he planted a crop of buckwheat in the spring. Then, six weeks later, Dick tilled that buckwheat under and planted a second crop. Then finally, in late summer he tilled that under and planted annual ryegrass. The next spring — no sign of nut grass.

## Benefit 4.

### Improve Your Soil Structure

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Pick up a handful of good soil. It is soft, dark and has a spongy “give.” Smell it. Not unpleasant at all. Rich.

Examine it closely. Notice how it separates into small granules. These are called “aggregates” and explain the soil’s looseness. Clay particles, microscopic in size, fit together very tightly, leaving little space for air, water or roots. When the soil is well aggregated, these clay particles are molded into rounded granules that have spaces between them. They fit together loosely like a pile of pebbles rather than tightly like bricks. Water and roots can penetrate those spaces between the granules.

Green manures play a big role in the formation of these granules. First the plants protect them from being shattered by raindrops. When the crop is turned under, the micro-organism population is increased many fold. And it is this population that produces polysaccharides, the glue that holds together the material in each aggregate. A good green manure can produce several thousands of pounds per acre of this glue.

#### *Hidden Benefits*

A gardener sees only the leaves and stems of the green manure crop, and this vegetation is only part of the plant’s contribution to the soil. Don’t forget the root system.



Few realize how large a root system can be. A scientist grew a single rye plant in a box for four months, then measured the roots. His findings were almost unbelievable — nearly 14 million roots with a combined length of 387 miles. This means roots reaching down, loosening soil, and bringing up minerals. It means, too, hundreds of pounds of organic material decaying in the soil.

## Benefit 5.

### Increase the Life in Your Soil

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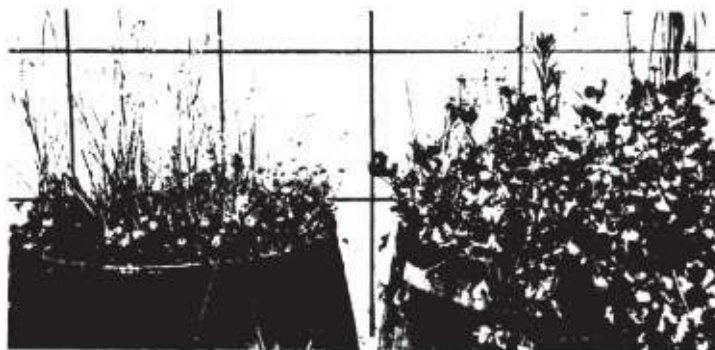
By turning under lush green manure crops, you can create conditions so that the millions of organisms in your soil will flourish.

And the list of jobs they will do for you is tremendous:

- They decompose organic matter in the soil and release nutrients that plants can use.
- They create humus, organic matter that helps the soil to hold water and retain nutrients.
- They help dissolve nutrients tied up in the insoluble minerals of the soil.
- Some of them even take nitrogen from the air and make it available to your crops.

#### *Help the Earthworms Help You*

The green manure gardener provides ideal conditions for earthworms. He offers them food in large amounts as he tills under those green manure crops. He gives them protection, too, a cool, protected soil in the summer, and insulation during the fall, when a sudden frost across bare ground would kill them before they could move deep into the earth.



What does the gardener get from them for this food and protection?

More than he gives. Earthworms will increase in numbers. They will eat and eat, and pass more than 50 tons of materials per acre through their systems.

The product of this is castings, and compared with topsoil, castings are exceedingly rich, containing twice the calcium, 2½ times the magnesium, five times the nitrates, seven times the phosphorus and eleven times the potassium of topsoil.

## Benefit 6.

### Save Time and Energy

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Composting and green manuring are alike in that both are excellent ways to improve the soil in your garden. And the greatest difference between them is the amount of work required to achieve this.

Composting is one of the most valuable tools of the gardener, providing him with rich and nutritious food for his garden. But it is hard work. You must select a site and build an enclosure. You must find the proper materials to compost, providing a source of carbon as well as a source of nitrogen, on a ratio of about 15 to 30 parts of carbon to one part of nitrogen. The pile must be built up and should be turned several times.

Compare this with green manuring. The seed bed is prepared, the seeds are sown and covered, then the gardener waits until the crop has grown. He turns it under, an easy task with tractor-drawn disks and plows, or rear-tined rotary tillers.

The only carrying involved was carrying that seed to the garden. In composting, materials must be carried to the pile, and the compost carried to the garden and spread.

Green manuring provides uncounted pounds of inexpensive organic material, and it grows right where you need it.

Think of green manuring as a way of composting on a large scale. Instead of making piles of compost, you are turning your whole garden into an efficient compost pile.



