



COVER CROP PROGRAM

King's Agriseeds - *Designing Cover Crop programs for your farming system.*

Proven Mixtures, Diverse Species, Experienced Support

Cover Crop Product Guide

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Late Summer & Early Fall planted Cover crops

Note: Plant Zone Hardiness Maps – In this Guide I refer to Growing Zones or USDA Plant Hardiness Zones for late summer or fall planting dates for the cover crops. After speaking with many farmers throughout the Northeast and Mid-Atlantic I've come to realize that many don't know what their plant hardiness zone is. Therefore, as an appendix, I attached maps of each of the states in the King's Agriseeds sales region with their growing zones.

Crimson clover (*Trifolium incarnatum*) variety 'Dixie'

Sales locations: In the Northeast, Pennsylvania Rt. 78 and south, above this line crimson clover does not **consistently** over-winter, with the exception being some of the Finger Lakes region area and some other New England coastal areas that get buffered by lake or ocean effect. Otherwise the crimson is not recommended as a winter annual for these northern locations, but can be spring seeded as a summer annual.

Planting Windows:

Fall planting: seed six to eight weeks before the first killing frost.

Zone 7: August 20 – October 1 or the first opportunity in the spring.

Zone 6: August 10 – September 20 or the first opportunity in the spring.

Zone 5: Spring plant

Zone 4: Spring plant

For spring planting as a summer annual, plant as soon as all danger of frost is past.

Note: if planted in spring or summer it will bloom in the same year and will not over winter.

Seeding rate: 15- 20 lbs/A drilled, 22 to 30 lbs/A broadcast. When planted with another crop as a companion lower the seeding rate to 10 – 14 lbs/A

Note -Crimson clover seed should be inoculated for best performance with nitrogen fixing 'crimson clover' type inoculant.

It can be broadcast and rolled or drilled into a firm seedbed, shallow drilling produces a better stand.

There are two major types of crimson clover available commercially. The hard seeded type and the soft seeded type. The hard seeded type contains a higher percentage of hard seed that will delay germination until fall, when the conditions are favorable for growth. They are also referred to as “reseeding types” These varieties will tend to germinate in the fall if allowed to set seed in the late spring. ‘**Dixie**’ is a “hard-seeded” or “reseeding” variety.

When planted in the fall crimson clover will grow as a winter annual and will flower early to mid-May in the northeast.

When planted in the spring, crimson clover will grow in an annual habit flowering in the same year in 70 to 90 days.

Nitrogen: Fall planted crimson clover can fix and accumulate from 50 to 80 lbs/A of N by mid-April, this Nitrogen is primarily in the above ground growth; approximately 50% of that amount or **25 to 40 lbs Nitrogen /A is available** for the following crop in the first year. If the crimson clover is left to grow until June then 140 to 260 lbs/A of N can be accumulated with approximately **70 to 130 lbs Nitrogen/A being available**. Spring growing conditions will affect the growth of crimson clover and have influence on the amount of biomass and nitrogen produced.

BENEFITS

- Use as a cover crop or green manure.
- Over-seed into small grains and other vegetable crops.
- Mix with grasses and small grains as hay or forage.
- For early season weed control and nitrogen source, crimson clover can be spring seeded, then mowed or plowed down as a green manure or sprayed and killed for a summer crop.
- Roll down at full bloom to kill or spray earlier to kill and use as nitrogen rich no-till mulch.
- Use as a cover crop for orchard systems due to its shade tolerance. It can be disked into the soil as a green manure, if reseeding varieties are used stands can re-establish every fall.
- Used as a winter cover and green manure in row crops, it can be over seeded in summer or fall crops in August or September.
- In the warmer parts of the Northeast and Mid-Atlantic Delmarva area, in a typical Soybean to corn rotation, crimson clover has been aerial seed into Soybeans before leaf drop when leaves are starting to yellow, it then grows as an overwintering cover crop and provides nitrogen for the following corn crop in rotation.
- Crimson grows well under cool, humid conditions, quickly forming a ground cover which will compete with weeds
- It tolerates many soil types, and can yield up to 200lbs/A of N in its biomass, although 70 to 130lb/A is more common
- Young crimson is very palatable and seldom causes bloat. Crimson clover can be kept in a palatable vegetative state through the summer by managing it with repeated mowing, but growth is reduced in hot dry weather. It will not re-grow if grazed or mowed after flowering begins.

Hairy Vetch (*Vicia villosa*) VNS Variety not stated or Varieties ‘Purple Bounty’ & ‘Purple Prosperity’.

Varieties “Purple Bounty” and “Purple Prosperity” are new USDA variety releases that have been selected for winter hardiness in northern climates and for earlier bloom.

