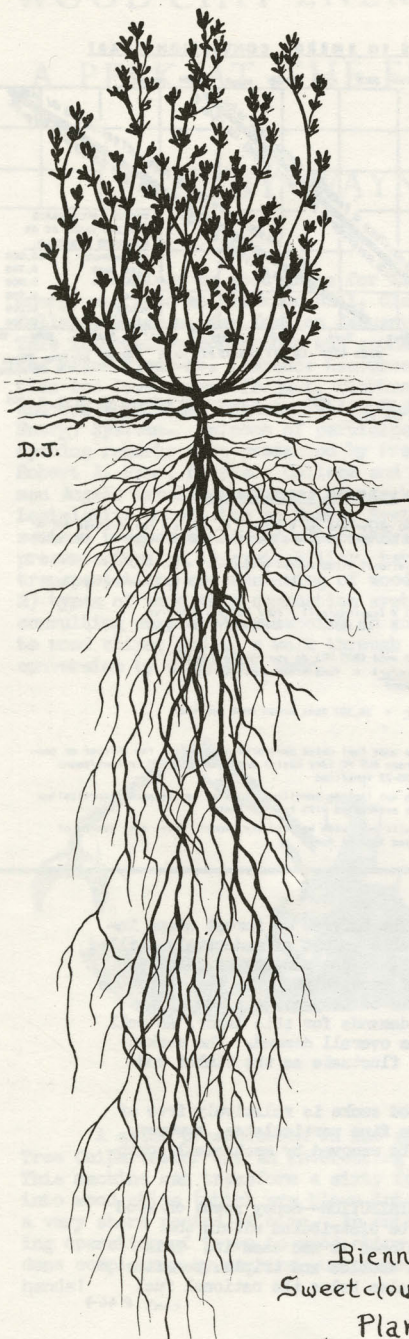
# GREEN MANURE

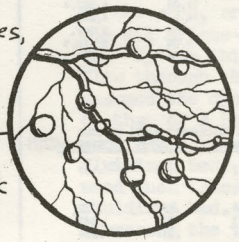
## Building Soils . . . . .

## without Importing Nutrients




Biennial Sweetclover Plant (June 1st of second year)

~Scale~
1 in. : 1 ft.




by
*Doug Jones*

Do you have more tillable land than you really need for your garden or your current cropping system? Do you lack enough animal manure to keep your soil fertile? Would you like to add a dose of nitrogen and organic matter to your land, equal to a twenty-ton-per-acre application of average farm manure? Would you like to loosen your subsoil and tap its mineral treasures? Is your garden buried in weeds by August 15? Do you leave your soil bare over the winter?

If your answer is yes to any of these questions, you should investigate the valuable practice of green-manuring, otherwise known as "cover-cropping." These different names emphasize two different beneficial effects of the practice.

A cover-crop is a technique of soil conservation—you plant something on a piece of bare ground that is not being used, to prevent soil from being washed or blown away. This is also done to take up the excess soluble nutrients which are in the soil from previous fertilization and from the continual release of minerals caused by the breakdown of organic matter (hence another common term, "catch crop"). Then, before you plant the next crop, you plow, harrow, or rototill your cover crop into the soil; its decomposition will condition the soil and feed the next crop.

When soil-conditioning and nutrient build-up are your main objectives, you might refer to what you are doing as "green manuring." The literature on green manuring contains some contradictory information. For example, some sources stress the necessity of tilling the crop under while it is still succulent, low in fiber, with a low carbon:nitrogen ratio. Others say to let it get as mature as possible without going to seed (unless you want it to reseed, which carries the risk of establishing that plant as a weed in subsequent crops).

Actually, the decision on <u>when</u> to turn your green manure under depends on several things: 1) what you expect it to do for your soil, 2) the condition of your soil, 3) the sequence of your rotation, and 4) the characteristics of the plant(s) used.

Turning under a young, succulent crop insures rapid decomposition, because the C:N ratio is low; the microbes attacking the buried plants have lots of nitrogen for their metabolism, and won't steal it away from subsequent crop plants. This is important for a crop like rye, the standard winter cover crop in the Northeast. If it's a succulent 8 inches tall on May 1, it'll be a fibrous 20 inches in three weeks, already difficult to incorporate and too low in nitrogen to decompose rapidly. Thus, a late turnunder means you will have to wait a month before planting your next crop unless you add a good quantity of animal manure when you turn it under.

