



Maine Organic Farmers and Gardeners Association

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MOFGA FACT SHEET # 10

Using Green Manures

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Introduction

There is no such thing as the "best green manure". A grower has to decide what is the most important benefit to their farm system of growing green manures and what is the window of opportunity that they have to take cropland out of production. This fact sheet is organized by the window of opportunity. Within each of the sections the cover crops are grouped by benefits offered and their particular growing needs are discussed.

FALL COVER CROPS

Loss of nutrients due to leaching is greatest in the spring and the fall. Fall cover crops are used to catch free nutrients and assimilate them in the plant tissue. The nutrients will be held from leaching and released when the cover crop dies. Fall cover crops should be quick to develop a fibrous root system that covers as much soil as possible. Planting early is important. For example, October 1st plantings compared to September 1st result in only 25% of the nitrogen uptake and only one half the root area.

Rye, cereal

Most winter hardy winter cover crop with best ability of taking up the greatest amount of free nitrogen. Can be sown latest. Tolerates poor soil and low pH. Very competitive fall and spring growth. Produces a great deal of organic matter with a high C/N ratio so immobilization must be considered. Another concern is allelopathy. Rye plowdown may interfere with germination of the next crop. Some researchers have seen evidence that even corn may be affected. Wait a week or two after plowdown, if the dry matter yield is large, to alleviate any problems with allelopathy.

Seeding rate: 90-150 lb/A (2.5 lb/1000 sq. ft.), increase to 200-300 lb/A if seeding late

Seeding date: Mid August to late September (mid October in warm areas of ME)

pH: 5.0-7.0

Oats

Oats are not winter hardy in Maine. When used as a fall cover crop a dead vegetative mat is left in the spring, which is easier to incorporate than winter rye. Transplanting or no-till seeding

through the oat mulch in the spring can help with weed control. However, the light colored mat keeps the soil from warming up in the spring. Oats and oat/pea mixes make very good late fall pasture.

Seeding rate: 100 lb/A (2.5 lb/1000 sq. ft.), 50-75 lb/A in mixes

Seeding date: Mid August to early September

pH: 5-6.5

Annual ryegrass

Ryegrass is not as winter hardy as cereal rye nor will it germinate in as cold a soil. It does have a good dense fibrous root system effective for catching free nutrients. It is shade tolerant. Over seeding into summer crops (e.g. corn, tomatoes, peppers, late season brassicas) is commonly done at last cultivation. After crop harvest, the ryegrass is left as a fall cover. Ryegrass is a heavy feeder that does not perform well in poor soils. Annual ryegrass usually does not survive Maine winters. Mid summer seedings will be a dense dead mat the following spring.

Seeding rate: 15-35 lb/A (.5 lb/1000 sq. ft.)

Seeding date: July through mid August

pH: 6.0-7.0

LATE SUMMER PLANTED LEGUMES TO FIX NITROGEN

Winter annual or biennial legumes can be used as cover crops. However, they do not establish fibrous root systems rapidly, thus they are not as effective as grasses at picking up soil nutrients. In systems that do not have large quantities of free nutrients in the soil at the end of the cropping season, late summer planted legumes can serve as an excellent source of fixed nitrogen. It is important that they fit into the cropping schedule. They must be planted early for good winter survival and harvested late in spring to take advantage of their lush spring growth. Cutting their life short by early spring plowing greatly reduces the amount of nitrogen they fix and raises the question of the return on the cost of the seed.

Hairy vetch

The most cold tolerant of the winter annual legumes. Most roots are shallow and slow developing which limits fall nutrient



Incorporating green manure

uptake. Hairy vetch has high potassium and phosphorus requirements, but is one of the best nitrogen fixers. It can fix 60-150 lb/A. Under good growing conditions and proper management hairy vetch can supply the nitrogen needs of even heavy feeders. Spring growth is rapid, especially late spring when vetch nears flowering. Vetch fits well into a field where it can be planted in the late summer and allowed to grow late into the following spring. Ideally vetch should not be killed until it flowers when it reaches maximum dry matter and it can be killed by mowing. Vetch is commonly planted with winter rye which offers support for the vetch vines. Supported vetch gets more light and is easier to mow-kill. Furthermore, the rye will increase the stable organic matter input (vetch decomposes very quickly and thoroughly). The vetch will compensate for nitrogen immobilization caused by the rye so they make good companions.

