



HAIRY VETCH

(Vicia villosa Roth)

hairy vetch is probably the most cold tolerant of the winter-annual legumes commercially available. It has overwintered successfully throughout the Northeast and in parts of Canada. It grows well on a wide range of soils, and if allowed to grow until flowering, is likely to be the highest yielding of the winter-annual legumes.

Culture

1	2	3	4	5	6	7	8	9	10
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Cold hardiness: zone 4 pH preferred: 6.0–7.0 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Hairy vetch is herbaceous and vining, forming a dense jungle unless it has support for climbing. Stems may measure 12 feet in length, but stands rarely reach more than 3–4 feet in height, unless a companion crop is supporting the plants. Stems and leaves can be hairy or smooth. Flowers are blue to violet. Fall–planted vetch will flower mid–May to mid–June in the Northeast. Hairy vetch may have a weak taproot (1–3 feet deep), but it is basically shallow–rooted, with most roots in the top 8 inches. It has a relatively high phosphorus and potassium requirement.

Hairy vetch may establish rather slowly in the fall, especially if planted after daytime temperatures drop below 60°F, but spring growth will be rapid once soil temperatures warm up. Hairy vetch is suited to sandy or sandy loam soils, but it will do well on any soil type if drainage is good. It prefers slightly acid to neutral pH but can grow on soils too acid for clover and alfalfa as well as on alkaline soils.

Hairy vetch can produce 2,000 to 7,000 lb/acre(A) of dry matter although 3,000–4,000 lb/A is normal for the Northeast. Nitrogen contribution can range from 80–250 lb/A, averaging about 110 lb/A.

USES

Hairy vetch is used primarily as a green manure crop due to its prolific growth and nitrogen-fixing ability. Growers have noted improved soil tilth for the season following plowdown of a vigorous vetch crop. Because of slow fall growth, it is less appropriate for winter erosion control, unless mixed with a fast-growing grass, such as rye or oats. Rapid spring growth makes it an excellent spring weed suppressant. Reported allelopathic effects of the residue make it a suitable weedcontrolling mulch for no-till summer crops. Hairy vetch may be used as emergency feed, though livestock do not relish it.

In the Northeast, growers use hairy vetch in the following ways:

Nitrogen source for summer crops: Under good growing conditions and proper management, hairy vetch can supply the nitrogen needs of even heavy nitrogen feeders. Vetch biomass production increases rapidly just prior to flowering, but waiting for maximum biomass may delay planting of summer crops.

Mulch for spring and summer crops: Hairy vetch can be killed by mowing (see MANAGEMENT) or herbicides and left on the soil surface to provide weed control, nitrogen, and a moisture-retaining mulch. The mulch will tend to lower soil temperatures and may delay growth of warm-season crops. For small-seeded crops, this system may be better for transplants, as allelopathic chemicals in the newly killed mulch may inhibit germination. Nitrogen contributions from vetch mulch are generally lower than when the residue is turned into the soil.

Organic matter additions: Vetch by itself will contribute little to long-term organic matter increases in the soil because of its tendency to decompose thoroughly. Growing vetch with a winter grain, particularly cereal rye, will increase the stable organic matter additions while decreasing the chance of nitrogen tie-up from the cereal stand.

MANAGEMENT

Seeding dates: At least 30-40 days before a killing frost for best results. Zone 7: August 15 – October 10 Zone 6: August 10 – September 20 Zone 5: August 1 – September 10 Zone 4: July 15 – August 20 (results vary)

Growing vetch with grains may reduce frost heaving. Vetch can also be spring seeded as soon as the ground can be worked. Early spring seedings tend to flower and die back by early to midsummer, seldom producing as much biomass as a fall seeding. In cooler climates, late spring or early summer seedings may grow until fall before flowering, but in areas with hot weather, summer plantings languish.

Seeding rates: 20–40 lb/A. The lower rates are suitable if seed is drilled. If broadcasting, overseeding, or seeding late, use higher rates. If seeding with non–legumes, vetch rates can be reduced by 25% (50% if drilled) and the non– legume rate reduced by 50%. A mixture of 20–25 lb/A of vetch and 70 lb/A cereal rye has proved suitable under a wide range of conditions.

Seeding methods: Drill 1/2–1 inch deep into a well–prepared seedbed, or broadcast and incorporate lightly with a disk or other implement. Vetch can be overseeded into standing crops, but the large seed size may lead to poor germination under low moisture conditions. Irrigation or light cultivation following overseeding will help establishment.

Drill vetch after small grain harvest in late summer or after harvesting corn silage if sufficient warm weather remains. Overseed vetch into soybeans around soybean leaf-yellowing time. Overseeding into field corn in late summer or establishing at time of last corn cultivation has not been consistently successful due to vetch's low tolerance of prolonged shading.

Vetch can be broadcast in August into late–season vegetables in the Northeast. Avoid overseeding vetch where there will be heavy traffic while the stand is being established.

Seeds need to be inoculated with "pea/vetch" type inoculant if the plants are to fix nitrogen. No inoculant is necessary if vetch has been in the field within the last 3 years.

Mowing/Grazing: For high quality hay, vetch should be mown at ³/₄ bloom, although cutting after flower initiation will kill the stand. Process hay quickly or the leaves, which dry much faster than the stems, will drop off.

Incorporation: Optimal incorporation time is at flowering when vetch can be killed by mowing at ground level, or by herbicide, or by plowing or disking it under. Vetch will die back naturally after seed set, but because of a high percentage of hard seed (10-20%), seed production may lead to vetch becoming a weed problem. Mowing prior to plowing or disking can aid in incorporation and prevent light-weight tillage implements from becoming entangled by the viny growth. Rotovators, heavy disk harrows, and power spaders have successfully incorporated unmown vetch. Flail mowers can chop up the vetch, but sickle-bar mowers and some rotary mowers will become entangled unless the vetch is well supported by an upright companion crop and the crop is dry.

• Other management notes: It is not recommended to frost seed or drill vetch into small grains if a grain crop is desired as the vining habit will interfere with grain harvest. Also, vetch seed can be difficult to separate from wheat or barley seed since they are similar in size.

SEED PRODUCTION

Due to relatively high seed costs and seeding rates, it may be more cost– effective to harvest your own seed. The seed can remain viable for at least five years. The field can be direct–combined or swathed and field–combined when the lower pods are ripe. Seed pods shatter readily, so care must be taken. The vetch weevil or vetch bruchid (*Bruchus brachialis*) can significantly lower seed yield if infestation is heavy. Crop rotation may help alleviate weevil buildup.

PEST PROBLEMS

Hairy vetch can harbor cutworms and nematodes, including root-knot (*Meloidogyne* spp.) and soybean cyst nematodes (*Heterodera glycines*). Repeated use of hairy vetch can cause a buildup of root-knot nematodes, resulting in yield losses to following susceptible summer row crops.

Hairy vetch harbors various beneficial insects, including lady beetles, insidious flower bugs (*Orius insidiosus*, predator of numerous agricultural pests), and bigeyed bugs (*Geocoris* spp.).

VARIETIES/TYPES

There has been little commercial varietal development of hairy vetch although there are recognizably different types being sold under the generic name of hairy vetch. One type has noticeably hairy bluish–green foliage and bluish flowers. It appears to be more cold tolerant than the other predominant type which has smoother, deep green foliage and pink–violet flowers. 'Lana' woolypod vetch is thought by some to be a subspecies of hairy vetch. It is generally more tolerant of heat but less cold hardy than common hairy vetch and may have some usefulness as a winterkilled spring mulch.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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FAVA BEANS

(Vicia faba L.)

Fava or faba bean, a popular food for Mediterranean people, was noted back in Roman times for its soilimproving properties. Fava has also been called broad bean, horse bean, Windsor bean, field bean, bell bean and tick bean. They can grow to several feet in height in just a few months in cool, damp weather, providing a short-season green manure to precede summer crops. They are not winter hardy in the Northeast. Closely related to hairy vetch, favas can be efficient nitrogen fixers under the right conditions.

Culture

Scale:	1	2	3	4	5	6	7	8	9	10
Heat										
Drought										

Cold hardiness: zone 8 pH preferred: 6.0–7.3, with 6.5–7.0 best Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

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Fava beans are an herbaceous, erect legume, producing sizable seeds which are the offspring of large white flowers with purple markings. They can reach 6.5 feet in height, averaging around 2–3 feet. In the Northeast, fava beans (which are annuals) are planted in the early spring, but in warmer climes they can function as winter annuals. Fava beans develop a strong and aggressive taproot which accounts for much of their reputation for soil improvement.

Favas thrive in 50 and 60°F temperatures provided there is ample moisture. They will germinate and grow well in soils between 35–45°F. Although they tolerate light freezes (10–15°F), they generally will not overwinter in the Northeast. However, cold–hardy cultivars are being developed for areas whose winter extreme lows are between 0–15°F. Short–season varieties exist that are adapted to areas that move quickly from cold winters into hot summers.

Tolerant of almost any soil type, they prefer well-drained, slightly heavy soils, silty clays through sandy loams. Fava beans are more tolerant of acid soils than most other legumes and can also handle alkaline soils.

Large seeds allow favas to grow rapidly after germination, fixing more nitrogen

in 2 months than any other spring-planted cover crop. Research has shown that in 6 weeks of growth some favas can fix up to 100 lb/acre(A) nitrogen. Furthermore, fava beans fix nitrogen right up to maturity, while fixation by other legumes drops during pod formation. Figures on the amount of nitrogen provided by fava beans vary from 71–220 lb/A. If pods and seeds are removed, stubble might provide about 24 lb/A of nitrogen. Reports of biomass production run from 1,800 lb/A to 7,200 lb/A of dry matter, depending on the cultivar and growing time.

USES

Fava beans are used as cover crops and green manures, silage and hay, vegetable and grain. Bees are strongly attracted to them, making it a good honey plant. They are also an excellent attractant for beneficial insects.

For spring planting in cold soils (up to 50–60°F), fava beans are one of the best cover crops and highest producers available, exceeding any other nitrogen fixer. However, if soil temperatures go above 70°F, cover crops like sweetclovers (*Melilotus* spp.) perform far better than fava beans. In the more southern parts of the Northeast, fava beans planted in early spring can be turned under by the end of May, in time for planting a summer-

annual cash crop.

As a green manure, fava bean plants contribute a large amount of organic matter to the soil. In general, because of their stemmy growth, the residue will last longer than that of other legumes. This residue, along with the large taproot, makes fava beans an excellent candidate for opening up heavy soils.

In general, fava beans make excellent forage and silage but are less important as a hay. They are also grown with corn and sunflowers for silage.

MANAGEMENT

Seeding dates: Favas can be planted in the early spring, along with the earliest spring crops. In south-coastal New England, beans have been planted in April through May and also in July through August.

Seeding rates: Small-seeded cultivar rates range from 80–170 lb/A. Rates for large-seeded cultivars vary from 70–300 lb/A, depending on the cultivar and purpose. Use higher rates for green manure, lower rates for bean production.

Seeding methods: Favas can be drilled 1–2 inches deep; if sown in sandy or dry soils, a depth of 2–4 inches is recommended. Large-seeded varieties can be sown with planters used for lima beans. A common corn planter can be used for small-seeded cultivars. For use as forage and green manure, small-seeded cultivars are generally broadcast. Because of the large size of the seed, any method that will incorporate the seed to some extent will increase chances of successful establishment. A firm, well-drained seedbed gives best results, but favas can be grown with minimum tillage.

Seed should be inoculated with "pea/ vetch" type inoculant.

Mowing/Grazing: In general, fava beans do not do well if mown or grazed. Some regrowth may occur after one cut but will not stand close mowing.

Incorporation: Optimal time for incorporation is at flowering, which occurs 42–63 days from planting time. This is when the vegetation is most succulent and is easily worked into the soil. Because plants may be quite tall at this time, it may be easier to first mow the stand and let it wilt for several days before incorporation. Rototillers are effective in chopping up and partially incorporating the vegetation.

Other management notes: Fava beans will tolerate weeds, but will not act as a control unless sown at very high rates. If sown in mixtures with cereal grains or more viny legumes, weed problems can be ameliorated. If mixed with a vining companion, however, the stiff stalks of the fava beans may be pulled over.

PEST PROBLEMS

The most serious insect pests of fava beans are the broadbean weevil (*Bruchus rufimanus*) and aphids, particularly the bean aphid (*Aphis fabae*). Fava beans are considered more susceptible to aphid attack than other vetches. Aphid infestations will rarely have an adverse affect on fava bean used as cover crops, but this pest can damage the seed crop.

Favas are also susceptible to chocolate spot disease (*Botrytis fabae* and *B. cinerea*), which could limit their usefulness as a grain crop in the Northeast. Certain cultivars show some resistance to infection. Seeds can be planted in early spring, and/or early flowering varieties can be used so that pods are filled before the time that severe attacks generally occur. Leaving enough space between plants for good air flow and practicing crop rotations also helps.

Favas can attract many species of parasitic wasps and aphid-loving lady beetles.

VARIETIES/TYPES

Large–seeded types (subspecies *major*) produce flat beans which can be over ³/₄ of an inch long. They are commonly known as broad beans and are grown as a vegetable and for canning.

The small–seeded cultivars (subspecies *minor* and *equina*) produce fatter beans around 1/2–inch long called bell, horse, tick, or field beans. They are used mainly for stock feed, cover crops, and green manures. Small–seeded types are hardier, less prone to diseases, more competitive with weeds, produce more biomass, and are less expensive to plant than large–seeded types.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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CRIMSON CLOVER

(Trifolium incarnatum L.)

Crimson clover is a cool-season legume which can be grown as a winter annual in hardiness zone 6 and south. In the colder parts of the Northeast, crimson clover can be used as a short-season spring or fall green manure. Its rapid growth in cool weather makes it useful for weed control. Higher-than-average shade tolerance makes it a good choice for overseeding in many situations.

EALTH Series

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat										
Flood			1							
Drought										
Shade										
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Cold hardiness: zone 6; milder winters in zone 5 pH preferred: 5.0–7.0 Drainage preferred: well-drained

Average Annual Minimum Temperatures

> Zone 3 40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Crimson clover is upright and covered with soft hairs. Leaves and stems resemble red clover (*Trifolium pratense*), but leaflet tips are more rounded and the color is brighter green, sometimes with dark red flecks. Plants can grow to 28 inches in height but generally average between 12–16 inches. Fall–planted crimson will flower in early to mid–May in the Northeast. Spring or summer planting will flower in 70–90 days. The spectacular crimson–colored clover heads go to seed quickly. Some varieties have high percentages of hard seed, which is an advantage if self–reseeding is desired.

Crimson will germinate and grow vigorously under cool, humid conditions, quickly forming a ground cover which competes with weeds. Provided soil drainage is good, crimson clover can tolerate almost any soil although it grows best on loam soils with good humus content.

Crimson clover used as a green manure can yield up to 200 lb/acre(A) of nitrogen although it more commonly provides 70–130 lb/A. It also can provide 2,000– 7,000 lb/A of dry matter in a year, with 2,500–3,000 lb/A being an average yield for the Northeast.

USES

Crimson clover is an excellent winter cover crop and green manure where it will overwinter successfully. It will not produce as much biomass or fix as much nitrogen as hairy vetch (*Vicia villosa*), but its vigorous early growth and non–vining habit may make it preferable for fall weed control and for overseeding into certain crops. It is often mixed with grasses or small grains for hay. Young crimson clover is very palatable to livestock and seldom causes bloat.

Because of its shade tolerance, crimson clover is used as a cover crop and green manure in orchard systems. It can be left to mature and then disked into the soil. If reseeding cultivars are used, good stands will reestablish in fall every year, under proper management.