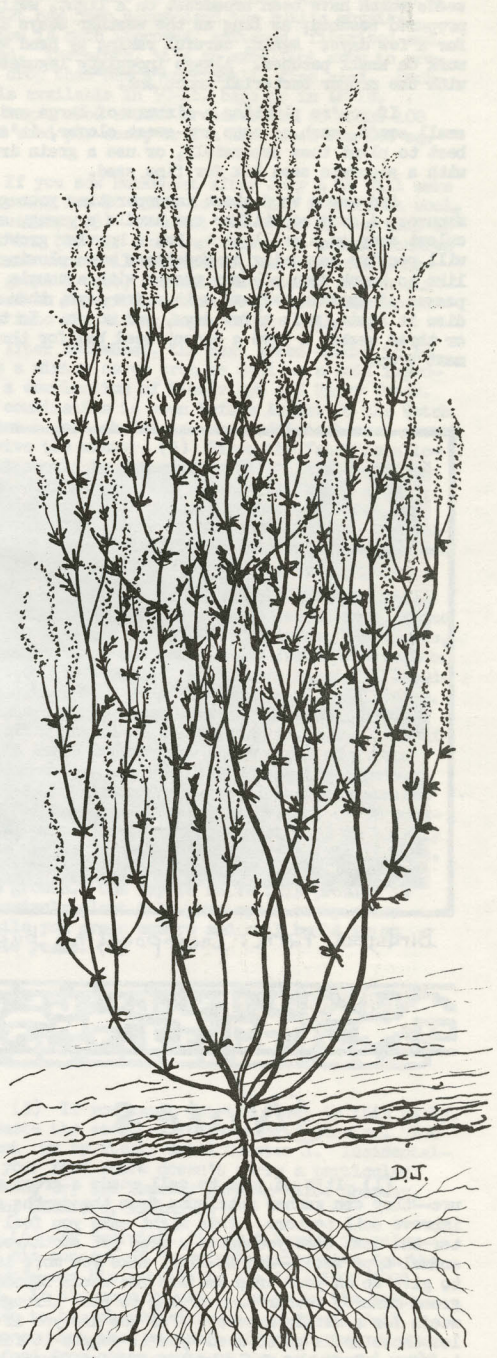
Buckwheat is normally turned under 5-6 weeks after planting, before any seeds have formed. (See footnote on this after Samuel's article.)

So when is it desirable to let a green manure crop get more mature and stemmy? Whenever you are not rushed to plant something else. Only if it becomes big and stemmy do you realize any net gain in soil <u>organic matter</u> and eventually humus. The organic matter derives from the cellulose of the buried plants, and is the key to long-term soil fertility. It makes heavy soils drain better, light soils hold together and leach less, and feeds the life of the soil—the myriad organisms which make nutrients available to plants as they digest organic matter, and later as they themselves die and decay.

So, if you are not pressed to plant a harvestable crop on a certain field, if you have a piece of land that you don't know what to do with, or if you want to "detoxify" some chemically-abused soil, try green manure. If your pH is above 6.0 or can be limed to bring it toward neutral, you would do well to plant sweet clover, for you can let it get stemmy and it will still decompose quite fast because of its high nitrogen content. The seed is cheap compared with other clovers, and sweet clover fixes as much nitrogen as its close relative, alfalfa. It needs ample calcium and phosphorous for best growth.

A word about planting various green manures: those with larger seeds should go 1-2" deep. This includes buckwheat, rye, hairy vetch, sudan grass, and other small grains. The most effective way to plant these is with a grain drill which makes many little rows about 7" apart (also a useful tool for planting large plots of spinach and peas). But you can do well with a hand-held cyclone seeder which broadcasts the seed as you walk over the field in a planned pattern. After broadcasting, you can cover the seed with a light pass with disc harrows set straight, or with a "cultipacker" or roller, or, on small patches, with a garden rake.