Seeding rate: 20-40 lb/A (.75 lb/1000 sq. ft.) alone, if with winter rye 15-30 lb/A of vetch and 50-60 lb/A rye.

Seeding date: Mid August

pH: 6.0-7.0, but will tolerate lower pH.

Sweet clover

There are two kinds of sweet clover, an annual and a biennial. The biennial types are planted in the summer and grown until flowering late spring or early summer. Sweet clovers are often used to improve poor soil. Their long taproots can go down 8 feet and will recapture nutrients that have leached beyond the reach of most annual crop root systems. Sweet clover is also known to be a scavenger for phosphorus, able to get it from fixed sources in the soil. The deep roots are also credited with loosening compacted soils and breaking up plow pans. Although sweet clover is a competitive plant its second season, during its establishment it is slow growing and will not out compete many kinds of weeds. It is very difficult to kill sweet clover until it has gone to flower it's second growing season.

Seeding dates: Spring through summer

Seeding rates: 9-20 lb/A (.3 lb/1000 sq. ft.)

pH: at least 6.0

SUMMER FALLOW CROPS

Green manures can be used in fallow fields during the growing season to improve soil structure, add organic matter, prevent soil erosion, and provide weed control, all of which indirectly manage nutrients, but directly green manures can be used in fields pulled out of production of cash crops for a growing season to:

- 1) fix nitrogen
- 2) use deep roots to reach nutrients leached out of the average root zone, and
- 3) scavenge for nutrients unavailable to typical cash crops.

Also, summer fallow crops can help by taking up soluble, and therefore leachable, nutrients and keeping them in an organic form until the cover crop dies.

GREEN MANURES FOR CONTROLLING WEEDS IN A SUMMER FALLOW:

SMOTHER CROPS A smother crop is a crop that crowds and shades out weed growth. They can be crops that grow very

tall and quickly such as Japanese millet or oats, or they can be plants that produce large leaves such as buckwheat. Beware when using smother crops that weeds may not be completely eradicated, i.e., they may only be stunted but still growing in the shadows. In such cases they may go to seed. Keep an eye on them.

SERIES OF GREEN MANURES SEPARATED BY WEEKS OF TILLAGE

The most aggressive scheme for using green manures to combat weeds is to plant a series of them during the growing season. A one to three week (depending on the weed pressure) period of weekly tilling between each green manure crop is recommended. The different growth habits of the different green manures compete with a wide variety of weeds. Also, the tillage operations between crops kills weeds that may be surviving under the green manures, as well as stimulating weed seeds to germinate and then killing them before they produce new seeds. A very competitive series is planting oats early in the spring, then till them in the early summer and planting a smother crop for the summer. In the late summer till in the smother crop and come back with oats or rye for the fall. The smother crop you choose from the list below is mostly based on the equipment you have available. If you have the equipment to handle it sorghum-Sudan grass is more aggressive than buckwheat and produces vastly more organic matter.

Buckwheat

Buckwheat is a broad-leaved non-legume summer annual that requires warm temperatures and well-drained soils. It has a short growing season and can reach the flowering stage in 4-6 weeks. It will grow on a wide variety of soils and is commonly used to improve poor soils due to its ability to scavenge for hard to pick up phosphorus. Buckwheat does not produce very much biomass. It is very succulent and decomposes almost entirely. Be sure to have another catch crop planted after buckwheat to catch the released nutrients.

Seeding rate: 35-100 lb/A (1 lb/1000 sq. ft.)

Seeding dates: Buckwheat is frost sensitive and will not germinate in cold soil. Plant anytime from after the last frost date in spring until 40-60 days before the first frost date of the fall.

pH: 5.0-7.0

Sorghum-Sudan grass

This is often referred to as Sudax. It is a summer annual grass that can grow eight feet tall. You must have appropriate equipment to deal with sorghum-Sudan grass. It produces a very dense growth that can out-compete almost any weed. Sorghum-Sudan grass produces vast amounts of organic matter. Because of its high demand for nitrogen it makes a good catch crop. On the other hand, to use as a weed suppressor it must have good fertility available. It can be used as forage, but it should only be grazed after it is at least eighteen inches tall because young plants contain toxic levels of cyanogenic glucosides.