As a winter cover crop and green manure in row crops, crimson clover can be overseeded into summer or fall crops in August or September. It has been successfully overseeded into fall-planted lettuce in Pennsylvania. It also has been drilled after silage corn in zone 6 and south. Crimson has consistently grown well when overseeded into yellowing soybeans in the warmer parts of the Northeast. For early season weed control, the clover can be planted in the spring, then mowed or plowed down before the summer crop. The clover can be planted as a summer green manure alone or in mixtures, but it does not grow well in hot, dry weather, and there are other legumes more suitable for summer months.

MANAGEMENT

Seeding dates:

Zone 7: August 20 – October 1 or first opportunity in the spring. Zone 6: August 10 –September 20 or first opportunity in the spring. Zone 5: Spring. Zone 4: Spring.

Seeding rates: 9–40 lb/A. A rate of 18–20 lb/A is usually recommended. When drilling into a fine seedbed, rate can be lowered to 15 lb/A. In companion seeding, seed crimson clover at 10–14 lb/A and the other crop at one–third to half its rate. For overseeding, increase rate by 25–50%.

Seeding methods: Seed can be broadcast and rolled or drilled into a firm seedbed; shallow drilling produces a better stand. Cool, but not cold, night temperatures (below 60°F) and sufficient moisture are needed for good germination and seedling survival.

Crimson has not performed well in Pennsylvania when frost seeded into winter cereals in the spring. Seedings with oats as a nurse crop have performed very well both in the spring and the fall; the mixture appears to be particularly good at smothering young weeds.

Seed needs to be inoculated with crimson clover inoculant or, if unavailable, with general "clover" type inoculant if the plants are to fix nitrogen. If crimson clover was grown in the field within the last 3 years, then the inoculating bacteria should already be in the soil, making inoculation of the seed unnecessary.

Mowing/Grazing: Once established, growth is best and lodging is reduced when the clover is mowed, provided it is cut no closer than 3–5 inches. In fact, clover can be kept in a vegetative state through summer by repeated mowing (although, as mentioned previously, growth will be poor in hot, dry weather). For the best hay, clover should be cut at or before full bloom. However, clover will not regrow if it is mowed or grazed after flowering begins. If reseeding is desired, reseeding type cultivars should be planted and allowed to mature before being cut. Other management notes: It is possible to no-till plant into killed crimson clover stands. Because of the clover's stemminess, this can be a much greater challenge than no-till planting into a vetch crop.

PEST PROBLEMS

Crimson clover seems to have better nematode resistance than other annual clovers although there are reports of severe damage from root-knot nematodes (*Meloidogyne* spp.). It is more disease resistant than most alternative clovers.

VARIETIES/TYPES

There are two major types of crimson clover available commercially— "hard-seeded" and "soft-seeded." Hardseeded types contain a higher percentage of hard seed that will delay germination until fall, when conditions are favorable for growth. These varieties will then tend to germinate in the fall if allowed to set seed in the late spring. Five widely used reseeding cultivars are 'Dixie,' 'Auburn,' 'Autauga,' 'Chief,' and 'Talladega.'

Known winter-hardy cultivars include 'Chief,' 'Dixie,' and 'Kentucky Select.' 'Kentucky Select' and 'Dixie' have overwintered in northeastern Connecticut. Other winter-hardy germplasm may be available in the near future.

A soft-seeded cultivar developed in Mississippi, 'Frontier,' and reseeding cultivar, 'Tibbee,' are noted for their large seeds, excellent seedling vigor, higher fall and winter growth, goodto- excellent seed and forage yields, and early maturity.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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RED CLOVER

(Trifolium pratense L.)

Red clover is a cool-season legume which is best adapted to humid areas of northern U.S. It is a shortlived perennial, typically persisting 2–3 years. It has a well-developed taproot which is effective in loosening compacted soils and recycling nutrients from deep in the soil profile.

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat						5	1.			
Flood										
Drought										
Shade										

Cold hardiness: zone 4 pH preferred: 6.2–7.0 Drainage preferred: well-drained

Average Annual Minimum Temperatures

> -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

A true clover, red clover has hollow, erect stems arising from a thick crown and trifoliolate leaves which usually have a pale 'V' in the center of each leaflet. Its pink to light purple flowers are common sights in fields and roadsides of the Northeast. Its thick taproot, with numerous side branches, may extend to a depth of several feet.

Red clover starts off somewhat slowly, but once established, grows moderately fast. It does best under cool, moist conditions without extreme summer or winter temperatures. Although it will grow well on most well-drained soils, except sands, provided there is adequate moisture, it prefers heavy, fertile soils of near-neutral pH. It is more readily established than some of the small-seeded legumes like alfalfa because it can handle less-thanperfect drainage, acid soils, and clays. Red clover can even tolerate wet soil conditions but not prolonged flooding.

If managed as a multiple cutting hay, it can yield up to 7,120 lbacre(A) of dry matter, averaging 4,500 lb/A. If spring planted and plowed under after 2 months, red clover may still provide as much as 2,000 lb/A of biomass.

Red clover is an efficient nitrogen fixer under ideal conditions. If grown for a full season, it can average around 100–110 lb/A. If seeded and turned under in the spring, it still can provide 70–80 lb/A of nitrogen.

USES

When planted as a cover crop or green manure, the benefits of red clover include nitrogen and organic matter additions, weed suppression, improvement of soil structure, and nutrient cycling. It is used as a hay crop as well and makes an excellent forage.

Because it is tolerant of shading, red clover can be successfully overseeded into row crops, certain vegetables, and small grains, serving as a cover once the cash crop is harvested. It then can be used for hay and/or a seed crop, and finally incorporated as a green manure. It is also a useful cover crop in orchard systems, although it has been accused of harboring nematodes that are harmful to apple trees. The deep taproot loosens soil and also mines phosphorus and other nutrients from deeper soil layers, making them available for subsequent plants.

Red clover is an important and widely used hay crop, especially when mixed with grasses. If red clover is grown alone, bloating of livestock can be a problem.

MANAGEMENT

Seeding dates: In the Northeast, red clover can be planted in early spring as soon as the ground can be worked or any time until late summer when there is sufficient moisture. It also can be frost seeded into winter grains in late winter or early spring. Seeding rates: 7–18 lb/A. If used in a mixture with grasses, lower the rate to 5–8 lb/A. If broadcasting, use the higher rates. With drilling, lower rates will produce a good stand.

Seeding methods: Broadcast and roll or drill 1/4-1/2 inch deep. Red clover can also be frost seeded. When frost seeding, broadcast the seed on the soil surface in the early morning while the soil surface is still frozen.

To establish red clover in the spring without herbicides, it is recommended that a nurse crop of oats at 1.5–2 bushels per acre be seeded with it.

Unless clover has been grown in the field within the last 3-years, red clover should be inoculated with "clover" type inoculant.

Mowing/Grazing: If grown with a companion grain crop, clover growth is enhanced if the grain stubble is mown and removed after the grain is mechanically harvested; the straw, weeds, and clover tops have some feed value. Red clover can be grazed or cut repeatedly, provided it is not cut below 2 inches.

Incorporation: Red clover can be incorporated at any time there is sufficient biomass. Since red clover is not an annual, it will not be killed by mowing at flowering and must be either fully incorporated or killed with herbicides.

Other management notes: In New York, researchers have successfully established stands of red clover and red clover and ryegrass mixtures into field corn at last cultivation. Red clover also can be overseeded into soybeans when the beans are at least 6 inches tall, or later, when they reach leaf-yellowing stage. Red clover alone and in grass mixtures produced good stands when overseeded into peppers and tomatoes in July in Pennsylvania. It also can be overseeded into winter squash before the vines are well developed (although rank growth may encourage disease), or into sweet corn at last cultivation or at tasseling.

Fall seeding of red clover is not recommended if the clover is to be treated as a winter annual (*i.e.*, turned under the following spring), as the amount of biomass production is not competitive with other winter annuals. In the Northeast, it is generally planted in the spring and allowed to grow for a full year before incorporation, allowing one or more hay cuts before incorporation as a green manure.

Red clover is a heavy user of phosphate and potash. Some growers prefer to fertilize their green manure, with the understanding that the nutrients will be recycled to the following crop.

Seeds remain viable for a relatively long time, so if allowed to set seed, you may have to live with volunteer clover for some time to come.

PEST PROBLEMS

Red clover can fall prey to various viruses, bacteria, nematodes, and fungi, including northern anthracnose (*Kabatiella caulivora*) and powdery mildew (*Erysiphe polygoni*), crown rot (*Sclerotinia trifoliorum*), and certain root rots. Following red clover with soybeans is not recommended, as volunteer clover plants could host bud blight, a viral disease of soybeans.

Among the insect pests of red clover, two root-parasitizing insects are considered major causes in shortening its perennial life. They are the clover root borer (*Hylastinus obscurus*) and the clover root curculio (*Sitona hispidula*). Red clover can be susceptible to rootknot nematodes (*Meloidogyne* spp.). This is a vulnerability exhibited by the genus *Trifolium*.

VARIETIES/TYPES

There are two basic types of red clover: early-flowering or double-cut

type, referred to as medium red clover, and late-flowering or single-cut form, generally called Mammoth red clover. There are numerous commercially available varieties of each type.

Mammoth red clover, a vigorous, hardy biennial, is taller, larger–leaved, blooms 10–14 days after medium red clover, and gives higher yields of hay in the first cutting. It will overwinter in most of the Northeast, but performs poorly in hot, dry weather. It makes a better green manure, but a lower–grade hay compared to medium red clover.

Red clover is highly variable so that regional strains have developed which show different cold tolerances, disease and pest resistance, and productivity based on adaptation to local conditions. Consult your local extensionist or seed dealer for locally adapted varieties.

The farmer can ameliorate 100 acres with clover more certainly than he can 20 from his scanty dung heap. While his clover is sheltering the ground, perspiring its excrementitious effluvium on it, dropping its putrid leaves, and mellowing the soil with its tap roots, it gives full food to the stock of cattle, keeps them in heart, and increases the dunghill. —J. B. Bradley Essays and Notes on Husbandry and Rural Affairs, Philadelphia, 1801

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SOIL

MS

<u>HEALTH</u> Series

northeast cover crop Fact Sheet #5

WHITE CLOVER

(Trifolium repens L.)

White clover is a perennial, low-growing, coolseason clover which spreads and maintains itself via creeping stems (stolons) and, if conditions allow, by reseeding itself. Although it is 'rarely competitive with other clovers in terms of production, its hardiness under a wide range of conditions has made it a useful cover crop in many situations. It is found in almost all temperate zones.

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat Flood										
Drought Shade								Û		

Cold hardiness: zone 4 pH preferred: 6.2–7.0 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

White clover is familiar to most people, as it is a common volunteer in lawns and waste places. Leaflets are broad and marked with a white 'V' and sometimes with dark red flecks. Flowers are white or rose-tinged, 5/8-3/4 inches in diameter.

Although slow growing when first seeded, white clover exhibits strong seedling vigor and spreads rapidly once established. Plants can reach 8-12 inches on good sites (depending on cultivar type), but 4-6 inches is more common. It prefers cool, moist conditions and fertile, welldrained soils of near-neutral pH but can tolerate heat, drought, and flooding moderately well. Although it prefers soil types of clay through sandy silt loams, it tolerates any soil type and is more tolerant of poor conditions than most true clovers. The fibrous root system is fairly shallow, mainly found in the top 8 inches of soil, although roots can extend 30-60 inches in deep, open soils. A taproot up to 40 inches long can develop in the first year, but it dies by the end of that year. Its shade tolerance makes it a good choice as an understory cover in orchards or vineyards.

White clover used as a green manure can yield up to 200 lb/acre(A) of N, although it more commonly provides less than 130 lb/A (when plowed at bud or early flower stage). Nitrogen contributions vary with growing conditions, as well as with type and cultivar; 'Ladino' clover generally provides the highest amount of nitrogen.

USES

Although traditionally used as a forage legume, it is a versatile cover crop and green manure, particularly in mixtures with grasses. Its low growth habit and tolerance to traffic make it a good choice for situations where a lowmaintenance cover is needed and where foot and tractor traffic is intense.

Because of its shade tolerance, white clover is a good cover crop for orchard systems. Since the clover grows thickly and spreads readily, it is also excellent for erosion control in any system. In vegetables, small grains, and sweet corn, white clover has been used as a living mulch, for weed control, and as traffic lanes. The clover can be overseeded into small grains and vegetables, including sweet corn, and once established can help control weeds (it has been a successful weed control in winter squash, for example). Researchers in the Northeast have also planted sweet corn into an established white clover field, using it as a living mulch. The clover must be rototilled or intensively mowed in these systems to keep it from becoming competitive with the corn.

As a forage crop, white clover is often seeded with one or more temperate or

tropical grasses. Pure stands of white clover are generally not used for forage because of low growth habit and relatively low yield.

MANAGEMENT

Seeding dates: Early spring through late summer in all northeastern zones. Summer plantings are only successful where the soil is moist and somewhat cool, as in a partially shaded situation. Although white clover exhibits tolerance to frost, late fall plantings should be avoided as small plants are readily heaved by freezing and thawing.

Seeding rates: 6–10 lb/A. Increase up to 14 lb/A when overseeding under adverse conditions. In mixtures with other legumes and grasses, decrease to 4–6 lb/A.

Seeding methods: Seed can be broadcast or drilled, with drilling preferred for a more even stand. Clover can also be frost seeded in early spring when the soil has been opened by frost heaves. Frost seeding should be done in early morning when there is still frost in the soil. If seeding is delayed until midmorning when the soil surface has become slippery, stand establishment will be poor.

Grains are often seeded with the clover at half their normal rate to reduce weed competition while the clover is being established and to help prevent frost heaving.

Legume seed is generally inoculated with the appropriate bacterial inoculant so that the plants can fix nitrogen. White clover requires a "clover" type inoculant. However, if white clover has been grown in the field within the last 3 years, even as a volunteer, it probably is not necessary to inoculate the seed.

Mowing/Grazing: Since white clover does best under regimes of heavy grazing or mowing and survives trampling, frequent cutting will keep the clover competitive with the grasses and weeds, provided the clover is not cut or grazed below 2–3 inches. If clover is to overwinter in areas of severe frosts, fall grazing or mowing should be planned so that sufficient growth (6–8 inches in the taller varieties) will be left in order to avoid excessive frost damage.

Other management notes: For good stand establishment and growth, sufficient potassium and phosphorus must be available in the soil. In mixtures with grasses, grasses will tend to predominate if soil nitrogen is high. If soil nitrogen is low, clover will predominate.

PEST PROBLEMS

White clover exhibits tolerance to nematodes. However, it is susceptible to various root and stolon rots. The most important insect pest is the potato leafhopper (Empoasca fabae). Other insect problems include the meadow spittlebug (Philaenis spumarius), clover leaf weevil (Hypera punctata), alfalfa weevil (Hypera postica), and Lygus bugs (Lygus spp.). Such pest problems can be alleviated by choosing resistant cultivars, rotating crops, maintaining soil fertility, and proper cutting schedules. If the clover is not cut or grazed frequently, the heavy accumulation of vegetation creates a microclimate that predisposes the system for disease and insect problems.

VARIETIES/TYPES

White clover is classified arbitrarily by size into small, intermediate, and large types. The small varieties are low growing and commonly found in lawns and closely grazed pastures. The variety names often include the words 'wild white.' They are generally considered weedy types. Intermediate varieties include 'Common' and 'Dutch White' and what may be termed 'New Zealand White,' an improved pasture white clover. Intermediate types have solid stems with leaves that are dull green on both sides. In general, intermediate cultivars flower earlier and more profusely than the large varieties and tend to be more heat tolerant.

The large varieties, which are often called 'Ladino' after the first large cultivar introduced from Italy, can be 2–4 times larger than the intermediate varieties. They are less heat tolerant and generally have narrower environmental tolerances than the smaller types, but their taller stature make them suitable for hay or silage. Also, 'Ladino' cultivars grow well on poorly drained soil, better than most hay–type legumes other than alsike clover (*Trifolium hybridum*).