## Benefit 7.

### Stop Wasting Nutrients

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When the growing season is over, a lot of nutrients are left in the soil. What will happen to them?

Some, of course, will remain in the soil until next season. But much of that goodness may be leached away and lost.

To avoid this loss, plant green manures, and this time call them catch crops, to underscore their ability to catch and hold nutrients that might otherwise leach out of the soil, or cover crops, if they are left over the winter.

This approach is particularly valuable in the south, where soil life stays active all winter, breaking down organic matter and releasing nutrients. In such areas of mild winters with heavy rainfall, nutrients that would be lost can be caught and held until needed.

Planting these crops is a way to store safely over the winter the soil nutrients, because they can't be lost while they are a part of growing plants or undecayed plant material.

#### *Escaped Nutrients Are Dangerous*

Runoff and leaching of nutrients is wasteful, and can be harmful to our environment as well. One problem is that phosphates and nitrates from fertilizer often end up in lakes and waterways.



Lakes that have remained pure and clear since the Ice Age suddenly become scummy and stagnant. Ultimately the fish die, the water smells, and the lake can reach the stage where it is “too thin to plow and too thick to drink.”

Nitrates can also leach through the soil into well water, becoming a health hazard.

Gardeners, of course, contribute less to these problems than large farms do, but they also have fewer excuses for waste.

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## Benefit 8.

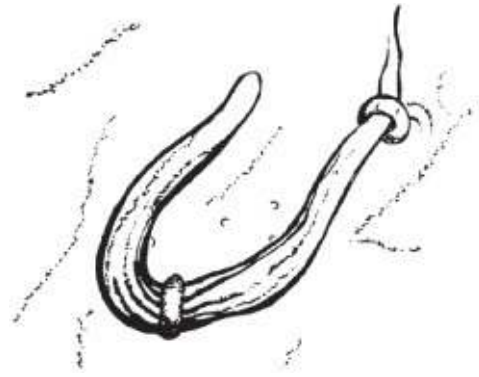
### Growing Healthier Plants



Here's the real reason for any activity in the garden — to grow healthier plants that produce the tastiest crops.

Most gardeners have noticed that a combination of good soil, adequate moisture and sunny, warm days will result in healthy plants, and that the threats to garden plants, such as pests and disease, seem to avoid crops that are healthy. Green manuring, by its contributions to improving soil, thus helps to provide good conditions for healthy plants.

Green manures seem to contribute even more. They seem to suppress plant diseases carried in the soil, doing this by encouraging the beneficial soil life. Diseases develop when the balance of power is upset and the disease organisms outnumber and overpower the good organisms. By growing a green manure crop and turning it under, we can often increase the beneficial organisms so they regain control. Potato scab and snap bean root rot are examples of diseases that can be eliminated with the right green manures.



#### ***Green Manures Help Fight Nematodes***

Root-knot nematodes are a threat to gardens, particularly in the South. These microscopic worms invade the roots of many vegetables, produce knots or lumps on the roots, and stunt the growth of the plants.

It's difficult to eliminate a buildup of nematodes in the soil. Green manures can help you avoid them and may even help you to reduce their population if they are already a problem.

Green manures help by encouraging natural predators of nematodes, such as nematode-trapping fungi.

Under the right conditions, the fungi can multiply faster than the nematodes. Turning under large quantities of organic matter in the form of green manures provides these conditions.

## Benefit 9.

### Improves Soil's Ability to Hold Water



The gardening books say that most crops should have “moist but well-drained soil.” Fine, but what do you do if your soil is sandy, and so dries out quickly, or if it is clay and crusts when drying?

The answer: Green manures.

In the sandy soils the green manures turned under will increase the amount of organic matter in the soil and greatly increase its ability to hold water. With clay, the soil structure will be improved by the green manures, enabling the water to soak in much more readily.

Compacted subsoil called hardpan may prevent water from draining down through or from working back up to the surface by capillary action. Grow a crop with strong, deep taproots, such as alfalfa or clover. These taproots penetrate into the subsoils and loosen them. When the crops are turned under, the roots decay, leaving columns through which water will travel.

#### *Grow Your Own Mulch*

Don't overlook the possibility of cutting a green manure crop and using it as mulch in another part of your garden.



By doing so you can transfer benefits of the green manure crop immediately to that part of the garden where you are growing food crops.

The mulch will conserve moisture, smother weeds, encourage soil life, improve soil structure, and prevent erosion.



## Benefit 10.

### Make Your Garden More Attractive

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Vegetable gardens can be a pleasure to view in the summer, and an eyesore in the fall.

You can change that by growing green manures.