Sales locations: Northeast- North Carolina to Maine

Two Planting Windows:

1st – (typical window)

Late summer to September 20th

In Southeastern PA and further south

Plant by Mid September in central PA & farther north

Fall planting - desirable to plant 30 to 40 days before the first killing frost.

Zone 7: August 15 – October 10

Zone 5: August 1 – September 10

Zone 6: August 10 – September 20

Zone 4: July 15 – August 20

2nd planting window,

Planting too late in the fall does not provide enough growth to over-winter. If the fall optimal window is missed then hairy vetch can be **dormant seeded** just before the ground freezes or it can be spring seeded as early as you can get in the field, Dormant seeding and spring seeding will not benefit as a winter cover crop and will not grow as much biomass compared to the fall seeded mix. These two options (dormant & spring seeding) apply for it to be used as a spring cover and subsequent green manure primarily for vegetable growers to use for summer planted vegetables (2nd tomato & pepper planting, 2nd potato planting, summer squash, 2nd sweet corn planting) but not to be used for early spring seeded vegetables or spring seeded agronomic crops. If mixed with oats it can be cut as a forage in late spring and then let to grow to provide some fertility to be used by a subsequent summer planted sorghum-Sudan grass crop.

Hairy vetch can be sold unmixed as a separate crop, if the grower wants to seed it with other small grains (rye, triticale, winter barley), Hairy vetch and rye is the most common of these combinations as a cover crop. Hairy vetch can also be mixed with crimson clover and rye as a mix and planted in the fall.

Seeding rate: As a straight stand, in Pennsylvania & North: 25 to 30 lbs/A; in the South 15 to 25 lbs/A. In Mixes 15 to 20 lbs/A, best to drill, can also broadcast and cover with roller or harrow, plant ½ to 1 inch deep.

Hairy Vetch seed should be inoculated for best performance with nitrogen fixing pea-vetch inoculant.

BENEFITS

- Hairy vetch is planted in the fall and starts growth before becoming dormant in winter. In the spring with the long days the plants make abundant growth and fix large quantities of nitrogen.
- Hairy vetch is valuable for conventional farmers, their nitrogen fertilizer expenses can be lowered by a third to half.
- **Nitrogen:** Fall planted Hairy vetch can fix and accumulate from 80 to 130bs/A of N by mid-April, this Nitrogen is primarily in the above ground growth; approximately 50% of that amount or **40 to 65 lbs Nitrogen /A is available** for the following crop in the first year
- If the hairy vetch is left to grow longer until June then 150 to 250 lbs/A of N is accumulated with approximately **75 to 125 lbs Nitrogen/A will be available**.

- Spring growing conditions will affect the growth of hairy vetch and have influence on the amount of biomass and nitrogen produced.
 - Reduces pesticide loss and soil erosion by runoff.
 - In organic production systems it is especially valuable and used by growers as a primary source of on-farm grown nitrogen and doubles as their cover crop requirement.
 - In late spring, the vetch plants can be tilled into the soil as a nitrogen rich green manure.
 - Or it can be rolled down and killed, leaving a ¾" to 1½ inch thick thatch mat of dead stems that serves as a weed smothering mulch.
 - This mat also keeps moisture in the soil during the growing season over summer, slows down rain runoff and protects soil from eroding.
 - The small leaflets decompose and provide much nitrogen to the following crop such as corn, tomatoes or pumpkins.
 - No-till planters or transplanter can be utilized to plant the main crop into the mulch-mat.
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Vetch & Oats (mix)

Hairy Vetch (*Vicia villosa*) and **Oats** (*Avena sativa*)

Sales locations: North Carolina to Maine

Two Planting Windows: (Same info as above)

Seed 30 to 40 days before the typical first killing frost date.

Seeding rate: 60 lbs/A, best to drill, can also broadcast and cover with roller or harrow

Hairy Vetch seed should be inoculated for best performance with nitrogen fixing pea-vetch inoculant.

67% Oats	40 lbs/A - Jerry Oats or lower cost oats
<u>33% Hairy Vetch</u>	<u>20 lbs/A Hairy vetch</u>
100% total	60 lbs/A total

BENEFITS

- Oats will germinate quicker than the hairy vetch and they give quick soil cover, benefiting to start to hold soil in place and help prevent soil erosion. The oats won't kill at the first frost unless it is a very hard frost, typically they will live until the ground freezes. They will leave winter-killed mulch in among the hairy vetch.
- Growing hairy vetch with oats as a nurse crop helps reduce frost heaving and the dead oats help to insulate the hairy vetch somewhat, if no snow is present.
- Oats will provide early weed suppression in fall and recycle free nitrates. The hairy vetch provides the benefits of providing over-winter soil cover and then in the spring it fixes much nitrogen, which is primarily put into its above ground biomass which grows rapidly providing spring weed suppression as well.
- If this mix is planted late summer (August), especially in years with moisture, the oats will grow quite tall, the mix can be cut in mid September as a forage as long as it's not cut too low, leaving enough hairy vetch plant material there to re-grow before the first killing frost in October. This option is pushed back, or may not be an option as we move to northern locations.