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SOIL HEALTH Series

northeast cover crop Fact Sheet #6

BERSEEM CLOVER

(Trifolium alexandrinum L.)

Berseem clover, also known as Egyptian clover, is an annual true clover which grows best in the Northeast in spring and fall when the cool, moist weather most closely matches that of its Mediterranean origins. Although it does poorly in extremes of hot and cold, it is one of the few legumes that can be grown as a fullseason annual in the Northeast from early spring to late fall. It will tolerate light frosts but winterkills when night temperatures consistently fall to 20°F. Average temperatures of 63°F are required for vigorous growth.

Culture

Tolerance Scale:	1	23	4	5	6	7	8	9	10
Heat Drought									
Shade (1= verv low	<i>r.</i> 1	0 = x	/er	y h	iq	h)			

Cold hardiness: zone 7 pH preferred: 6.5–7.5 Drainage preferred: moderately well to well-drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F Zone 5 -20°F to -10°F -10°F to 0°F Zone 7 0°F to 10°F

Berseem clover is erect and branching, with long, slender leaflets that are slightly hairy and lacking a watermark. Stems are hollow, and the flowers are abundant and ivory to white in color. The root system consists of a short tap root that extends up to 2 feet into the soil. Although it is an abundant seed producer, very little of the seed is hard, and it typically does not reseed and reestablish itself well. Depending on the cultivar and growing conditions, it can reach heights of 5 feet but generally stays in the range of 1 to 3.5 feet.

Berseem clover establishes rapidly compared with other legumes and exhibits good seedling vigor. It can produce seed in 50–90 days, depending on the cultivar and seeding date. It tolerates all types of soils except sands but prefers loamy and silty soils. Berseem can grow on alkaline to acidic soils, but is reported to do best on slightly alkaline soils. Moderately well–drained to well–drained soils are preferred, but berseem clover can withstand periods of waterlogging, an adaptation from its origins where the clover was seeded into the muds left by the receding waters of the Nile River in Egypt.

A single cut of berseem clover can yield from 1,000–3,500 lb/acre(A) of dry matter. In milder regions, multiple cuttings (5–7) are often taken, 8,000–17,000 lb/A dry matter can be harvested over a year. Likewise, 130–500 lb/A of nitrogen can be obtained through multiple cuttings over a year. However, for a single cutting, 50–95 lb/A is reasonable.

USES

Although berseem clover has been extensively cultivated for forage, it is an effective cover crop and green manure, "break crop" in rotations (disrupting pests' life cycles), and weed suppressant.

In the Northeast, it has proven itself a versatile full-season green manure and may have some usefulness as an overseeded cover in spring vegetables. It will grow rapidly in both cool and warm weather but will slow down in extreme heat and will generally not overwinter in areas north of hardiness zone 7. Because it can quickly accumulate high amounts of biomass, berseem is a good candidate for a "mow and blow" system in the Northeast in which biomass from strips of green manure are chopped and transferred to adjacent strips containing horticultural crops.

Berseem clover's rapid establishment and regrowth after cutting make it a good smother crop for weedy areas. It can withstand frequent mowing for weed control.

As a forage, berseem clover can be green chopped, grazed, or used for silage.

It has excellent palatability, and there have been no reported cases of bloat in ruminants feeding on it. A companion– seeded crop of berseem and oats can be harvested together for haylage when the oats are in the dough stage.

MANAGEMENT

Seeding dates: In the Northeast, berseem clover can be seeded as early in the spring as possible. Summer seedings may be successful if water is available and shading is not severe.

Seeding rates: 9–25 lb/A. Use lower end of range when drilling, higher end when broadcasting. If excessive seeding rates are used, the thickness of the resulting stand will prevent tillering and spreading of the root crowns.

Seeding methods: A well-worked and firm seedbed is best, similar to an alfalfa seedbed. If broadcast, seed can be covered lightly with a chain drag and firmed with a cultipacker roller.

Seeds need to be inoculated with "clover" type inoculant if the plants are to fix nitrogen. If clover was grown in the field within the last 3 years, inoculation is probably not necessary.

Mowing/Grazing: The clover can be cut or grazed when it reaches 14–18 inches tall (some cultivars can be cut at 10 inches), but about 3 inches of stubble should be left. Berseem clover is very responsive to mowing or grazing and will resprout quickly from the crown.

If being used as a green manure as well as a hay, cut less frequently. Berseem will put on more regrowth if clipped before bloom than if clipped after bloom.

Incorporation: Berseem can be mowed several times for forage and then incorporated as a green manure, or allowed to produce seed after the final cutting. For maximum nitrogen contribution, incorporate as a green manure at time of flowering. However, berseem can be incorporated at any time there is sufficient herbage.

Other management notes: Berseem can be seeded in mixtures with white clover in newly planted pasture to help boost yields, or can be planted into old clover and alfalfa as a renovator. It has also been successfully grown with small grains such as oats and rye. Frost seed-ing berseem into winter wheat has not worked well in Pennsylvania.

PEST PROBLEMS

Berseem clover shows little resistance to root–knot nematodes (*Meloidogyne* spp.). This is a vulnerability exhibited by the genus *Trifolium*. This clover seems to be a personal favorite of rabbits.

To its credit, berseem clover attracts bees and bigeyed bug (*Geocoris punctipes*), a generalist predator.

VARIETIES/TYPES

Berseem clover cultivars are generally characterized by the type of stem branching they exhibit: from the crown; from the crown and along the main stem; or along the upper part of the stem. The third type will not regrow after being cut, but the first two types will.

The most commonly available varieties currently include Bigbee,' 'Multicut' (formerly called 'Burton') and 'TopCut,' all crown–branching cultivars that were developed in the United States. 'Multicut' grows taller and faster and blooms later than 'Bigbee' but is less winter hardy. 'Bigbee' retains its seeds well but is susceptible to crown rot.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SOIL

ALSIKE CLOVER

(Trifolium hybridum L.)

Alsike clover is a cool-season perennial true clover that is adapted to cool climates and low, wet soils. It generally persists for 3 to 6 years, depending on conditions, but is often treated as a biennial. It is well adapted to conditions in the Northeast and overwinters in most of New England.

EALTH Series

Culture

ToleranceScale:1 2 3 4 5 6 7 8 9 10HeatHeatFloodHeatShadeHeat(1= very low, 10 = very high)

Cold hardiness: zone 4 pH preferred: 6.3 Drainage preferred: poorly to moderately well drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Alsike clover has a reclining growth habit (companion grasses help keep the plant more erect), and produces tillers from the crown. It can range in height from 8 inches to 5 feet, but normally it is 1 to 3 feet tall. Flowers are pink to white and resemble those of white clover. Ripe pods shatter readily. Unlike red clover (*Trifolium pratense*), the main stem does not terminate with a flower head, so alsike will continue growing in height after flowering. The root system is shallower than that of red clover; the bulk of the root system is found in less than a foot of soil.

Wet fertile clay or heavy silt soil is the preferred habitat for alsike clover, but it will grow on any soil if there is abundant moisture. Alsike can endure waterlogging that would kill most crops, surviving and growing well for periods even in water– soaked, water–covered soil. It tolerates both greater acidity and greater alkalinity than most clovers and is more cold hardy and heat tolerant than red clover.

Alsike clover fixes nitrogen and can contribute from 60 to 119 lb/acre(A) of nitrogen. Total biomass production averages 30–40% lower than red clover.

USES

Alsike clover is an important legume in Europe, Canada, and northern United States where it has been cultivated mainly as a forage and hay crop. It can also serve as a green manure and cover crop and is an excellent bee plant. It is generally used for the same purposes as red clover.

Alsike can be seeded with small grains, leaving a cover after the grain is harvested. When sown into winter grains, alsike can either be frost seeded or sown at a late snowfall so that the seed will be carried into the soil with the snow melt. Alsike has been consistently successful when frost seeded into winter wheat in March in Pennsylvania. Good stands can also be obtained by broadcast seeding into a winter grain before stem elongation of the grain or by drilling or broadcasting along with spring grains.

Alsike can be used as a cover crop and green manure in rotation with vegetables or corn. In New Jersey, it has been successfully planted in July or August, after early potatoes or cabbage, or sown into corn at the last cultivation. When overseeded into corn in Pennsylvania, restricted air movement and low light caused some mildew infection, but the clover persisted well. Buckwheat (*Fagopyrum esculentum*) can be mixed with alsike when seeding in late summer for good weed control and green manure.

Alsike makes a good hay and forage, which can be exceptional if it is in a mixture. It usually is not cultivated alone but is mixed with red clover, timothy (*Phleum pratense*), or other grasses, which improves hay and boosts yield. Alsike is recommended for wet, natural meadows, swales, and creek bottoms, where it will volunteer and spread.

MANAGEMENT

Seeding dates: Cultural methods for alsike clover are similar to those for red clover. In the Northeast region, alsike is'usually seeded in the early spring (April–May). In southern New England and south, it can also be sown in late summer to early fall. When planting alsike with grasses, it is a common practice to sow the grasses in the fall and overseed the clover in early spring (frost seeding).

Seeding rates: 4–10 lb/A. If drilled, lower rates can be used, while broadcasting would, require higher rates. Use 8– 10 lb/A when overseeding. If seeded in a mixture, 3–5 lb/A is probably adequate. If a heavy seeding rate of 15 lb/A is used, a dense stand 2 feet in height will develop.

Seeding methods: Seed can be broadcast and rolled or drilled ¹/4– ¹/2 inch deep into a firm, weed-free seedbed. A cultipacker seeder or equivalent equipment gives good results.

Seeds need to be inoculated with "clover" type inoculant if the plants are to fix nitrogen. However, as the bacteria used for inoculation are so widely distributed, inoculation probably is not necessary if white, red, alsike, or crimson clover has been grown in the field within the previous 3 years.

Mowing/Grazing: Alsike can be grazed or cut for hay when 1/4 to 1/2 of the stand is in bloom. If it is seeded with red clover, it is best cut when the red clover is in full bloom as red clover stems will harden up more quickly than the fine stems of alsike clover. At least 2 inches of stubble should be left at harvest. Subsequent harvests or grazing should occur when 1/4 of the alsike clover is in bloom.

Incorporation: As a green manure, alsike can be incorporated in the spring or fall, depending on its planting date and intended use.

Other management notes: Alsike clover has a medium lime requirement-

and responds well to lime application. It also responds well to high phosphate and potassium levels.

PEST PROBLEMS

Alsike clover is generally less susceptible to pests than red clover.

VARIETIES/TYPES

There are relatively few cultivars of alsike clover, mainly because there is relatively little variation in this species. Two cultivars that are available are 'Aurora' and 'Tetra.' 'Aurora' was developed in Canada and is noted for its hardiness and seed yield. 'Tetra,' a tetraploid form from Sweden, may be more persistent and higher yielding than diploids.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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ANNUAL WHITE SWEETCLOVER

EALTH Series

(Melilotus alba var. annua Coe)

Annual white sweetclover, sometimes known as 'Hubam' sweetclover (originally a variety name), is not a true clover but is more closely related to alfalfa. Although not winter hardy in the Northeast, it has recently gained favor as a productive summer legume for soil improvement. Its deep taproot and rapid growth in warm weather make it an excellent choice for adding organic matter and nitrogen, or smothering weeds during summer fallow. Its shade tolerance makes it a useful species for overseeding into spring grains and vegetables. A biennial form of white sweetclover is described in Fact Sheet #9.

Culture

Tolerance									
Scale:	1	23	4	5	6	7	8	9	10
Heat									
Drought									
Shade				1					
(1= very low	1. 1	0 = v	ver	v h	ia	h)			

S

Cold hardiness: no frost tolerance pH preferred: 6.5–7.2 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

3 (

White sweetclover is an erect, herbaceous, stemmy legume with trifoliolate leaves and small white flowers carried on numerous slender stalks. Young plants can be distinguished from alfalfa by the leaflets, which are toothed all the way around, not just at the tip. Plants can grow from 2 to 6 feet or more in height. Annual sweetclover produces a taproot that is relatively shorter and more slender than the biennial forms but is still effective in working compacted soil. Although not native to the U.S., white sweetclover is commonly seen in grasslands, arable soils, wastes, and roadsides, especially in calcareous soils.

Although biennial forms of sweet-. clover are notoriously slow growing when first seeded, annual cultivars show rapid early growth. Sweetclovers can grow just about anywhere, from semiarid to humid regions as long as there is 17 or more inches of rainfall appropriately distributed throughout the year. They will tolerate soils from clay to sand but do best in clay loams with neutral to alkaline pH. Plants are sensitive to soil acidity and will perform poorly if pH is below 6.0.

Because of its rapid growth, 'Hubam' annual white sweetclover can provide up to 9,000 lb/acre(A) of dry matter yield in one season (total of 3 cuttings), although 1,000–5,000 lb/A may be more common. As a nitrogen–fixing plant, white sweet-clover can provide 70–90 lb/A of nitrogen. Because of such characteristics, sweet-clovers are recommended for regenerating poor, thin soils.

USES

Annual white sweetclover is useful as a summer cover crop and green manure, nurse crop, soil–improving crop, weed suppressant, and animal forage. It is also a valuable honey crop.

'Hubam' annual sweetclover has been successfully used as a cover and green manure in vegetable systems. In the Northeast, it has been overseeded into spring broccoli in June. In this niche, it can continue to grow after broccoli harvest to smother weeds and produce biomass and nitrogen before a fall crop. It can also be interplanted between rows of winter squash, and it has performed consistently well when overseeded into winter wheat in Pennsylvania, either as a frost-seeded crop in March or broadcast later in the spring.

'Hubam' has been sown with a spring small grain as a nurse crop. Planted in late summer, it will winter kill, forming a nice mulch for spring weed control and soil improvement. As a summer cover, it can make a good catch crop and nutrient recycler. Sweetclovers appear to have a greater ability to extract phosphorus, potassium, and other soil nutrients from insoluble minerals than most other crops, and the deep taproot can mine minerals from deeper soil horizons. These nutrients will then be available to the following crops.

Sweetclovers are also grown for forage, hay, and silage. However, if the hay or silage is improperly cured it can cause "sweetclover poisoning" in cattle, which can lead to sudden death. Seed meal is added as a protein supplement in cattle feeds once toxic substances are removed.

MANAGEMENT

Seeding dates: The annual cultivars should be planted in mid–spring although frost seedings into winter grains may also be successful. It can reach full flower in 12 weeks (by mid– to late summer), and will continue to flower until it dies back in the fall. If 'Hubam' is planted in the summer, it may flower by late fall.

Seeding rates: 15-30 lb/A.

Seeding methods: Seed can be drilled 1/4-1/2 inch deep or broadcast and rolled.

Legume seed should be inoculated with the appropriate bacterial inoculant so that plants can fix nitrogen. White sweetclover seed should be inoculated with "alfalfa/medic" type inoculant.

Other management notes: Because of their near-woody growth, sweetclovers can be difficult to incorporate. Mowing annual sweetclover before it becomes too densely fibrous will speed decomposition and make incorporation easier. Using the annual form which has been winterkilled and left as mulch can facilitate incorporation in the spring.

PEST PROBLEMS

Sweetclovers can harbor diseases and pests such as cutworms and nematodes. An important insect pest is the sweetclover weevil (*Sitona cylindricollis*), which defoliates seedlings. There are attempts to develop resistant cultivars.

Floral nectar attracts numerous predatory wasps and parasitic flies. Although you might be tempted to stop and smell the flowers, the blossoms' attractiveness to bees makes a flowering sweetclover field a risky place to linger.

VARIETIES/TYPES

Annual forms produce more aboveground growth but less root biomass than the biennial forms in the first year of growth. The annual form includes the cultivars 'Hubam,' 'Emerald,' 'Floranna,' and 'Israel.' 'Hubam' is widely used for soil improvement and grazing in southern U.S. and is commonly the only cultivar that is commercially available.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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BIENNIAL SWEETCLOVERS

(Melilotus officinalis (L.) Desr. and Melilotus alba Desr.)