Most gardens, after the crops have been collected, have a bare and desolate look. Some are a mass of blackened squash vines, posts on which tired tomato plants still cling, and weeds in unlikely patches.

Others are bare, with the gardener having raked and removed the trash, and left the soil exposed to the erosive blasts of winter.

Then there's the garden that is soft with a thick mat of green. It belongs to the green manure gardener. You'll notice some patches which are green are higher than others. That's because he doesn't wait to plant his whole garden with green manures, but fits them in when and where he can. He will harvest a row of vegetables, and quickly spread seed. Or he may even plant between rows while the crops are still growing.

Gardeners in the north can have a green garden right up to the first snow by planting a crop such as annual ryegrass. A heavy, rich growth will appear in only a few weeks.

Southern gardeners have a much bigger variety from which to choose. Crimson clover and blue lupine are two good selections. Vetch, field peas, annual sweet clover and bur clover are others. In both the north and south, a wide band of kale can be grown to provide a contrast, and to offer good eating for many months.



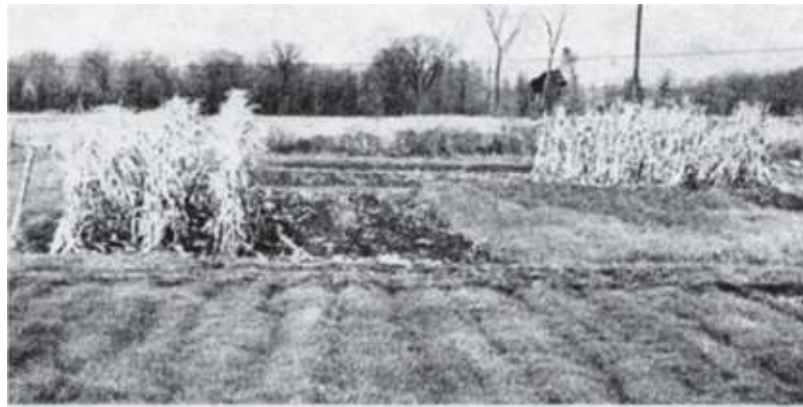
# Green Manuring Methods

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Use your imagination in planting green manures and cover crops. There's sure to be a crop that will fit into your situation. If you have lots of room and good tilling equipment, you have a greater choice of approaches, but there are possibilities for even the smallest areas. Here are three basic methods for green manuring. Try them, experiment a bit, and find out what works best for you.

## ***A. Rotation***

For a two-year rotation divide your garden into two plots. Plant garden crops in one, and manures for the entire season in the other. Switch uses of the two plots the next year. A three-year rotation works the same way except that only one-third of the garden is planted to green manures each year. Either way, perennials such as asparagus and berries are kept in a separate part of the garden.



CROPS	Seeding Rate (Pounds Per Acre)	Seeding Rate (lbs./1000 sq.ft.)	Depth to Cover Seed (in.)	Adapted to Soils of Low Fertility	Areas of U.S. Where Best Adapted	Comments
<b>Legumes</b>						
Alfalfa	20	1	H	—	all	Has deep roots and is excellent for mulch. Needs a pH of 6 or higher. Should grow a full season.
Beans, Snap	—	15	1½	*	all	Broadcast in wide rows. Harvest before turning under.
Beans, Soy	90	5	1½	*	all	Can be turned under early or be allowed to mature and be harvested.
Clover, Alsike	10	½	½	—	North	Good for areas too wet or acid for red clover.
Clover, Red	10	½	½	—	North & Central	Needs a pH of 6 or higher. Should grow a full season. Can be cut for mulch.
Clover, White	10	½	½	—	all	Needs a pH of 6 or higher. The giant variety, Ladino, is best for green manure.
Cowpeas	90	5	1½	*	South & Central	Fast-growing crop for hot, dry weather. Drought resistant.
Hairy Indigo	10	½	½	*	Deep South	Needs warm, well-drained soil. Highly resistant to root-knot nematode.
Lespedeza	25	1	½	*	South	Good for restoring poor, eroded, acid soil.
Sweet clover, white	15	½	½	*	all	Needs a pH of 6 to 7. Should grow a full season. Has strong, deep taproot.
Sweet clover, yellow	15	½	½	*	all	Similar to white variety but does better under dry conditions.
<b>Nonlegumes</b>						
Buckwheat	75	2	¾	*	all	Fast-growing warm-season crop. Grows in most any soil and can smother weeds.
Millet, Pearl	30	1	½	*	all	Fast-growing warm-season crop. Good for smothering weeds.
Sudan Grass	35	1	¾	—	all	Makes rapid, vigorous growth during the hottest part of the summer.
Bur Clover	30	1	½	—	South	Will re-establish itself each fall if allowed to go to seed every five years.
Crimson Clover	30	1	½	—	South & Central	One of the best winter annuals from New Jersey southward.