Small-seeded crops like clover, alfalfa, or grass should go only ½" to 1" deep, which is more difficult to accomplish. A roller or cultipacker is the ideal. Dragging a few sets of old tire chains hooked to a plank will do it, if the soil stays moist for several days. A heavy rain alone will cover



Biennial Sweetclover in Full Bloom—
July 15 of Second Year

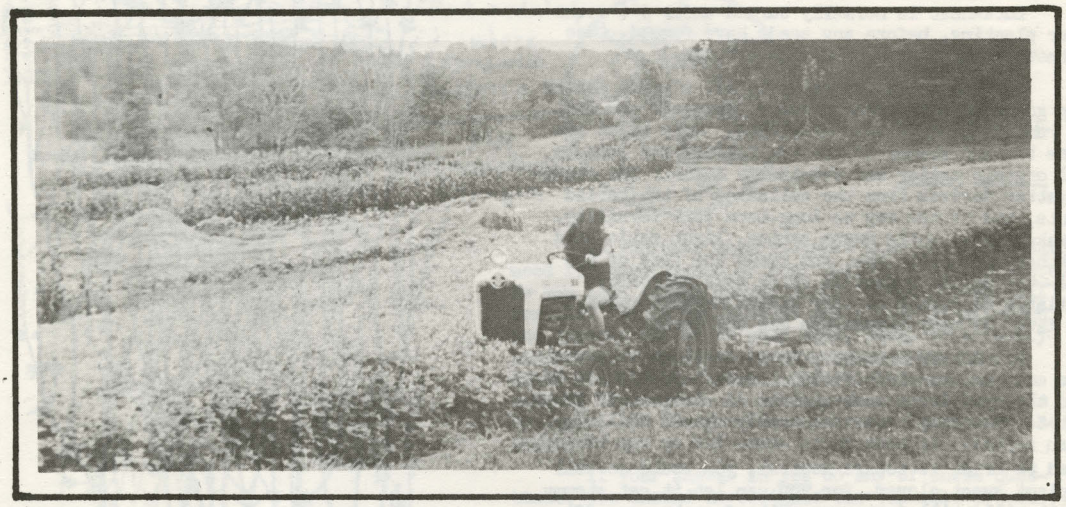
seeds which have been broadcast on a light, well-prepared seedbed, as long as the weather stays damp for a few days. Again, careful raking by hand will work on small patches. Always inoculate legumes with the proper bacterial inoculant.

If you're planting a mixture of large and small seeds, such as oats and sweet clover, it's best to plant them separately, or use a grain drill with a separate seed box for fine seed.

And now a word about incorporating your green manure: A good rototiller can handle a young, succulent crop on a small plot, but a heavier growth will require harrowing or sometimes even plowing. I like to knock down a heavy growth with a couple passes of the disc harrow, wait a few days, then disc it again, wait a few days, and so on. In two or three weeks, I have a decent seed bed for the next crop.

WARNING: "When large quantities of green materials are turned under, some time should elapse before a subsequent crop is planted, in order to avoid seedling injury from the decomposition products." (Principles of Field Crop Production, Martin and Leonard.) In warm weather, this would range from ten days for a very young, succulent crop, to four-five weeks for a thick, stemmy crop. Frequent discing shortens this period.

The following two articles by Samuel Kayman, founder of the Natural Organic Farmer's Association, contain information about some of the crops commonly used in our climate for green manuring: weeds, buckwheat, rye, hairy vetch, and his favorite, sweet clover. Scattered through his articles are small numbers referring to footnotes which I have added, either to explain what he means by a certain statement, or to give additional advice on the cultural techniques of particular crops.



Birdsfoot Farm: Incorporating buckwheat at half-bloom, using disc harrows

# Notes

(1) It's no joke to call weeds a green manure—they can gather nutrients from the depths and improve soil texture. This might make you feel better the next time you watch a crop get smothered in annual-type weeds—and it might make you more inclined to give up on your crop and let the weeds become a green manure, rather than trying to pick through the weeds for a measly harvest. For woe are you if you let those weeds go to seed—you'll regret it for years to come. Turn the whole business under—crop, weeds, and all—just as the weeds are starting to flower (August 1), plant some rye, and try again next year.

(2) Seed available at most feed stores. If you're buying more than a bushel, shop around—the prices vary a bit.

(3) Buckwheat will, however, grow quite well when planted anytime between May 15 and August 15. This makes it ideal, even on fertile soils, as a "catch crop" and soil conditioner in between other crops. Buckwheat will help to control weeds in the subsequent crop, and will rapidly make a lush growth to shade the soil, protecting it from solar oxidation of organic matter, and loss of ammonia. It will make a heavy growth in only five-six weeks.