HEALTH Series

Culture

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			881	
				~~

Scale:	1	2	3	4	5	6	7	8	9	10
Heat	E									
Drought						ŀ.				
Shade								-		
(1 = verv lov	v. 1	0 =	= v	er	v h	ia	h)			

Cold hardiness: zone 4 pH preferred: 6.5–7.5 Drainage preferred: well–<u>drained</u>

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

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Sweetclovers have long held an esteemed role in soil improvement. Their thick long tap roots, which may extend as deep as 8 feet, are credited with loosening compacted soils, breaking up plow pans, and recapturing plant nutrients that have leached beyond the reach of most annual crop root systems. The deep roots also help sweetclovers withstand drought better than most other legume cover crops. Sweetclovers are tolerant of a wide range of soil and climatic conditions, with the exception of acid soils. Abundant aboveground growth contributes significantly to both soil nitrogen and organic matter. To obtain maximum benefits from biennial sweetclovers, they should be spring seeded and allowed to grow until early the following summer when they will flower. Biennial sweetclovers will generally overwinter in most of New England.

Biennial sweetclovers that are readily available include yellow blossom or common sweetclover (*Melilotus officinalis*), and white sweetclover (*Melilotus alba*). An annual white sweetclover which is being used as a summer cover crop is described in Fact Sheet#8. Although not a native species, sweetclovers have adapted to a wide range of conditions in the temperate zone; they are a common sight along roadsides and in disturbed places throughout most of the U.S.

Sweetclovers are erect, herbaceous legumes with many tall, straight stems and trifoliolate leaves. Flower stalks carry numerous small yellow or white flowers. Growth is typically slow after germination, and the aboveground biomass from the first season will tend to die back in the winter, leaving the root crowns with numerous buds and providing little winter cover. The following spring, sweetclovers will grow with an almost frightening vigor, sometimes reaching heights of 8 feet before flowering in early summer. Stems can become almost woody at this point and may require extra patience to mow and incorporate.

Sweetclover can grow nearly anywhere, from semiarid to humid regions, producing adequate yields when the rainfall is as low as 16 inches per year. Yellow blossom sweetclover can withstand drier conditions than white sweetclover and mature 10–14 days earlier than biennial white sweetclover. Sweetclovers will tolerate soils from heavy clay to light sand but do best in loam soils with neutral to alkaline pH. They will perform poorly if soil pH is below 6.0.

Because of its vigorous growth, yellow blossom sweetclover can provide up to 7,500 lb/acre(A) of dry matter yield in its second year of growth. However, yields of 3,000–4,000 lb/A are more common. Second–year yields are usually higher than those of the first year. As a nitrogen– fixing plant, biennial sweetclovers can provide 90–170 lb/A of nitrogen, with averages closer to 100 lb/A. Because of such characteristics, sweetclovers are excellent conditioners for poor, thin soils.

USES

Besides their usefulness in breaking up soil compaction, catching leached nutrients, adding nitrogen and organic matter, sweetclovers have been used for pasture or hay, weed control, and erosion control. They are also an important pollen source for honey. Seed oil is used for making paint and varnish, and the plant fiber can be made into paper pulp.

Sweetclover (more commonly yellow blossom than white) has been used in the Northeast as a full-year fallow on heavy or compacted soils or soils low in organic matter. Frost seeding into winter grains allows harvest of at least one crop during the life cycle of the sweetclover and helps control weeds while the sweetclover establishes.

In New York and Pennsylvania, yellow blossom sweetclover has been successfully overseeded into corn 6–18 inches tall, although in areas where corn grows tall and excludes more light, overseeding can be problematic. Overseeding into sweet corn has generally been more successful due to the shorter stature of the corn.

Sweetclover can make a good catch crop and nutrient recycler. It appears to have a greater ability to extract potassium, phosphorus, and other soil nutrients from insoluble minerals than most other crops. The deep taproot can mine minerals from deeper soil horizons making nutrients available for the following crops.

Sweetclover is grown for forage, hay and silage. However, if the hay or silage is improperly cured and becomes moldy, varieties high in coumarin (a potentially toxic plant chemical) can cause"sweetclover poisoning" in cattle, which may lead to sudden death. The seeds of yellow blossom sweetclover are reported to poison horses.

MANAGEMENT

Seeding dates: Biennial sweetclover may be sown in early spring through late summer in the Northeast.

Seeding rates: 9–20 lb/A. White sweetclovers may occasionally be sold unhulled, in which case seed at 20–30 lb/A.

Seeding methods: Seed can be drilled 1/4-1/2 inch deep or broadcast and rolled.

Slow spring growth can be compensated for by sowing with a small grain as a nurse crop to control weeds. Once the companion crop is harvested, sweetclover grows rapidly, which makes it effective for weed control in its second year. Frost seed into winter grains early in the morning when the soil surface is frozen. Broadcast into winter grains before rapid stem elongation of the grain.

Legume seed needs to be inoculated with the appropriate bacterial strains for plants to fix nitrogen. Sweetclover seed should be inoculated with "alfalfa/ medic" type inoculant.

Incorporation: As a green manure, yellow blossom sweetclover can be plowed under in late fall the first year, although better results are obtained from incorporating sweetclover the following spring when top growth reaches 6 inches or more. Sweetclover may regrow from healthy crowns if it is incorporated too early, requiring additional tillage. If allowed to grow to its full height, stems will become fibrous and may be difficult to mow and incorporate. Some growers prefer to mow once or twice in the spring when sweetclover reaches 12-24 inches tall before final incorporation. Nitrogen content of the top growth of the second-year crop levels off once plants reach 12-16 inches tall, so early spring incorporation can give maximum nitrogen contribution and conserve moisture.

Other management notes: For pasture, stands should be grazed in the second year when they reach 8–10 inches tall, to keep the plants from becoming woody and unpalatable. Hay quality in the second year degrades as plants mature, due partly to increased woodiness and partly to the buildup of coumarin.

PEST PROBLEMS

Sweetclover species can harbor diseases and pests such as cutworms and nematodes. An important insect pest is the sweetclover weevil (*Sitona cylindricollis*), which defoliates new seedlings. Floral nectar attracts numerous predatory wasps.

VARIETIES/TYPES

Recommended cultivars of yellow blossom sweetclover include 'Albotrea,' 'Common Yellow,' 'Erector,' 'Madrid,' 'Goldtop,' and 'Switzer.' 'Madrid' is a recommended seedling cultivar noted for its good vigor and production and its relative resistance to fall freezes. 'Goldtop' has excellent seedling vigor, matures 2 weeks later, provides larger yields of higher quality forage and has a larger seed than 'Madrid.'

White biennial sweetclover varieties include 'Denta', 'Polara,' and 'Arctic'. 'Polara' and 'Arctic' are adapted to very cold winters. 'Denta' and 'Polara' have low amounts of coumarin.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SOIL

HEALTH Series

northeast cover crop Fact Sheet #10

FIELD PEAS

(Pisum sativum ssp. arvense (L.) Poir. or Pisum arvense L.)

Field peas are annual legumes that thrive in cool, moist areas. Although field peas will not overwinter in most of the Northeast, their rapid growth in chilly weather makes them potentially useful as a shortterm spring green manure. In Maryland or south, they can be grown as a highly productive winter annual. Canadian field peas and Austrian winter peas are 2 common types of field peas.

Culture

l'olerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat									1	
Flood										
Drought	E									
Shade										
(1- yory low	. 1	0		0	o k	ial	5			

(1 = very low, 10 = very high)

Cold hardiness: zone 7 pH preferred: 6.5–7.5 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F -20°F to -20°F -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Field peas are herbaceous, succulent, and viny, with weak stems that require a supporting crop for vines to stretch to their full length of up to 5 feet. The rose to lavender colored (sometimes white) blossoms are quite showy and attractive to bees.

Field peas like well-limed, welldrained clay loam soils, near-neutral pH or above, and moderate fertility. Field pea root systems are shallow, making them susceptible to drought on lighter, sandy soils. If grown on humus-rich black soils, field peas will produce abundant viny growth with few seed pods.

Although the peas can withstand temperatures as low as 10°F with little or no injury, they will not consistently overwinter north of Maryland. They are sensitive to heat, especially in combination with humidity, and will tend to languish in July in most of the Northeast.

When fall seeded in Maryland and cut before corn planting, dry yields reached 5,050 lb/acre(A) and supplied up to 190 lb/A of nitrogen. In Canada, after 2.5 months, dry yield was 5,100 lb/A, supplying 172 lb/A of nitrogen.

USES

Grown for seed, forage, green manure or as a cover crop, field pea is a versatile legume. Field peas can also protect soils against erosion and, with their vigorous growth, suppress weeds. Long-vined varieties may be better at weed control than short-vined types. Aboveground growth of winter peas is extremely succulent, breaking down rapidly after incorporation. For this reason, it is not a suitable choice for building long-term organic matter, or for use as a dead mulch for weed control.

Field peas function well as a spring green manure for summer crops planted after May. If mixed with oats, the combination produces plenty of biomass and is a great spring weed smotherer. In northern areas with cooler summers, field peas can be seeded with oats and vetch as a fullsummer soil-improving crop. In Maryland and south, it can also be fall planted and plowed under before springplanted corn. Fall-planted field peas in areas north of Maryland will typically winterkill and quickly decompose, leaving a slimy, unpleasant-smelling spring ground cover.

Nurse crops are often used to support the pea vines and reduce lodging. Oats are the most commonly used support crop, although growers sometimes sow barley, rye, or wheat. Certain field pea cultivars have been successfully interseeded with rape or other mustards as a nurse crops.

Field peas, alone or with oats, make excellent hay, pasture, or silage for live-

stock. Because of their succulence, however, field peas are difficult to cure. Whole dry beans can be eaten by livestock, and certain green and yellow varieties are marketed as split peas for soups. When dry beans are removed, little residual nitrogen will be retained in the residue.

MANAGEMENT

Seeding dates: In the Northeast, field peas are best planted as early as possible in the spring. In spite of the large seed size, frost seedings can be made into winter grains, although the pea vines are likely to make grain harvest nearly impossible.

Seeding rates: Rates can vary from 70 to 220 lb/A. Small-seeded types are sown at lower rates and large-seeded types at the higher end. If sowing in a rough seedbed, increase the rate by 15–25 lb/A.

Seeding methods: Field peas are commonly sown with a grain drill. They can also be broadcast, but seeds need to be covered, not just left on the surface. Sow thickly when broadcasting, otherwise plants tend to fall over and rot, unless a nurse crop, like oats, is also planted. Seed 1–3 inches deep, depending on soil moisture—it is important that the seed contact moist soil.

Seed should be inoculated with "pea" type inoculant, unless field peas have been grown in the field in recent years.

Mowing/Grazing: Plants do not respond favorably to mowing or grazing. Field peas are harvested for hay when most pods are well formed. Due to lodging problems, peas are usually cut with a mower with lifting guards and a windrow attachment.

Incorporation: Optimal incorporation time is at flowering, when the maximum nitrogen accumulation has occurred. Peas can be plowed down with tandem discs, which leave enough residue on the surface to help protect the soil from erosion.

Other management notes: Field peas are harvested for seed when pods are mature, which is 20–30 days after blooming or 52–75 days after planting. Use the same method as cutting for hay. A pick–up combine is used to thresh the

crop from the windrow or bunch. Defective seed or those with weevils can be separated out by floating them off in brine. Seeds remain viable for a relatively short time.

PEST PROBLEMS

Field peas are susceptible to numerous diseases, which can generally be controlled by using clean seed, planting resistant cultivars, and practicing crop rotation.

One of the most critical insect pests is the pea weevil (*Bruchus pisorum*). Crop rotation can be helpful in controlling the weevil. The pea aphid (*Acyrthosiphon pisum*), loopers, wireworms, pea moth (*Laspeyresia nigricana*) and root–knot nematodes (*Meloidogyne* spp.) are some of the other pests which can cause problems with field peas. However, relatively high densities of aphid predators, such as lady beetles and syrphid flies, have also been seen on field peas.

VARIETIES/TYPES

The name Canada or Canadian is broadly and somewhat ambiguously used, but generally refers to cultivars. whose seeds have white or yellow seed coats. These include varieties grown for human consumption. 'Trapper' yellow pea is one of the cultivars of Canadian field pea. Varieties with gray, brown, or mottled seeds are generally used for soil improvement or feed. These include 'Common' Austrian winter pea and its new and improved cousins 'Melrose' and 'Glacier.'

There are numerous varieties of field peas available as well as new ones under investigation. 'Poneka' and 'Miranda' protein peas are two cultivars that are currently under development as promising forage and cover crops.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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COWPEAS

(Vigna unguiculata (L.) Walp. or Vigna sinensis (L.) Endl. ex Hassk.)

he cowpea, variously known as crowder pea, blackeyed pea, or southern pea, is perhaps the most heat-adapted annual legume that is readily available in the U.S. While seed production is possible in the Northeast, its rapid growth in hot, dry weather and high nitrogen fixation potential makes it more useful to northerners as a quick summer green manure than as a mainstay at Sunday dinner.

EALTH Series

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat			T							
Flood										
Drought										
Shade										

SOLL

Cold hardiness: no frost tolerance pH preferred: 5.5–6.5 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 40°F to -30°F 30°F to -20°F 20°F to -20°F 20°F to -10°F -10°F to 0°F Zone 7 0°F to 10°F

Cowpeas grow much like soybeans or common beans. Depending on the cultivar, they can be erect or somewhat prostrate and spreading. They are short–day plants and fast growers in warm weather, quickly reaching heights of 2 to 2.5 feet. They are, however, sensitive to cold and easily killed by frost. Seeds are highly variable in color, including red, black, brown, green, buff or white, solid color or spotted, marbled, speckled, eyed, or blotched.

Cowpeas prefer sandy loams but do well on any moderately textured soil that is well-drained. They have taproots which go relatively deep, contributing to their ability to withstand drought, although most of the moisture used comes from the surface foot of soil. They are more drought tolerant than soybeans but less tolerant of waterlogging. They can also deal with low fertility and highly acid to neutral soils, doing better than clover and alfalfa on poor or acid soils.

Dry matter yields for cowpeas can vary from 2,000–4,500 lb/acre(A), with 3,000–4,000 lb/A being typical for hay crops. Since they are nitrogen–fixers, they can contribute up to 315 lb/A of nitrogen to the system. However, 130 lb/A is a typical figure, assuming the entire crop is put back into the soil and not harvested for seed or hay. Unlike many other grain legumes, cowpeas can leave a net gain of nitrogen to the soil even if seeds are removed.

Although they may not produce as much total dry matter as 'Hubam' sweetclover (*Melilotus alba*) during the summer months, they will, if properly inoculated, probably fix more nitrogen. Additionally, the residue is more succulent and will break down more readily if a fine fall seedbed is required.

USES

Cowpeas have been cultivated for their seeds, green pods, and leaves for human and animal consumption. They are excellent summer annual cover crops, green manures, and soil improvers which can be incorporated before late summer or early fall crops, or used to build up very poor soils. Leafy, prostrate cultivars can provide good protection from erosion. The more vigorous varieties can smother weeds when planted alone or overseeded into row crops.

Cowpeas have served as green manures in vegetable and cereal systems, planted prior to brassicas or small grains that are sown in the fall. In Pennsylvania, they have been successfully overseeded into spring broccoli in June. After broccoli harvest, the cowpeas continued to grow well during the summer heat. They were then turned under prior to sowing a fall spinach crop in late August. Being moderately shade tolerant, cowpeas can be overseeded into corn or grown in orchards or vineyards, although they are susceptible to mildew if the shade is too heavy.