<b>Legumes</b>						
Lupine, Blue	100	2½	1	—	Gulf Coast	Most widely used of the lupines. Needs moderate fertility.
Lupine, White	150	4	1	—	Deep South	The most winter-hardy lupine. Needs neutral, fairly fertile soil.
Lupine, Yellow	80	2	1	*	Florida	Least winter-hardy of lupines. Does well on moderately acid, infertile soil.
Pea, Field	90	5	1½	*	South	Needs well-drained soil with pH above 5.5. Can be spring-planted in the North.
Sweet clover, Yellow Annual (Sourclover)	15	½	½	*	South	A good winter annual for the Southwest. Needs a pH of at least 6.
Vetch, Common	60	2	¾	—	South	Less winter-hardy than hairy vetch and less suitable for sandy soil.
Vetch, Hairy	40	1½	¾	—	all	The most winter-hardy vetch and the best for most situations.
Vetch, Hungarian	60	2	¾	—	South	Better adapted to heavy, poorly-drained soils than other vetches.
Vetch, Purple	60	2	¾	—	Gulf Coast	Least winter-hardy but produces more green material than other vetches.

<b>Nonlegumes</b>						
Barley	100	2½	¾	—	all	Prefers pH 7 to 8. Spring varieties must be used in the North.
Bromegrass, Smooth	30	1	½	—	North	A fibrous root system and cold-hardiness make this a good winter cover crop.
Kale	15	½	½	—	all	Plant in late summer and it will grow on into the winter. Can be eaten anytime.
Oats	100	2½	1	—	all	Tolerates a wide pH range. Not good on heavy clay. Spring varieties must be used in the North.
Rye	100	2½	¾	*	all	Winter rye is the most hardy of the small grains and a very important winter cover crop.
Rygrass, Annual	35	1	¾	*	all	One of the best winter cover crops. Grows rapidly in the fall. Dies before spring in the North and is easy to till under.
Wheat	100	2½	¾	—	all	Prefers pH 7 to 8.5 and fertile soil. Winter variety is very cold-hardy.



## ***B. Winter Cover Crop***

Winter cover crops protect the soil from erosion and temperature extremes, and add organic matter when they are turned under in the spring.

Annual ryegrass is good in the north for space where you will plant early crops the following spring. Hairy vetch, kale and winter rye will resume growth in the spring, so plant where later crops, such as corn, squash and melons, will be planted. Choices in the South include crimson clover, bur

clover, yellow sweet clover, vetch, field peas, lupine, rye, oats, barley, and wheat.

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### ***C. Spot Planting***

When there's a bare spot in your garden, fill it with a green manure, possibly an edible one such as beans or peas. In the fall, after the last cultivation, plant between the rows. Cowpeas, buckwheat, and ryegrass are fast-growing and quickly fill vacant spots.

# How to Plant Them

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## ***1. Prepare Soil***

Turn under crop residues and weeds, and let them decompose. Rototill soil to fine texture. Add fertilizer and lime if they are needed.



## ***2. Sow Seed***

Broadcast by hand. See chart to determine amount of seed needed.



## ***3. Cover Seed***

Rake it in, or go over area with rear-mounted rotary tiller set at a very shallow depth. Roll it or simply walk on seedbed.



## ***4. Water If Dry***

If weather is hot and dry, water the plot so the seeds are moist until they put down roots.



### **Soil Test Recommended**

Does your soil need fertilizing before you plant green manures? Is it too acid? A soil test will give you the answers. It is available through the Agricultural Extension Service as well as from private laboratories. It's either free or inexpensive, and can result in better crops.

# When to Turn Under a Green Manure

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Here are some guidelines for determining when green manures should be turned under, to get maximum benefit from them.

One rule is: Don't let them go to seed. A crop of buckwheat is an excellent soil conditioner, but if it is permitted to go to seed, and that buckwheat comes up again in a vegetable crop, suddenly the buckwheat looks and acts suspiciously like a weed, since it is a plant growing where it is not wanted.

Another rule is to plant a vegetable crop soon after turning under the green manure. In that way you avoid loss of the nutrients.

Are you trying to add minerals to your soil? Then turn under the crop while it is still fairly young, green and succulent. The acids produced as the green material rots will free locked-up soil nutrients. The soil will be ready for planting in as little as two weeks.

Do you want to build up the organic material in your soil? Then let the crop mature. The woody material will last in the soil much longer, and assist you to increase the humus in the soil. If you do this, you should wait six or eight weeks before planting another crop.



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