(4) This is not, in my experience, completely true. Though it begins to make mature seeds at an early stage in the flowering process, I have never found it to be a bother as a "volunteer" or weed in subsequent crops, except for small grains planted immediately after the buckwheat. Letting it go to full bloom will increase the yield of organic matter for your soil. If you keep bees, and don't mind the strong taste, you can time your buckwheat flowering for an otherwise slack nectar period.

# Buckwheat

*by*

*Samuel Kaymen*

The first thing to consider is the condition of the piece of ground you wish to green manure. A very poor piece, one that supports a thin growth of weeds that seem to flower very early, needs nitrogen. Such a worn-out piece could be the result of poor soil management or direct abuse by chemical "fertilization" and/or toxic biocides. Green manuring is an excellent way to bring such a piece back to health and vigor, and consequently, high quality productivity. It's not easy or cheap, especially if you intend to heal with entirely vegetive growth. If you can, obtain some animal manure, for it will greatly speed up the healing process. The readily available nitrogen will not only promote lush crops of non-legumes, but as well the biological life.

Assuming you have such a poor piece of abused, exploited, and mismanaged earth, one way to start is to make use of the weeds that grow there naturally since their very function is to improve the soil. Left to nature, this would take a long time. But we can speed the process by incorporating the weed crop into the living (and let's assume there is some life left) layer of the soil. Then allow the weeds to germinate and grow up again. Always incorporate the weed crop at the time they are young, green, succulent, so they will decompose very rapidly providing an immediate release of soluble materials that will benefit the next crop (1).

If your piece of earth has a little grass growing with the weeds, you don't have to "weed fallow"the ground for a season. You can start immediately with the first green manure crop to use on poor land, i.e., Buckwheat. (2) This wonderful plant has the ability to make use of minerals in the soil to better advantage than many others. Since it accumulates calcium, its decomposition sweetens the soil. It's an effective crop in competing with weeds and will not allow most to grow up to make seed. Since it does well on acid soils, it's an excellent green manure to start with. After a crop of Buckwheat has been decomposed the soil's physical condition is much improved, softened, fiberized and mellowed. Therefore, it's an excellent crop to preceed a crop that has a very small, fine seed. Buckwheat is available in 50-lb. bags or in 48-lb. bushet bags. You should broadcast it at about 100 lbs. of seed per acre, or 1/4 lbs. seed for 100 sq. ft.

If you sow Buckwheat after July 4 it will make good growth, for it likes to make its flowers in cool, moist weather. (3) At about 10% bloom is the time to till it in. (4) If you have access to animal manures and ground rock soil amendments, such as rock phosphate, granite dust, dolomite limestone, all should be spread on the green manure crop before incorporating it into the living layer of the soil.

After Buckwheat, the next green manure to be used as a winter cover crop as well as a soil improver is a combination of Winter Rye and Hairy Vetch. If the combination is sown before August 20 the Vetch will have a good chance to make sufficient root growth to survive the winter. (5) Since the Vetch is a legume, it should be innoculated with its appropriate nitrogen-fixing bacteria, which will insure good growth on poor soil, especially where no Vetch has been growing for a long time. For less than one dollar, most feed stores will sell you enough innoculant for a bushel of seed.

The mixture should be Balbo Rye at the rate of 110-140 lbs. per acre and Vetch at the rate of one bushel (60 lbs) per acre. (For less than acre rates, just remember that one acre is 209 feet x 209 feet or about 44,000 sq. feet.) The mixture should be broadcast by either hand or a "Cyclone" type hand seeder. This mixture can be sown between the rows of vegetables after your last cultivation in August. So if you can't green manure your whole piece of ground because of crops, then you can at least get between the crops. That points out one of the most serious problems of "survival fields" where most crops occupy the ground way into the Fall when it's definitely too late for Vetch, even sometimes too late for Rye. For Rye to winter well it must make sufficient root and top growth. One way to solve this problem is to intensively plant half your space every other year while you green manure and soil build it on alternate years. (6)

## Notes, Cont'd

If you want to get a seed crop, plant between June 15 and July 4, or figure twelve weeks before your fall frost. This is because the plants remain succulent throughout the period of seed formation, and will be difficult to thrash or combine unless a frost has killed their non-hardy foliage, after which the plant quickly dries out, providing the fall weather is not too damp. (You can see the obvious risk here, with our typically wet autumn.)

Buckwheat grows so fast that you can get two full green manure crops in one season, then seed to winter wheat or rye, or do one early buckwheat crop, and then plant fall vegetables or a seeding of biennial sweet clover.