Livestock and humans find cowpeas palatable, though some northerners of the human sort might claim it is an acquired taste. Cowpeas make good silage when mixed with sorghum or corn. As a hay, it takes about 2 weeks to cure.

MANAGEMENT

Seeding dates: In the Northeast, cowpeas should be sown in spring after all danger of frost is past and the soil is warm—essentially the same planting time as soybeans. Cowpeas can also be sown in mid- to late summer if they are to be turned under as a green manure.

Seeding rates: Drill at 25–45 lb/A for grain, or broadcast up to 120 lb/A for green manure, with 70 lb/A usually sufficient under moist conditions.

Seeding methods: For grain, drill 1/2–1 inch deep (deeper in sandy soils) in rows 30–36 inches apart. As green a manure or forage, seed in rows 6–8 inches apart, or broadcast and roll. Seeds can be sown on a seedbed prepared as for corn. They can also be seeded after small grains with only a disking as preparation, especially if land is relatively weedfree.

Seeds need to be inoculated with "cowpea" type inoculant in order for the crop to fix nitrogen.

Mowing/Grazing: Cowpea can be harvested for a single hay crop when most pods are fully formed and turning yellow and the first ones have just ripened. Cutting too early makes hay difficult to cure; a late cutting contains more long, woody stems and leaves and pods which readily shatter. Plants do not regrow well after mowing or pruning.

Incorporation: When used as green manure, plants are sometimes rolled down or mown before being turned under. It is best to incorporate while the enfire crop is in the green state.

Other management notes: Cowpeas can yield 350–2,700 lb/A of seeds. Early maturing varieties can produce seed in 90 days; later-maturing types need 240 days. Since maturation occurs unevenly, seed is generally harvested when 1/2-2/3 of the pods are ripe. Harvest can be done by hand, with a special harvester, or with self-rake reapers.

PEST PROBLEMS

Cowpeas may harbor root-knot (*Meloidogyne* spp.) and sting nematodes (*Belonolaimus gracilis*). Use of resistant varieties along with rotations with immune crops, such as winter grains, corn, sorghum, and some soybeans, are the best control measures.

Anthracnose (Colletotrichum lindemuthianum) is a problem in humid situations. Charcoal rot (Sclerotium bataticola) can be a problem under certain soil conditions. Cowpea wilt (Fusarium oxysporum var. tracheiphilum) can result in death of the plants. The best control is to plant resistant varieties, if available. Cowpeas are reported to show resistance to stem rot (Phytophthora vignae).

Insects attacking cowpeas include the cowpea weevil (*Callosobruchus maculatus*) and four-spotted bean weevil (*Mylabris quadrimaculatus*). Weevils can be controlled with insecticides, fumigation, or heat treatment of the stored seeds. Grasshoppers can be a problem on occasion. Other pests include cowpea curculio (*Chalcodermus aeneus*; some varieties resistant to this), lygus bugs (*Lygus* spp.), corn earworm, lima bean pod borer, mites, cowpea aphids, bean thrips, and armyworms. Various beneficials have also been seen on cowpeas, including a number of predatory and parasitic wasps, lady beetles, and bigeyed bugs (*Geocoris* spp.).

VARIETIES/TYPES

The many cowpea varieties in the U.S. can be differentiated by use: horticultural varieties for human use and agronomic varieties for forage and cover crops. Horticultural types include the following cultivar groups: Crowder peas (black, speckled, brown or brown-eyed large seeds, crowded in pods); Blackeyed peas(seeds are white with black eye, not crowded in pods); Cream cultivars (small, cream-colored seed, not crowded in pods); intermediates between Crowder and Black-eyed types (deep purple pods and buff or marooneyed seed).

Forage cultivars may be more suitable as cover crops as they put on more vegetative growth.

Any of the varieties may have either a determinate or indeterminate growth habit. Indeterminate plants will continue to grow until they are killed by frost.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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CEREAL RYE

(Secale cereale L.)

Rye, also known as winter rye or cereal rye, is the most cold-tolerant of the commonly used cover crops and has been extensively used throughout the Northeast in a wide range of cropping systems. Rye germinates and grows very rapidly even in cold weather, outgrowing wheat, oats, and other annual grasses. It can be seeded in fall later than other cover crops.

Culture

Tolerance										
Scale:	1	2	3	4	5	6	7	8	9	10
Heat	I							100		1
Flood	I.									
Drought	t	1	Ú		П					
Shade	Ē			1	11	1				
(1= very low	7. 1	0 =	= v	er	v h	ial	h			

Cold hardiness: zone 3 pH preferred: 5.0–7.0 Drainage preferred: well-drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Rye's growth habit resembles wheat, but plants are usually taller, with longer, more slender, somewhat nodding spikes. Plants average in height from 4 to 5 feet. The root system is fibrous and extensive, with no defined taproot. It is the most developed root system among annual cereal crops, which makes rye ideal for taking up and recycling excess nutrients.

Rye is a long–day plant, with flowering induced by 14 hours of daylight with temperatures between 41–50°F. Once flowering begins, vegetative growth stops and the plants can be killed by mowing.

Rye can germinate if temperatures are $34-40^{\circ}$ F or higher. Vegetative growth re-' quires temperatures of at least 38° F. However, once it is well established, rye can withstand temperatures as low as -28° F. The plant structure enables it to capture and hold protective snow cover, which enhances winter-hardiness and possibly water availability. It is reported to improve winter survivability of companion-seeded legumes, especially hairy vetch.

Although it prefers rich, well–drained loam soils, rye will tolerate heavy clays to poor sands, as well as acid soils. It is more productive on lighter soils than on heavy clay and can handle dry soils better than wet, poorly drained soils. Rye is one of the best pioneer crops for sterile soils. With a low lime requirement, extensive root system, and good drought tolerance, it can outyield other cereals on droughty, sandy, and infertile soils.

The dry matter yield can range from 1,100 to nearly 9,000 lb/acre(A). Yields of 3,000–4,000 lb/A are more typical. Rye does not fix nitrogen but may be very effective at taking up excess soil nitrogen in the fall.

USES

Rye's versatility is manifested by its many uses. The grain is used for human and animal consumption (and whiskey production). Its rapid growth and allelopathic compounds provide effective weed control; hardiness and erect stature make it a good companion or nurse crop; a fibrous root system helps improve soil tilth and slow erosion; and it is noted for "catching" and thereby preventing leaching of excess soil nitrogen.

Because of its tall stature, rye can provide some windbreak effect. It is also a good nurse or companion crop for vining legumes like hairy vetch (*Vicia villosa*) as it provides structural support and winter protection.

Rye and rye/hairy vetch mixtures have been successfully managed as mulch for no-till corn. Being relatively shade tolerant, rye can be overseeded into tasseling and silking corn. Once the corn is harvested, the rye provides winter cover. In soybeans, rye can be overseeded in the fall at soybean leaf drop or drilled after harvest of summer crops.

Rye grain and straw are relatively low-quality livestock feed. The grain is not very palatable to livestock, so it is generally ground and fed with other grains. Some growers are able to market green straw for horse bedding.

MANAGEMENT

Seeding dates:

Zone 7: early September to mid–November Zone 6: late August to late October Zone 5: mid–August to mid–October Zone 4: mid–August to late September Zone 3: mid–August to mid–September

Seeding rates: 60 to 200 lb/A. As a green manure, 90–160 lb/A is adequate. If rye is seeded late, the rate should be increased up to 300 lb/A to provide adequate cover. In mixtures with legumes, the seeding rate is reduced, often to the lowest locally recommended rates. A rate of 56 lb/A is recommended if rye is sown with clover. In a mixture with hairy vetch, rye can be seeded at 70 lb/A and the vetch at 20–25 lb/A.

Seeding methods: Rye can be drilled into a prepared seedbed or broadcast and disked lightly or cultipacked to cover. If sown into tasseling and silking corn, it can be aerial seeded. If sown late, it is especially important to insure good seedto-soil contact in order to produce an adequate stand (this is true for any crop).

Incorporation: Although rye can be incorporated whenever there is sufficient biomass, it may regrow following tillage if tilled under when less than 8 inches in height. To kill rye by mowing, wait until plants have initiated flowering. A sickle bar mower may be better than a flail mower as it causes less matting, thereby promoting better emergence of following no-till crops.

Suppression of crops has been observed when they follow incorporated rye residue. This suppression may be due to tie–up of soil nitrogen and/or to the allelopathic chemicals in the rye. This can be avoided by turning the rye under 3–4 weeks before seeding the next crop, if conditions are feasible for leaving the ground bare during that period. Incorporating rye before it is 18 inches tall, while it is still fairly succulent, may avoid tie–up of soil nitrogen.

PEST PROBLEMS

Rye is attacked by a number of insects that are pests in small grains, such as the grasshopper (mainly *Melanoplus* spp.), chinch bug (*Blissus leucopterus*), Hessian fly (*Mayetiola destructor*), jointworm (*Harmolita tritici*), and sawfly (*Cephus* spp.). Losses from these insects are generally not great; however, when sown early, winter rye can create a good habitat for the depositing of grasshopper eggs, which could become a problem for following crops.

The fungus ergot (*Claviceps purpurea*), which is poisonous to livestock and humans, can be a serious problem when rye is harvested for grain. Rye can also be attacked by stem smut (*Urocystis occulta*) and anthracnose (*Colletotrichum* graminicolum). Control measures include crop rotation and plowing under crop residues.

VARIETIES/TYPES

There are two distinct types of rye grown in the United States: winter rye and spring rye. The winter varieties are the most important for the Northeast. They must be sown in the fall if a grain crop is desired as they require low temperatures during the dormant stage in order to head.

'Aroostook' rye is an extremely cold-tolerant cultivar which is highly productive throughout the Northeast, even on low fertility soils. However, to reduce seeding costs, growers may wish to use a non-certified 'Balbo' type which has good resistance to lodging. Consult your extensionist or seed dealer for specific recommendations regarding variety selection.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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RYEGRASS

(Lolium spp.)

Ryegrasses are important cool-season grasses, possibly the most widely used of all grasses. They are found throughout the U.S., doing best in cool, moist regions. The two most important species are annual or Italian ryegrass (Lolium multiflorum Lam.) and perennial ryegrass (L. perenne L.).

Culture

Tolerance			
Scale:	1 2 3 4 3	5678	9 10
Heat			
Flood		-++	
Drought			
Shade	+++++	00	1953
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1)5	6		
1 the	SAU	Zone -40°F to	-30°F
SH Y	7	Zone	4
d	mar and	-30°F to	-20°F
		-20°F to	-10°F
		Zone	6 0°F
		10 1 11	

20ne 7 0°F to 10°F Both species are rapid growers, but annual ryegrass germinates and establishes more quickly and exhibits greater seedling vigor than perennial ryegrass. Annual ryegrass generally acts as a short-lived annual or winter annual. It reaches 2-4 feet in height if left uncut. Perennial ryegrass may live 3-4 years and grow to 1-3 feet tall. Both are erect, non-spreading bunch grasses. Flowering is induced by long days, but perennial ryegrass requires a period of cool temperature before flower initiation. Annual ryegrass can become a troublesome weed if allowed to set seed.

Ryegrass root systems are dense, fibrous, and deep. They are effective in holding soil, increasing water infiltration, and improving soil tilth.

Ryegrasses are tolerant of a wide range of soils, forming dense covers even in low fertility and acid soils. They will grow on sandy soils if well fertilized, but best growth occurs on loam soils of medium to high fertility, slightly acid to neutral pH, and adequate drainage. They withstand temporary flooding if stands are well-established, but perennial ryegrass is less tolerant of standing water than annual ryegrass.

Ryegrasses are heavy moisture and nitrogen users. If subjected to extended periods of high temperatures, drought, or low fertility, ryegrasses perform poorly. Perennial ryegrass is more cold-hardy than annual ryegrass, but both species readily winterkill in colder parts of the Northeast.

Dry matter production can be 4,500-

9,000 lb/acre(A), up to 13,350 lb/A/year under multiple-cut management. Yields will be much lower if ryegrass is left uncut. Annual ryegrass, seeded in September in Pennsylvania and cut in mid-May, yielded 1,736 lb/A of biomass.

USES

Catch crop: Extensive root systems and high nitrogen needs make ryegrasses effective catch crops for excess nitrogen. In Maryland, annual ryegrass planted after corn harvest in fall recovered 53% of leftover fertilizer nitrogen by mid-May.

Weed control/nurse crop: Rapid growth and dense cover make ryegrasses good competitors against weeds. If seeded with legumes or other grasses, they suppress weeds while slower-growing companions establish themselves. Seeded at low rates, annual ryegrass is a useful nurse crop for fall-seeded legumes, even in areas where it winterkills. If it becomes too vigorous in the fall, it should be mown to keep from smothering the legume.

Soil protection: Because it can withstand temporary flooding, annual ryegrass can be planted in grass waterways or flood canals, or on flood-prone cropland.

Perennial ryegrass can provide an effective living mulch in areas where it does not winterkill. It has been used in strawberries to provide winter storm protection and improved fruit yield and quality. The ryegrass sod reduced soil compaction, suppressed weeds, and did not invade strawberry rows. It has also been useful in some vegetable systems. Strips of perennial ryegrass facilitated harvest of interplanted pak choi during cool, wet weather, allowing field traffic and reducing soil compaction.

Annual ryegrass can be overseeded into summer crops (*e.g.*, corn, soybeans, tomatoes, and peppers) at last cultivation or later at leaf yellowing. It can also be overseeded into winter or spring grains in late spring. If sown between spring crops of spinach, lettuce, or brassicas it provides soil cover for the 4- to 8-week fallow period before sowing fall crops.

Other uses: Some New England growers reported that carrots and daikon radishes grown in annual ryegrass were free of root maggots, gave adequate yields, and had excellent quality. Others felt that annual ryegrass repelled flea beetles from brassica crops.

Ryegrasses are good companion crops in spring-seeded permanent pastures; their early growth provides grazing while longer-lived perennial grasses are establishing. If seeded with winter grains or crimson clover (*Trifolium incarnatum*), they provide good temporary spring or fall pasture, which can then be turned under as a green manure.

MANAGEMENT

Seeding dates:

Zone 7: April through May, or July through September 30

Zone 6: April through May, or July through September 15

Zone 5: July through August 15

Seeding rates: 14-35 lb/A (18-25 lb/A most common). If mixed with a small grain, reduce seeding rate to 8-15 lb/A. Combined with a legume, such as crimson clover, seed ryegrass at one-third or less and clover at two-thirds their respective monocultural rates. For a dense cover and green manure, seed 25-35 lb/A.

Seeding methods: Drill seed at 1/4– 1/2 inch depth or broadcast and roll. Ryegrasses can also be aerial seeded and overseeded. If planted on highly erodible slopes, apply 3,000-4,000 lb/A of straw as a stabilizing surface mulch during establishment. If seeding into existing grass sod, sod should be mown or grazed very close to the soil prior to seeding.

As a cover crop, annual ryegrass can

be overseeded alone or with medium red clover (*Trifolium pratense*) at last cultivation of corn or drilled immediately after silage harvest. Ryegrass establishes better when corn does not form a complete canopy. Afnual ryegrass can also be overseeded into soybeans at leaf-yellowing stage or into other crops before full canopy closure. Mixtures of ryegrass with red and white clover (*T. pratense* and *T. repens*, respectively) often perform well in overseedings. Avoid seeding before the main crop is well established to prevent serious competition for moisture and nutrients.

Incorporation: If annual ryegrass is used as a green manure, optimal incorporation time is during early bloom, which is often in spring. Plowing or disking at this time will kill the ryegrass, avoiding seed set. Allow 3 weeks after incorporation before seeding the next crop as ryegrass can tie-up nitrogen. Allowing time for decomposition will also avoid the lumpy seedbed often seen after ryegrass plowdown.