Seeding rates: 30 lb/A (.5 lb/1000 sq. ft.)

Seeding dates: early to mid summer

pH: 7.0

Japanese Millet

Japanese millet produces very lush growth and is good green manure for the adding organic matter. It is a warm season crop that needs relatively fertile soil.

Seeding rates: 30 lb/A (0.5 lb/1000 sq. ft.)

Seeding dates: Late spring to early summer

pH: 5.5-6.5

LEGUMES FOR FIXING NITROGEN IN A SUMMER FALLOW:

Crimson clover

Crimson clover is used as a winter cover in the southeast. In the northeast it is used as a summer cover. However, crimson clover does not grow well in the hot part of the summer and as a summer green manure produces less nitrogen (50-60 lb/A) and less dry matter than red clover. In contrast to red clover or alfalfa, it will not survive the winter so it is a good choice when you want to be sure none survive to be weeds. It is shade tolerant and can be used under seeded with spring grains. It also serves well as a living mulch between rows of crops such as asparagus, tomatoes, or raspberries. Crimson clover can be kept in a vegetative state for the season by mowing. Mow before any flower initiation. Do not cut closer than 5 inches. For best weed competition, let it grow to flowering (70-90 days) and mow before seeds mature, then incorporate.

Seeding rates: 10-40 lb/A (.5 lb/1000 sq. ft.)

Seeding dates: spring to early summer

pH: 5.0-7.0

Oats (oats/peas/vetch)

Peas and hairy vetch use the oats as a trellis and their different season of growth lend them to work well as a complete season cover crop that fixes nitrogen. The oats begin growth very early and the peas come along later in the spring using the oats as a trellis. The vetch does most of its growth from July to freeze-up. Summer drought can be a problem with this mix. Weeds may join the mix too.



Peas, vetch & oats mix

Seeding rate:

oat/pea/vetch-

100/50/30 lb/A

Seeding date:

Early spring

pH: 6.0-7.0

Cowpeas

Cowpeas are heat-adapted annual legumes that are winter killed in the northeast. They are short day plants that grow fast in the heat, tolerate dry conditions because of their tap roots, but they are sensitive to water logged soils. They grow well in sandy soils and may not do well in clay in some years. They are

very sensitive to frost. Cowpeas are excellent nitrogen fixers and typically contribute over 130 lbs of N per acre under good growing conditions. They should be plowed under when still green in the end of the summer when there is still time to plant a fall cover crop.

Seeding rates: 60-100 lb/A when used as a green manure

Seeding date: After the last frost in the late spring

pH: 5.5-6.5

MULTIPLE SEASON GREEN MANURES

Some green manures serve well for more than one season. Few farmers can take land out of production for multiple seasons, but this practice does the most for building biological activity in the soil as it and the populations of microbes and invertebrates are left undisturbed.

Alfalfa

Alfalfa is sometimes called the prince of green manures. It has very deep tap roots that can reach 30 feet deep tapping unreachable nutrients. It has the greatest potential for nitrogen fixation of the legumes. But it does not tolerate poorly drained soils and requires a pH of at least 6.5. Also, winter survival in Maine is poor if there is not a good, consistent snow cover all winter. Alfalfa is best used over 2 or more years. It can be cut for hay or haylage, or used for pasture, but do not cut or graze between the first week in September and the end of October.

Seeding rate: 12 lb/A (.3 lb/1000 sq. ft.)

Seeding date: Spring

pH: 6.5-7.5

Red clover

Red clover is a cool-season legume with a well-developed taproot which is effective in breaking up compacted soils and extracting nutrients from below the average root zone. It grows best in loamy, fertile soils. Although it needs well-drained soils, it tolerates wet conditions much better than alfalfa. When planted as a summer green manure, the benefits include nitrogen fixation (70-100 lb/A), organic matter addition, weed suppression, improvement of soil structure, and nutrient cycling. Red clover is tolerant of shading and does very well when over seeded. Frost seeding into a winter grain in the very early spring (when the ground is still frozen) can establish a good stand of red clover that will take after the grain is mowed or harvested. Red clover can also be over seeded into corn at the last cultivation. Late seedings of red clover must be left to grow the second season to get full benefit.

Planting rates: 7-20 lb/A (.3 lb/1000 sq. ft.)

Planting dates: Early spring to summer

pH: 6.2-7.0

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