(5) If you can't get the Vetch in this early, don't waste the seed, as it's rather expensive. You can plant rye by itself until October 1. Incidentally, if your feed store doesn't carry a particular field seed, try the Shumway Catalog—R.S. Shumway, Seedsman, Rockford, Illinois.

(6) By "survival fields," Samuel is referring to his concept of "survival agriculture for the Northeast"—see his article in the Fall 1977 ROOT - DRINKER. In the near future, farming in the North will have to become more diverse, as fossil fuel costs go so high that we can't afford to import most of our food from other parts of the nation and world. This will require changes in our diet and skillful use of every warm day in our relatively harsh climate. Hence, the practice of interplanting one crop into another that hasn't been harvested yet.

# White Sweetclover

by Samuel Kaymen

Sweet Clover (Melilotus), is native to temperate Europe and Asia. By 1900, its value as a soil building crop was recognized. In America, it was formally called Bokhara Clover.

It is winter hardy and will grow where the annual precipitation, properly distributed, is 17 inches or more. It can be noticed easily along new highway cuts where non-acid subsoil is exposed. It will grow on infertile soil where the pH is above 6.0.

Sweet Clover is a legume that grows 5 feet tall in the annual form and can grow to 10 feet high in the biennial form. The first year, one central stem develops and the strong, spike-type taproot begins its growth, that could go to 8 feet deep. (Good to break up hardpan and help drain compacted fields.)

The roots may double in weight after September 25th due to food storage that it needs for its second year of spectacular growth. Usually the first year growth will not exceed 24 inches; it can be grazed or be left entirely for soil building.

Care must be taken if one intends to cut Sweet Clover for hay. If it has too much moisture at time of storage, heating and spoilage may result in the formation of a toxic substance, dicoumarol, because of the presence of coumarin, normally very high in Sweet Clover. The dicoumarol can prevent an animal from clotting its blood in case of a cut, and the animal will bleed to death. (7)

The requirements for Sweet Clover are similar to alfalfa. However, Sweet Clover seeds are very "hard" and should be properly scarified before sowing in order to get a high germination rate. Sow 10-15 lbs. scarified seed and 18 to 20 lbs. unscarified seed per acre. It is best planted in early spring, as a high moisture content is preferable for the best germination. (8)

Of the biennial form of Sweet Clover, there are both yellow and white flowering varieties. The white grow bigger and mature later than the yellow. Most white sweet clover available in the U.S. is unnamed. The annual variety that is mostly available is called Hubam. It does well in New England. The white biennial is Melilotus Alba and the yellow is Melilotus, officially. The yellow is tolerant of drought and competition; its leaves are finer, making a better hay, but lower yield.

In the use of Sweet Clover as a soil builder, tests have shown accumulations up to 200 lbs. of nitrogen per acre and over 2½ tons of dry organic matter per acre. It often preceeded corn in rotation before the advent of cheap Nitrogen from the chemical factories. It is one of the most valuable honey plants known.

References are Forage, Hughes, Metcalf, Heath, Iowa State U. Press, Ames, Iowa; and Principles of Field Crop Production, Martin-Leonard, Macmillan Co.

## Notes, Cont'd

(7) Our humid climate makes sweet clover an undesirable hay crop because of this possibility of poisoning; it is also more stemmy than alfalfa. However, sweet clover is completely safe for pasturing at any stage of growth, as long as cows have access to grass pasture also, to prevent bloat. Don't pasture during September, though, when legumes are storing nutrients in their roots for winter.

It is probably important not to let sweet clover go to seed before you turn it under, if you are likely to plant hay on that field in the future. The sweet clover could become an undesirable "weed" in your hay, with the dicoumarol danger mentioned above. Turn under yellow sweet clover no later than July 1, and white no later than July 10.

(8) A common practice is to seed sweet clover together with a spring grain like oats or barley. As with a seeding of grass and legumes for hay or pasture, the small grain acts as a "nurse crop," controlling the weed growth. When the grain is cut, any annual weeds will also be topped, sufficient for the legumes to make a quick growth and smother the crippled weeds. You're taking advantage of the legumes' ability to grow back quickly from crown buds at ground level, an ability lacking in annual weeds.

It is possible to plant sweetclover as late as July, but it won't make as heavy growth the second year as a spring planting will. We plan to experiment with broadcasting it into corn or soybeans in July, right after the last cultivation.