Other management notes: If ryegrass is used as a cover crop and green manure, buy non-certified seed to reduce costs. Be aware that annual ryegrass cross–pollinates readily with other species of ryegrass, so annual ryegrass seed may be contaminated.

Seeding ryegrass with a legume such as red or white clover will help alleviate nitrogen tie-up after plowdown. In mixtures, ryegrass tends to dominate unless it is planted at very low rates and/or is suppressed by mowing. Annual ryegrass should not be allowed to set seed unless its continued presence is desired.

PEST PROBLEMS

The ryegrasses are susceptible to

crown and brown rust (*Puccinia* spp.) although resistant varieties are available. They are also affected by leafspot (*Helminthosporium* spp.), barley yellow dwarf virus, and blast (*Piricularia grisea*). Annual ryegrass may harbor high densities of pin nematodes (*Paratylenchus projectus*) but low densities of root lesion nematodes (*Pratylenchus penetrans*).

Growers that maintain ryegrass as a living mulch often complain that it harbors rodents.

VARIETIES/TYPES

There are two basic groups of annual and perennial ryegrasses: diploid (two sets of chromosomes) and tetraploid (four sets of chromosomes). Tetraploid varieties of perennial ryegrass have larger leaves, larger but fewer tillers, more open growth (so less ground cover), and are better for mixtures with legumes. Diploid varieties, however, generally show greater growth after emergence and greater persistence.

There is natural hybridization between annual and perennial ryegrasses, producing plants with intermediate persistence. These hybrids are often called "short-rotation" ryegrasses in relation to perennial ryegrass. Their flowering requirements are similar to annual ryegrass. Generally these hybridized types are called common ryegrass and *L. multiflorum* although they are hybrids. Ask your seed dealer or extension agent for varieties most suitable to your needs.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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OATS

(Avena sativa L.)

The cultivated oat, so recently acclaimed for its heartsaving fiber, may have an equal role to play in saving soil in Northeast cropping systems. Although not winter-hardy in the Northeast, oats can grow extremely rapidly in cool weather, making them ideal for quick fall cover, as a winterkilled spring mulch, or as a nurse crop for slower-growing legumes.

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat		Í	1							
Flood			1		- 14					
Drought										
Shade	1					103		έ.,Ω	101	N.

(1= very low, 10 = very high)

Cold hardiness: zone 8 pH preferred: 5.0–6.5 Drainage preferred: well–drained

Average Annual Minimum <u>Tem</u>peratures

> 20ne 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Oats will grow most rapidly in cool moist conditions, reaching a height of up to 4 feet, but they can adapt to many climatic extremes. The root system is fibrous like other members of the grass family although it is not as extensive as that of cereal rye. Oats can perform well on a variety of soil types, provided the soil is fairly fertile and well–drained. Loam soils, particularly silt and clay loams, are the preferred soil types.

An oat crop planted in the spring in the Northeast may produce between 6,000–8,000 lb/acre(A) of total dry weight if allowed to mature. Fall growth would more likely yield 2,000–4,000 lb/A before winterkill.

USES

Oats can be exploited for a variety of purposes: human or animal food; cover crops and green manures; catch and nurse crops; erosion and weed control; bedding and mulch; and soil improvement.

Winter cover crop: In the Northeast, oats are sometimes sown in late summer as a cover that winterkills, leaving a protective dead mulch. This mulch serves as a weed suppressant and erosion and moisture control. Prior to planting vegetables or other crops in the spring, it can be easily incorporated, much more easily than the overwintering cereal rye. It has been used successfully in this manner after corn or soybean harvest, being seeded after grain or silage harvest. It could also be used in orchard systems. A drawback to this system is that the light–colored reflective mulch might slow soil warming in the spring.

A study in Massachusetts found that oats mixed with either hairy vetch (*Vicia villosa*) or Austrian winter pea (*Pisum sativum* ssp. *arvense*) were the best cover crops for no-till sweet corn. The cover crops were planted in the fall. Plants that did not winterkill were killed by mowing or treated with herbicide after the plants commenced flowering. The system was then fertilized with 30 lb/A nitrogen, and the mulch was easily managed for no-till corn planting.

Spring mulch: Vegetable growers and researchers alike have been eyeing winter– killed oat mulch for years as a way to control weeds in spring transplants, but to date there are no confirmed reports that it has been used in this way. A likely drawback would be delayed warming and drying of the soil.

Temporary cover crop/catch crop: Because of its rapid growth, oats can serve as a temporary cover crop to protect soil and catch nutrients during short periods in cool weather when the soil would otherwise be bare. In warm weather, buckwheat or sorghum-sudangrass are better choices. Nurse crop: Oats make an excellent nurse crop for legume establishment. They can be sown in combination with slow–establishing legumes, like white or yellow sweetclover (*Melilotus alba* and *M. officinalis*, respectively), crimson clover (*Trifolium incarnatum*), and vetch (*Vicia* spp.). Weed problems are mitigated, and the oats can help the winter survivability of the legume.

If spring seeded with red clover (*Trifolium pratense*) or alfalfa (*Me-dicago sativa*), oats can be harvested for hay or grain while the legumes are allowed to grow for a season or two longer. If spring planted with a fast-growing annual legume like berseem clover (*Trifolium alexandrinum*), oats can be removed (preferably in the dough stage) for haylage along with the legume.

Weed control: Oats suppress weeds not only through smothering and outcompeting them, but also through possible allelopathic effects. They can be used in rotation on vegetable fields that have become infested with weeds. The oats can be spring sown, followed by a summer annual cover, then seeded again in the fall. Each cover is incorporated into the soil before the next cover is established.

Forage/grain: As a forage or hay, oats are more palatable to livestock than cereal rye. Oats also provide the best straw for feed or bedding. As a grain, few Americans were able to pass through childhood without being treated to the pleasures of steaming oatmeal mush. And now we know they're also good for our hearts and for moving along cranky digestive systems.

MANAGEMENT

Seeding dates: In the Northeast, oats can be sown in April or May for a spring crop or cover (March in southern areas) or in late summer to early fall for a winter cover. Oats seeded before mid– August may produce seed, which can lead to a volunteer spring oat crop.

Seeding rates: As a cover crop, seed oats at 3 bushels/A, which is approximately 110 lb/A. If used in mixtures, reduce seeding rate to 1–2 bushels/A. For a thick, winter-killed mulch, fall seed at higher rates, at least 4 bushels/A.

Seeding methods: Seed can be drilled 1/2–1 inch deep or broadcast. If broadcast, use higher seeding rates. If drilling, rows are generally spaced 6–8 inches apart. Shallow seeding is possible and preferable in areas with high soil moisture; it leads to rapid emergence and less incidence of root rot disease. When buying seed for cover cropping purposes, certified seed is unnecessary.

Incorporation: If oats are spring planted as a cover crop and green manure, the optimal incorporation time is in spring while oats are still vegetative but before they begin to head. They can be cut for mulch at that same time.

Mowing/Grazing: Oats can be pastured or cut for hay or silage. They are best harvested for hay in the dough stage but in the milk stage for silage.

Other management notes: Oats have poor resistance to lodging. To prevent lodging, avoid high nitrogen situations, including planting after a legume plowdown. Excessive moisture can also cause lodging.

PEST PROBLEMS

Oats can be attacked by loose and covered smuts (Ustilago avenae and U. kolleri, respectively), stem and crown rusts (Puccinia graminis avenae and P. coronata, respectively), and Victoria blight (Helminthosporium victoriae). The principal means of control is to plant resistant varieties.

Oats are less prone to insect problems than barley and wheat. They are not attacked by the Hessian fly (*Mayetiola destructor*), and chinch bugs (*Blissus leucopterus*) prefer barley or wheat. However, oats are affected by the bluegrass billbug (Calendra parvulus), certain leaf hoppers, armyworms, the grain bug (Chlorocroa sayi), grasshoppers, and the Mormon cricket (Anabrus simplex). The spring grain aphid or green bug (Schizaphis graminum) can occasionally do severe damage. Other pests of oats are wireworms, white grubs, cutworms, fruit flies, thrips, leafhoppers, and winter grain mites. Depending on the pest, problems can be alleviated through crop rotation, controlling volunteer small grains and weeds, summer fallow, and seagulls, who saved the first wheat crops in Utah from a voracious horde of Mormon crickets.

VARIETIES/TYPES

Cultivated oats are sold as both spring oats and winter oats. Although winter oats are hardier than spring types, neither will overwinter in the Northeast, except occasionally in the southern extremes of the region. Winter oats are slower growing, so spring oats are preferred for development of rapid ground cover in both spring and fall. Oat forage varieties with higher proportions of leaf to grain, such as red oats, are grown in California but have not been proven to perform well in the Northeast.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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OIL HEALT Serie

northeast cover crop Fact Sheet #15

BUCKWHEAT

(Fagopyrum esculentum Moench)

Buckwheat is a broad-leaved summer annual that requires a short growing season, flowering in as little as 4–6 weeks and setting seed in 10–12 weeks. Its rapid summer growth makes it ideal as a quick, mid-summer smother or cover crop. Buckwheat is not frost tolerant so it is limited to late spring through early fall seasons in the Northeast. It is not related to legumes and does not fix nitrogen; however, it has a reputation for being able to efficiently utilize soil nutrients such as phosphorus and calcium, and it will tolerate infertile soils.

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat										
Flood	L									
Drought	Ľ									
Shade	1									

(1= very low, 10 = very high)

Cold hardiness: no frost tolerance pH preferred: 5.0–7.0 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 40°F to -30°F Zone 4 30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

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Buckwheat can reach heights of 2–5 feet or more and has a single, succulent stem, generally with several branches. The plant forms a single stout taproot with many branched lateral roots. Although the root system tends to be superficial in depth, there is a high root volume in the upper 10 inches of the soil. Buckwheat plants often wilt during the hottest part of a summer's day but will quickly recover in the damp evening air. Flowers consist of five petal–like sepals that vary in color from white or light green to pink or red.

Buckwheat will grow on a wide variety of soil types, including infertile, poorly tilled lands and soils of relatively high acidity. However, it does not grow well on heavy, wet soils or in soils with abundant limestone. On light, well–drained soils high in nitrogen, lodging can occur, reducing grain yield.

USES

Buckwheat is widely used as a summer crop for soil improvement, weed and erosion control, as a catch crop, for mulch, and for human and animal food.

Cover crop/soil improvement: Buckwheat can be quite effective in protecting and conditioning the soil prior to transplanting or sowing late-season crops. It is appropriate soil cover for any short, warmseason period when the soil would otherwise be bare. Buckwheat will produce much less biomass than other summer cover crops such as sudangrass (*Sorghum bicolor* var. Sudanense). It is succulent and decomposes very rapidly, leaving little residue to interfere with seedbed preparation. This tendency makes it a relatively poor choice for building up long-term organic matter, but growers report a short-term improvement in soil tilth and water-holding capacity following buckwheat.

Buckwheat has been used in orchard and vineyard systems as a summer cover crop. If it is mixed with a legume, such as Canadian field peas (*Pisum sativum* ssp. *arvense*), the system will also benefit from additions of nitrogen.

Weed control: In the Northeast, buckwheat is a popular cover crop and weed suppressant. In vegetable systems, land can be rotated into a series of short–season covers for 1 year to reduce weeds. A common sequence is rye or an early spring planting of oats, followed by 1–2 plantings of buckwheat, then rye or oats again in late summer or fall. Buckwheat can also be used for midsummer weed suppression before fall planting. Both living buckwheat and residues can have an allelopathic effect on weed germination.

Catch crop: Buckwheat has the abil-

ity to efficiently acquire phosphorus, and there is some evidence that it concentrates calcium, making buckwheat an effective catch crop. When plants are incorporated in the soil, they decay quickly, making nutrients more available to the succeeding crop.

Nurse crop: Slow–growing fall cover crops, such as hairy vetch (*Vicia villosa*), can be seeded with buckwheat in late summer. The fall cover is initially shaded by the faster–growing buckwheat, which helps suppress weeds. When the buckwheat is harvested, mowed, or dies back naturally, the fall cover can develop and occupy the land over winter.

Other uses: As a food source, flowering buckwheat is an important plant for honey production. The grain can be ground for flour or cooked whole. Buckwheat grain can also be fed to livestock and poultry, although it has a lower feeding value than other grains. The buckwheat hulls that are left from the milling process can be used as a mulch or compost. They can also be utilized for fuel, packing material, and insulating material.

MANAGEMENT

Seeding dates: Due to its frost sensitivity, buckwheat should be planted in the spring after all danger of killing frost is past. For a fall grain crop, plant at least 12 weeks before killing frosts. As a fall cover crop, seed at least 4 weeks before frost.

Seeding rates: 35–134 lb/acre(A); the higher rates should be used when broadcasting.

Seeding methods: Seed can be drilled or broadcast and incorporated with a light disking. Drilling requires less seed and produces more uniform stands. Seed can be planted 1/2 to 2 inches deep, with shallower depths preferred if the soil is moist and loose.

Seed can remain viable for several years, although it is best to use seed not more than 1-year old. Seed germinates at temperatures between 45 and 105°F. Plants emerge within 3–5 days after planting, depending on soil temperature, moisture, and planting depth.

Incorporation: Buckwheat can be

turned under when 8 inches tall, although optimal incorporation time is 7– 10 days after flowering and before seed set. Buckwheat can reseed and become a weed problem if not mowed or incorporated before maturation.

If using buckwheat as a green manure as well as habitat for beneficial insects, incorporation or mowing should be delayed until at least 20 days after flowering commences as it takes the minute pirate bug, a predator, 20 days to produce a generation.

Other management notes: Because of its rapid growth, 2 or more crops of buckwheat can be grown successively. Each crop can be sown immediately after tilling in its predecessor or strips of buckwheat can be left to mature and reseed.

PEST PROBLEMS

Buckwheat is relatively free of serious insect and disease problems. Some of the more common problems include a leaf spot caused by the fungus Ramularia and a root rot from Rhizoctonia. Also, buckwheat can harbor particularly high densities of root lesion nematodes (Pratylynchus penetrans). On occasion, buckwheat will be attacked by wireworms, aphids, birds, deer, and rodents. On the positive side, flowering buckwheat attracts hoverflies (Syrphidae family), whose larvae prey on aphids. It also attracts several species of predatory wasps and such predators as the minute pirate bug (Orius tristicolor), the insidious flower bug (O. insidiosus), trachinid flies, and lady beetles.

VARIETIES/TYPES

There are 3 principal types of buckwheat grown in the United States: Japanese, Silverhull, and Common or Common Gray. Some do not consider Common a true type, but rather a catch–all term for buckwheat with characteristics between Japanese and Silverhull, probably resulting from hybridization.

The Japanese type is large seeded and probably the most widely grown. Seeds are nearly triangular in cross section and brown to almost black in color. Plants reach 3–4 feet in height, with coarse stems and thick, widely separated branches. Leaves are large and heart– shaped. Flower sepals are white and about ¹/4 inch in diameter. Some varieties of the Japanese type include 'Mancan,' 'Manor,''Giant American,' and 'Pennquad.'

The Silverhull type has smaller seeds, more nearly round in cross section and glossy, silvery gray in color, sometimes with mottling. Mature plants can be a few inches taller than the Japanese type, but stems are thinner and easier to break. Plants have more branches and smaller leaves and flowers. Sepal color can be white to pink or red. 'Tokyo' and 'Tempest' are 2 varieties of the Silverhull type. These are older cultivars developed in Canada.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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FINE FESCUES

(Festuca spp.)

Culture

Tolerance Scale:	1	2	3	4	5	6	7	8	9	10
Heat				t	0		1.		m i	
Flood			I							
Drought						L		to		
Shade							to			to the
(1= very low	7, 1	0 :	= v	er	y h	nig	h)			in the second

Cold hardiness: zone 4 pH preferred: 5.3–7.5 (red fescues) 5.0–6.0 (hard fescues) Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F -30°F to -20°F -20°F to -20°F -20°F to -10°F -10°F to 0°F -20ne 7 0°F to 10°F

Fine fescues are perennial, cool-season grasses which generally outperform other cool-season grasses under low maintenance regimes. In crop production systems, they are best suited for living mulches in orchards, vineyards, and vegetable fields. The fine fescues include sheep fescue, hard fescue, fine-leaved fescue, red fescue and its derivatives, such as Chewings fescue. The various species and cultivars have similar appearance with respect to fine, bristle-like leaves, but there are notable differences in growth habit and rate, color, disease susceptibilities, and ability to handle environmental stresses.

HEA Se

Once established, fine fescues are competitive with weeds and require little to no fertilizer or pesticides. They are the best of the cool–season grasses for shaded sites. Dense root systems and ability to roll leaves give them medium to very good drought tolerance. They have a slow, nonaggressive spreading habit, although spreading ability varies among species and varieties. On the negative side, establishment is slow, sometimes requiring up to a year, which can lead to weediness, poor trafficability, and enhanced erosion.

Able to withstand infertile, acid soils, and dry, shaded conditions, fine fescues can nevertheless adapt to a wide variety of conditions. They can handle clay soils to soils with high sand content but do not tolerate wet, poorly drained soils. Fine fescues have only fair heat tolerance but are quite winter-hardy.

USES

Turf/erosion control: There is renewed interest in fine fescues as turfgrasses because of their low maintenance. They are suitable for a variety of situations, including golf course roughs, slopes, lake perimeters, median strips, and parks. They have been used for stabilization of hilly slopes with poor soils as well as cover under utility lines.

Horticultural cover crops: Fine fes-

cues work as interplantings in horticultural cropping systems and permanent cover crops in orchards, vineyards, blueberries, Christmas tree plantations, and nurseries across the northern two-thirds of the U.S. and into Canada.

Weed control: Established fescues provide good weed control, including suppression of woody plants and perennial weeds. This is due to competition for nutrients and moisture, but it also could be due to allelopathic effects. Fine fescues are tolerant of selective broadleaved weed killers; brush and weeds can be selectively removed without killing the fescues.

Catch crop: Fine fescues develop deep, extensive root systems which are efficient in moisture and nutrient acquisition.

Forage: Red fescue is quite palatable and fairly nutritive. Under the best growing conditions, it will give total dry matter yield comparable to perennial ryegrass (*Lolium perenne*) and may outperform ryegrass on steep, infertile soils. Chewings fescue and sheep fescue can also make useful hill pasturage, but sheep fescue yields considerably less than ryegrass.

Sod production: New England sod producers often mix Kentucky bluegrass (*Poa pratensis*) with a fescue to make the sod more adaptable to sun, shade, or variable fertility.

MANAGEMENT

Seeding dates: Seed late August to late September; or mid–March to mid– May. Fall plantings tend to have less weed pressure, especially annual weeds, than spring plantings and require less maintenance. Establishment is especially poor during hot summer months.

Seeding rates: Rates vary from 16 to over 100 lb/acre(A), depending on intended use and species. Commonly, 20– 40 lb/A are used for monocultures.

Seeding methods: Broadcast, drop, hydroseed, or drill. If using a grain drill, disconnect hoses at the seedbox so the light, fine seed can distribute more evenly over the soil surface. Drag, roll, or cultipack after seeding to improve seedsoil contact. Establishment can be helped by mixing small amounts of ryegrass (10% or less of mix) or other fast-growing grass.

Seedbed preparation: It is important to eliminate perennial weeds prior to planting as the slower growing grasses do not compete well with weeds during establishment. Add nitrogen as needed.

Mowing/Grazing: In the first year, mow weeds before they are 10 inches tall to limit competition. Mowing appears to be as effective as herbicides in controlling weeds during establishment.

Fine fescues generally tolerate mowing to 1.5 inches or less, although red fescues prefer taller heights (2–2.5 inches). In hot weather, it is best to leave the grass a little taller. Fine fescues usually do not require frequent mowing.

Incorporation: If incorporating the sod, the dense root systems make a clumpy seedbed which is difficult to plant into unless sufficient time is left for decomposition. Mowing the sod and tilling it twice, with a week between tillage operations, makes a finer seedbed.

Other management notes: A legume, such as white clover (*Trifolium repens*), may be sown with the fescues to provide additional fertility.

In tree plantations, it is best to leave 30–36 inch wide vegetation–free strip around trees. This minimizes competition from the cover, keeps rodents away from trunks, and makes mowing easier.

High nitrogen encourages disease problems, and intense irrigation and

poorly drained soils can hinder development. Lateral spread is slow, even for creeping red fescue, particularly on unevenly prepared sites or areas where the seeding pattern is not uniform.

PEST PROBLEMS

Fine fescues can be affected by a variety of diseases, including powdery mildew (*Erysiphe graminis*), dollar spot (*Sclerotina homoeocarpa*), net blotch (*Helminthosporium dictyoides*), rust (*Puccinia crandallii*), leaf spot (*Drechslera* spp.), and red thread (*Laetisaria fuciformis*).

Some fine fescues are infected with an endophyte (beneficial fungus associated with the grass, making it resistant to some common insect problems) which gives resistance to chinch bugs (*Blissus leucopterus*) as well as billbugs, sod webworms, armyworms, and possibly nematodes. Some endophytes can cause problems in livestock, however.

There are reports of severe damage to some varieties of red fescue from a root-knot nematode (*Meloidogyne microtyla*), particularly creeping red fescue. Look for resistant cultivars.

VARIETIES/TYPES

Creeping red fescue (*F. rubra L.* ssp. *rubra*): Distinct from other fine fescues in that it spreads by small, short rhizomes; adapted to well–drained, dry, and moderately shady spots; very intolerant of wet conditions; stems can reach lengths of 16–45 inches, depending on variety. Cultivars include 'Dawson,' 'Ensylva,' 'Fortress,' and 'Pennlawn.'

Chewings fescue (F. rubra L. ssp. commutata Gaud.): Similar to creeping red fescue, but lacks rhizomes and is a non-creeping, bunch-type grass with denser turf; good seedling vigor; low

growing, fine textured; withstands close mowing and handles shade and drought well. Improved cultivars include 'Banner,' 'Highlight,' 'Jamestown,' and 'Shadow.'

Hard fescue (F. ovina L. ssp. duriuscula or F. longifolia Thuill.): Low-growing (8-30 inches), noncreeping, bunch-type grass which establishes more slowly than the red fescues; little spreading tendency; fair to good seedling vigor and very good heat tolerance; drought tolerance better than the red fescues but not as good as sheep fescue; well adapted to shade and poor soils but will tolerate higher fertilizer usage than Chewings fescue; does not tolerate waterlogging but survives higher soil moistures than red fescue. Improved cultivars include 'Biljart (C-26),' 'Scaldis,' 'Waldina,' 'Reliant,' and SR 3000.

Sheep fescue (*F. ovina* L. ssp. *ovina*): A noncreeping, bunch-type grass; requires the lowest level of maintenance of the fine fescues but makes relatively poor quality, clumpy turf; establishes slowly; low in height (8–16 inches); poor heat tolerance but excellent drought tolerance. Improved cultivars include 'Bighorn,' and 'Covar,' and 'Aries.'

Fine-leaved fescue (*F. ovina* ssp. *tenuifolia* (Sibth.) Peterm. or *F. tenuifolia* Sibth.): Similar to sheep fescue but has shorter, narrower leaves and smaller seeds; able to survive on very poor and sandy soils but makes good growth only in cool weather.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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BRASSICAS

(Cruciferae family)

Culture

Tolerance										
Scale:	1	2	3	4	5	6	7	8	9	10
Heat	E				12					
Flood										
Drought							12			

(1= very low, 10 = very high)

Cold hardiness: zone 6 to 8 pH preferred: 5.3–6.8 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

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he term forage brassicas refers to a diverse group of crops in the mustard family developed as livestock feed. They are closely related to such cool-season vegetables as broccoli, cabbage, and radishes. Their value as cover crops lies in their ability to establish quickly in cool weather and the fact that many of them develop a thick taproot which can help improve soil physical characteristics. Their excellent qualities as highlydigestible forages may make them a desirable dual-purpose crop in systems that include livestock.

Brassicas thrive in a wide range of climatic conditions but prefer cool, moist climates. Plants may be annual or biennial, but tend to winterkill in much of the Northeast. Most will withstand light freezes. Unlike many perennials, brassica growth does not slow when days become shorter.

Brassicas prefer good drainage and loam to heavy soils. They will not tolerate poor drainage. Deep taproots afford fair drought resistance, although this varies with species and cultivar.

Biomass yields vary significantly, depending on conditions, crop use, species and variety. Average yields of rape and turnip in Pennsylvania are around 6,200– 8,000 lb/acre(A) after 90 days growth. Kale and swede average 8,000–12,000 lb/A after 120 days growth. Total yields are generally higher if brassicas are planted with rye, ryegrass, and clover. For descriptions of selected species, refer to the section entitled **VARIETIES/TYPES.**

USES

Catch crops: Brassicas are efficient nitrogen, phosphorus, and calcium feeders. Planted in the fall, they can significantly reduce nitrate leaching over the winter. Unfortunately, brassicas are not as cold-tolerant as many cool-season grasses and release their nitrogen rapidly after death.

Soil improvement/"break" crops: Brassicas' deep taproots can loosen compacted soil. Further, when used in rotation with other crops, they will "break" or disrupt pest and disease life cycles associated with traditional grass-legume rotations. When brassicas decompose, sulphur-containing compounds in their tissues break down into chemicals that inhibit soil-borne pathogens as well as insects, weeds, and nematodes. This "mustard effect" is variable with species and cultivar. If the residues are turned under and the field covered with plastic, this natural fumigation effect is enhanced.

Weed suppression: Once established, brassicas can be very competitive with weeds, perhaps in part due to allelopathic effects. Hybrids of a subspecies of Chinese cabbage (*Brassica campestris*) are being developed specifically as weed–smothering cover crops. The hybrids are dwarf plants which grow rapidly and die in 4–6 weeks, leaving little residue and a weed–free field.

Erosion control/no-till mulch: Brassicas can be mixed with oats and seeded in late summer to early fall. Oats and brassicas establish quickly and then winterkill in cold areas, leaving a protective mulch that can be no-till planted the next spring. **Forage:** Brassicas can be grazed or harvested for green chop or silage. Consider them "concentrates" instead of "forage" as their fiber content is quite low. To avoid bloat and other livestock problems, be sure that only 75% of the forage are brassicas, with the rest being grass pasture or dry hay.

Oil production: Some crops, such as rape, are also grown for oil.

MANAGEMENT

Seeding dates: Sow in the spring around corn–planting time, or in the fall at least six weeks before killing frost.

Seeding rates: General seeding rates for mustards used as cover crops are 5– 7 lb/A for small–seeded cultivars and 10–12 lb/A for large–seeded cultivars. Check with your seed dealer for specific recommendations.

Seeding methods: Brassicas can be drilled in rows 6–8 inches apart, ¹/₄–¹/₂ inch deep. They can also be broadcast into a tilled bed and cultipacked or lightly harrowed less than 1 inch deep. If planting into a tilled field, plow several weeks before planting so weeds will germinate, then do secondary tillage to make a firm, fine, weed–free seedbed.

Brassicas can be no-till planted into grass sod as follows: Graze or mow grass sod very close. As an option to herbicides, apply manure slurry to burn sod back and no-till plant brassicas through the slurry. Keep the sod suppressed for 2–3 weeks until the brassicas have established. Advantages of no-till establishment over conventional plantings are reduced erosion and fewer insect problems.

For better weed control, interseed brassicas with small grains at planting time. This method works well with rape and turnip. The small grain-suppresses weeds while the brassica is establishing and seems to reduce insect problems. Brassicas can also be successfully overseeded into standing crops.

Other management notes: Avoid letting brassicas go to seed as most produce some hard seed and could become long-term weed problems. If planted late enough in the season, many will winterkill before setting seed.

PEST PROBLEMS

Diseases like bacterial soft rot of roots and leaf spot are not usually a problem until brassicas near maturity. Some varieties are more disease resistant than others. To lessen problems with disease, do not grow brassicas on the same field for more than 2 years in a row. Also, graze or incorporate before plants reach maturity.

Turnips and other brassicas, including radishes, may harbor clubroot disease (*Plasmodiophora brassicae*) or cabbage root maggot (*Delia radicum*), so they should not be used in rotation with susceptible vegetable crops.

Insect pests may include aphids, flea beetles, and imported cabbage worms (*Artogeia rapae*). No-till planting seems to reduce problems with flea beetles.

VARIETIES/TYPES

Kale (*Brassica oleracea* L.): This is the slowest growing of the forage brassicas, along with swedes. Stemless varieties establish more rapidly and are shorter than stemmed varieties, which may grow as tall as 60 inches. Stemless kale can mature in 90 days, but stemmed varieties need 150–180 days.

Rape (*Brassica napus* L.): These are multi-stemmed with a fibrous root system which can loosen tough clay soils. Fast germination and growth make rape useful for weed control. Rape matures in 8–10 weeks. It can be used as an oil crop as well as forage, cover crop, and green manure. Small-stemmed (dwarf) cultivars do not compete well with weeds but are better for frequent grazing regimes than stemmy (giant) cultivars.

Swede (Brassica napus var. napo-

brassica or *Brassica napobrassica* Mill): This type is among the slowest growing of the forage brassicas. Although generally considered the same species as rape, swede has a large, edible root like turnip. It yields more than turnip but grows more slowly (150–180 days to maximum production). Plants usually have a short stem, but stems can reach 2.5 feet if grown with tall crops.

Turnip (*Brassica rapa* L.): A fastgrowing brassica, nearing maximum production after 80–90 days. Rapid fall growth makes it a good crop for late fall grazing. Turnips produce a large edible root, which in some varieties makes up the majority of the plant biomass.

Oilseed Radish (*Raphanus sativus* L., or *R. sativus* var. *oleiferus*): This type is very deep rooted, and therefore, useful in improving tilth and reducing nitrate loss. In Canada, after wheat harvest, radish seeding is delayed until mid–August so that it winterkills in October or November before it sets seed and becomes a weed problem.

Other brassicas: Other mustards can be used as cover crops in vegetables, row crops, orchards, and vineyards. These include wild mustard (*B. kaber*), white mustard (*B. hirta*), black mustard or Trieste (*B. nigra*), Indian or brown mustard (*B. juncea*), and Ethiopian mustard (*B. carinata*). Some of these can become serious weed problems.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SORGHUM-SUDANGRASS

(Sorghum bicolor (L.) Moench X S. bicolor var. sudanense)

Sorghum-sudangrass, often referred to as Sudax, results from a cross between a forage or grain sorghum (Sorghum bicolor) and sudangrass (S. bicolor var. sudanense). This cross produces a rapidly growing summer annual grass suitable for cover cropping, forage, soil improvement, and erosion control. Sudax exhibits the greatest tolerance to drought and heat of all the cover crops typically grown in the Northeast.

Culture

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	1	12							

Cold hardiness: no frost tolerance pH preferred: near neutral Drainage preferred: well-drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F O°F to 10°F

These warm–season hybrids show considerable variability in growth habits, with some cultivars reaching 18 inches in height at maturity while others grow to over 16 feet in height. All are erect, short–day (flower as daylight decreases in late summer) grasses, generally taller and coarser than their sudangrass parents.

Adequate germination requires soil temperatures of 68–85°F. Although the grass can grow at 60°F, optimum temperatures are in the 90s. Sorghum– sudangrass can grow on low–fertility soils and tolerate moderate acidity but prefer good fertility and near–neutral pH.

Sorghums have been termed "camel crops" due to success in areas with dry seasons. They go nearly dormant in drought, recommencing growth when there is sufficient rainfall. In comparison with corn, sorghum has lower leaf area per plant, more secondary roots, and a waxy cuticle that seems to be effective in retaining moisture. Stalks and leaves of sorghum dry and wilt slower than corn.

Summer annual grasses like sorghum– sudangrass hybrids can produce a tremendous amount of biomass. If cut several times during a season with good growing conditions, 13,000–18,000 lb acre(A) of total dry matter can be realized. In a single–cut system, yields of 4,000–5,000 lb/A are common.

USES

Sorghum-sudangrass hybrids are excellent summer cover crops, catch crops, and weed suppressants, along with providing high-quality forage. For short season additions of organic matter in warm weather, they are probably unrivaled in the Northeast.

Due to its rapid and dense growth habit, sorghum-sudangrass can outcompete weeds, providing a mulch and erosion control and improving soil tilth. It is useful as a midsummer cover and weed control before fall planting. Part of its weed-suppressing ability may be due to allelopathic substances, natural toxins contained in the plants. Vegetable fields with weed problems can be rotated in series of short-season covers that include small grains in the spring and fall and sorghum-sudangrass during the summer. Each cover is incorporated into the soil before the next cover is planted.

Because sorghum–sudangrass has a high demand for nitrogen, it makes a good catch crop, scavenging excess nitrogen in the soil, preventing it from leaching out.

Sorghum–sudangrass provides excellent forage and silage for livestock, and the hybrids produce more biomass than sudangrass. One problem is that sudangrass and its hybrids can contain toxic levels of cyanogenic glucosides (which convert to prussic acid in the rumen) when plants are young. Therefore, it should only be grazed when mature. Second–growth or drought–stricken plants can be especially harmful. Well–cured fodder and hay are generally safe to feed because the acid is released in gaseous form when silage is being moved and fed. Although freezing does not increase prussic acid levels, it does cause the glucosides to convert quickly to the acid form, making frosted sorghum potentially hazardous until it starts to dry out.

MANAGEMENT

Seeding dates: Sorghum-sudangrass hybrids can be planted in late spring (mid–May) or early summer once soil has warmed up and there is no danger of frost. A rule of thumb is to plant no earlier than 2 weeks after corn planting.

Seeding rates: 10–36 lb/A. Higher rates are recommended to produce rapid ground cover, but may lead to lodging on fertile soil.

Seeding methods: Seed can be drilled 1/2–2 inches deep (deeper in lighter soils, shallower in heavy soils) or broadcast. Firming the seedbed after seeding is desirable if it is dry or if rainfall is not anticipated before seedling emergence. This will help conserve moisture and optimize seed–to–soil contact. A level, well–tilled seedbed gives best results, including better weed control, although minimum–till methods are possible.

Mowing/grazing: When cutting or grazing sorghum-sudangrass, 4–6 inches of stubble should be left to avoid reduced regrowth or even plant death.

Other management notes: Sorghum residue, while decomposing, can tie-up soil nitrogen up to a few months after incorporation, This problem can be avoided by following sorghumsudangrass with a legume, adding a nitrogen source at plowdown, leaving land fallow for a few months, or using sorghum-sudangrass as a late-season cover, which winterkills and has time to decay before spring crops are planted.

PEST PROBLEMS

Most diseases that affect Sudax can

be avoided by planting resistant varieties and practicing crop rotation.

Sorghum-sudangrass has been reported to harbor high densities of root lesion nematodes (*Pratylynchus penetrans*) and sting nematodes (*Belonolaimus* spp.). Sting nematodes can cause reduced yields in cool-season vegetables if they follow a cover of sorghumsudangrass. Other sources say that sudangrass suppresses nematode levels.

Sorghums are relatively resistant to grasshopper, rootworm, and corn borer injury. However, they are attacked by the chinch bug (*Blissus leucopterus*), sorghum midge (*Contarinia sorghicola*), corn–leaf aphid (*Aphis maidis*), corn earworm (*Heliothis zea*) and sorghum webworm (*Celama sorghiella*). Planting early in the season can help control chinch bugs, sorghum midges, and may help reduce webworm damage. There are also cultivars and hybrids resistant to the chinch bug.

VARIETIES/TYPES

There has been extensive breeding of varieties and hybrids of sorghum and sudangrass, each adapted to specific uses and environmental conditions. Hybrids and varieties that are later–maturing with larger, leafier stalks may be preferable as cover corps. Varieties low in prussic acid should be used for forage. Consult your seed dealer or extensionist for more information on recommended varieties.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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CROWNVETCH

(Coronilla varia L.)

Crownvetch is a hardy, long-lived perennial legume which has become an important soil erosion control crop for the Northeast. Unfortunately, the same characteristics that make it excel as an erosion control crop also can lead to it becoming a noxious weed. It is an excellent choice for steep hillsides or roadcuts that require long-term cover, but for annual cropping systems, the management inputs and costs may not justify the benefits of this particular legume.

Culture

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	1	12	123						

Cold hardiness: zone 4 pH preferred: 6.2–7.0 Drainage preferred: well–drained

Average Annual Minimum Temperatures

> Zone 3 -40°F to -30°F Zone 4 -30°F to -20°F Zone 5 -20°F to -10°F Zone 6 -10°F to 0°F Zone 7 0°F to 10°F

Although its leaves resemble those of the true vetches (*Vicia* spp.), crownvetch is not closely related to them. It has a somewhat reclining growth habit, with coarse, weak, hollow stems 2–5 feet in length, which spread by underground creeping, fleshy roots. Although shrubby in appearance, the plant is herbaceous. It reaches 2–3 feet in height, making a dense mat, which is blanketed with whitish-pink to purplish-pink flowers from June to July or August. If managed properly, it can last indefinitely.

The root system is deep, strong, and coarse, which explains the plant's usefulness for erosion control. Roots have been found to extend 6.5 feet in poorly drained brick clay. Such an extensive system helps it withstand drought, which is one of its notable features.

Germination and early establishment are very slow, and crownvetch does not compete well with weeds. It takes 2–3 years to produce a well–established, vigorous stand, but once established, plants require little care.

Crownvetch requires well-drained soils with a pH above 5.5 for establishment. It can grow on infertile soils but will respond to phosphorus, potassium, calcium, and magnesium. Plants are frost and winter-hardy, although top growth will tend to die back during Northeast winters. Plants will green up again when temperatures rise above 50°F. Although crownvetch will grow under shrubs and trees in moderate shade, it won't do well in dense shade.

Crownvetch gives forage yields comparable to or lower than alfalfa (*Medicago sativa*) and similar to birdsfoot trefoil (*Lotus corniculatus*), around 11,100 lb/acre(A). It matures later than alfalfa, red clover (*Trifolium pratense*), and tall–growing cultivars of birdsfoot trefoil.

Since crownvetch is a legume, it can provide some "free" nitrogen to a system. In Pennsylvania, no-till corn planted into a 3- to 5-year old crownvetch stand can yield 100 bu/A without additional nitrogen. For each additional bushel of corn, add 1 lb/A of nitrogen.

USES

Crownvetch has been used principally for erosion control of critical areas such as steep roadbanks, industrial waste areas, and surface-mine spoils. It has been used as ground cover for home sites and urban developments, soil conservation and improvement, high-quality hay, forage or silage, and wildlife food and cover. More recently, work has been done on its use as a living mulch/cover crop into which corn, small grains, and forages can be planted using minimum or no-till methods. As a living mulch, crownvetch can significantly reduce water runoff along with soil and pesticide loss from slopes. It improves moisture infiltration in soil, which can increase moisture availability during dry years.

It has been used as living cover for seedings of corn, small grains, and forages (legumes, grasses or both). In Pennsylvania, it has served as a living mulch in a corn-corn-oats-winter wheat/soybean 4-year rotation. No-till oats and soybeans showed no yield loss if crownvetch was sufficiently suppressed. In southern New England, it has fit well into a corn and hay rotation system.

As forage, crownvetch is more palatable than most legumes if low-tannin varieties are used. It compares favorably with alfalfa and appears to be nonbloating. However, nutritional value declines as the plant matures, and stands recover rather slowly after being grazed or cut.

MANAGEMENT

Seeding dates: In the Northeast, spring is the best seeding time. Seeding after midsummer is not recommended, although crownvetch has been successfully no-tilled at least 6 weeks before the first light frost in Pennsylvania.

On sites too steep or rocky to be mechanically prepared, crownvetch can be frost seeded in late winter (February or March).

Seeding rates: Rates of 5–9 lb/A can give a solid stand in 1–2 years (this rate can be used if overseeding into silage corn). Even rates as low as 1 lb/A will give a good stand in 3–4 years.

If used for erosion control, seed 15–20 lb/A crownvetch with tall fescue (*Festuca arundinacea*) or ryegrass (*Lolium* ssp.) at 30 lb/A to provide quick cover during establishment. For forage, seed crownvetch at 7–10 lb/A with orchard-grass (*Dactylis glomerata*) at 3 lb/A, timothy (*Phleum pratense*) at 5 lb/A, or tall fescue at 8–10 lb/A.

If planting crown divisions, plant 2 feet apart. Plants will spread and cover the area in 1.5–2 years. If planted closer, they will cover the area sooner.

Seeding methods: Broadcast and

cover or drill seed 1/4 to 1/2 inch deep. It is best to cultipack or otherwise press soil after planting to insure good seed– to–soil contact. For rapid germination, seeds need to be scarified or acid soaked. The field should be free of hard–to– control perennial weeds as establishing crownvetch will be unable to compete with them.

If planting on steep areas, cover with 1.5 tons of straw/A and hold it in place with netting or other covering.

Seed should be inoculated with specific "crownvetch" type inoculant. "Vetch/pea" inoculant is not compatible with crownvetch.

Mowing/Grazing: It takes 1–4 years for a productive stand to be fully established. In the first year, the stand should not be grazed, but should be cut for weed control. Once established, crownvetch can be harvested for hay or grazed 10–14 days after first flowers appear (do not wait until full bloom, or you may not be able to make a second cut). Leave 6 inches of stubble since new growth comes from the buds on the stems.

Incorporation: Crownvetch stands can be killed by herbicides or by moldboard plowing, followed by secondary tillage if necessary. It is important to ensure the stand has been killed so that the crownvetch does not become an invasive weed.

Other management notes: Seeds are mostly hard, so if crownvetch goes to seed, you will have it for years to come.

Winter survival in conventional seedings is slightly less than no-till seedings, so conventional seedings should be made one month earlier than no-till seedings.

Because of its slow establishment, growers often overseed crownvetch into corn, soybeans, or small grains to avoid losing crop production.

In no-till living mulch systems, crownvetch must be suppressed, but not killed, with herbicides on a yearly basis to avoid competition with the cash crop. This system can be very risky as the crownvetch can easily be insufficiently suppressed or accidentally killed in the process.

Crownvetch seed and crowns are extremely expensive. Growers should spend ample time on management to protect initial seed-cost investment.

PEST PROBLEMS

Crownvetch is relatively pest free. Stands are resistant to most root-knot nematodes (*Meloidogyne* spp.), and to most insects and rodents. It is attacked by some fungi but not too seriously.

VARIETIES/TYPES

There are three named varieties: 'Chemung,' 'Emerald,' and 'Penngift.' 'Chemung' and 'Penngift' are both widely used in New England. All are equal in forage quality and yield, but in the Northeast, 'Chemung' has shown more seedling vigor and provides more cover in the first year of growth.

The cover crops you select may not be compatible with your current herbicide regime. Please refer to information on susceptible plants and residual times for herbicides used in fields to be planted with a cover crop.



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SPECIES	LIFE	HARDINESS	HEAT	DROUGHT tolerances	SHADE	N FIXED (Ib/A)	PREF.	SOIL TYPE PREF.	SEEDING RATES (Ib/A)	COMMENTS
CLOVERS Alsike	B/P	4	S	S	6	60-119	6.3	clay to silt	4-10	 ◆ Endures waterlogged soils & greater pH range than most clovers
Berseem	SA/WA	· 7	-6-7	. 7-8	5	50-95	6.5-7.5	loam to silt	9-25	 Good full-season annual cover crop
Crimson	SA/WA	6(5)	5	ω	7	70-130	5.0-7.0	most if well-drained	9-40	 Quick cover •Good choice for overseeding (shade tolerance)
Red	SLP	4	4	4	6	100-110	6.2-7.0	loam to clay	7-18	 Strong taproot, good heavy soil conditioner •Good choice for overseeding (shade tolerant)
White	LLP	4	6 .	7:	00	≤130	6.2-7.0	loam to clay	6-14	 Good low-maintenance living cover •Low growing •Hardy under wide range of conditions
Sweetclovers Annual White	SA	NFT	6-7	6-7	6	70-90	6.5-7.2	most	15-30	◆ Good warm weather smother & catch crop •Rapid grower •High biomass production
Biennial	в	4	6	7-8	4	90-170	6.5-7.5	most	9-20	 Deep taproot breaks up com- pacted soils & recycles nutrients Good catch crop •High biomass production
Cowpeas	SA.	NFT	9	8	. 6	130	5.5-6.5	sandy loam to loam	25-120	✦ Rapid hot weather growth
Crownvetch	LLP	4	7	8	7	NI	6.2-7.0	most	5-9	 Very good for slope stabilization & erosion control
Faba Beans	SA	œ	. ω	4	Z	71-220	5.5-7.3	loam to silty clay	80-170 (small seed) 70-300 (large seed)	 Strong taproot, good conditioner for compacted soils •Excellent cover & producer in cold soils Efficient N-fixer
Hairy Vetch	SA/WA	4	ω	7	5	80-250 (110 avg.)	6-0-7.0	most	20-40	 Prolific, viny growth •Most cold- tolerant of available WA legumes
Field Peas	WA/SA mual, WA= Winter A	7 Annual, LLP = Long-lived	3 I perennial, SLP	5 = short-lived perennial. I	4 3=Biennial: NI = no	172-190	6.5-7.5	clay loam	70-220	 Rapid growth in chilly weather
A = Annual, SA= Summer Ai	nnuàl, WA= Winter A	Annual, LLP = Long-lived	l perennial, SLP	= short-lived perennial, I	3=Biennial; NI = no	information; NFT = no fros	t tolerance		•	

HEALTH Series

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northeast cover crop Fact Sheet #20

SUMMARY

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Species	LIFE CYCLE	HARDINESS	НЕАТ	DROUGHT tolerances	SHADE	PREF.	Soil Type Pref.	SEEDING RATES (Ib/A)	COMMENTS
Non-LEGUMES Brassicas	A/B	6-8	Ŧ	. 9	IZ	5.3-6.8	loam to clay	5-12	 Good dual purpose cover & forage •Establishes quickly in cool weather
Buckwheat	SA	NFT	7-8	4	9	5.0-7.0	most	35-134	 Rapid grower (warm season) Good catch or smother crop Good short-term soil improver for poor soils
Cereal Rye	WA	3	9	œ	7	5.0-7.0	sandy to clay loams	60-200	 Most cold-tolerant cover crop Excellent allelopathic weed control •Good catch crop •Rapid germination & growth •Temporary N tie-up when turned under
Fine Fescues	TTD	4	3-6	6-7	, <mark>8</mark> -9	5.3-7.5 (red) 5.0-6.0 (hard)	most	16-100	 Very good low-maintenance permanent cover, especially in infertile, acid, droughty &/or shady sites
Oats	SA	œ	4	4	4	5.0-6.5	silt & clay loams	110	 Rapid growth •Ideal quick cover & nurse crop
Ryegrasses	WA (AR) SLP (PR)	6 (AR) 5 (PR).	4	m	7 (AR) 5 (PR)	6.0-7.0	most	14-35	 Temporary N tie-up when turned under •Rapid growth •Good catch crops •Heavy N & moisture users
sorghum-sudangrass	SA	NFT	6	8	Ĩ	near neutral	Z	10-36	 Tremendous biomass production in hot weather •Good catch or smother crop



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