- **Nitrogen:** Fall planted Hairy vetch can fix and accumulate from 80 to 130bs/A of N by mid-April, this Nitrogen is primarily in the above ground growth; approximately 50% of that amount or **40 to 65 lbs Nitrogen /A is available** for the following crop in the first year
 - If the hairy vetch is left to grow longer until June then 150 to 250 lbs/A of N is accumulated with approximately **75 to 125 lbs Nitrogen/A will be available**. Spring growing conditions will affect the growth of hairy vetch and have influence on the amount of biomass and nitrogen produced.
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Common Medium Red Clover- VNS - Red Clover, (*Trifolium Pratense*),

Sales locations: North Carolina to Maine.

Planting Windows:

Frost seeded in Feb to early March.

Early spring, (March-April) Seeded along with spring oats, spring barley utilizing grass seed box on the drill. Summer: Overseeded/broadcast into corn at last cultivation or at lay by time. (Check herbicide labels –should be at least 6 to 7 weeks after application of per-emergent herbicides such as atrazine.

Overseeded/aerial seeded into Soybeans at leaf yellowing prior to leaf drop.

Late summer planting with oats or with pasture/forage grasses.

Seeding rate: Drilled 10 to 12 lbs/A, ¼ to ½ inch deep.

Broadcast at 15 to 20 lbs/A

Drill with small grains 10 to 12 lbs/A with the spring sown grains.

Red clover uses **clover** type inoculant.

BENEFITS

- Can be frost seeded easily, begins growing with the small grain crop and delivers a summer cover that can be cut for hay or grazed.
- Can be turned under in fall for fall planted vegetables or let to grow over winter for spring plow downs.
- If frost seeded in grain rotations, after small grain harvest, it can be left to grow to keep the soil covered for the remainder of the year, over winter and then be used as spring plow-down.
- In livestock systems can be used as forage hay or grazed.
- In vegetable rotations strips of this can be managed for long term management of soil cover and nitrogen building and plowed down as a green manure at various times throughout the year when needed.
- Can be left to grow as a perennial through the winter to provide cover and fix nitrogen.
- Great Nitrogen source.
- Red clover will grow well in cooler and moist conditions and slow down over summer months.
- Flowers of red clover attract beneficial insects such as honey bees, tachnid flies and large predatory wasps.
- Can be no-tilled drilled into thinning pastures to build up the legume population.
- Can be drilled after sorghum-Sudan grass comes off.

3-Way Clover Mix - Red clover, Yellow blossom sweet clover, Ladino white clover

Red clover (*Trifolium pretense*), **Yellow blossom sweet clover** (*Melilotus officinalis*), **Ladino white clover** (*Trifolium repens*)

Sales locations: North Carolina to Maine.

Planting Windows: February and March - Frost seeded in small grains (wheat, barley, rye, triticale and spelt)

Early spring, (March-April) Seeded along with spring oats, spring barley utilizing grass seed box on the drill. Overseeded/broadcast into corn at last cultivation or at lay by time. (Check herbicide labels –should be at least 6 to 7 weeks after application of per-emergent herbicides such as atrazine.

Overseeded/aerial seeded into Corn at last cultivation or into Soybeans at leaf yellowing prior to leaf drop.

Late summer planting with oats or with pasture/forage grasses.

33% Red Clover

44% Yellow blossom sweet clover

23% Ladino white clover

100% total

Red clover and White clover use clover type inoculant, Yellow Blossom Sweet clover uses Alfalfa/Sweet clover type inoculant.

Seeding rate: Drill this mix at 10 to 15 lbs/A, ¼ to ½ inch deep.

Broadcast at 15 to 20 lbs/A

Drill with small grains 10 to 12 lbs/A with the spring sown grains.

This is a versatile mix that can be frost seeded, spring seeded or fall seeded, aerial seeded or broadcast at corn lay by or just prior to soybean leaf drop. With its diversity, the white clover and red clover will grow in long cool springs and in the fall and the yellow blossom sweet clover grows well in the summer or in dry spells.

BENEFITS

- Can be frost seeded easily, begins growing with the small grain crop and delivers a summer cover that can be cut for hay or grazed.
- Can be turned under in fall for fall planted vegetables or let to grow over winter for spring plow downs.
- If frost seeded in grain rotations, after small grain harvest, this mix can be left to grow to keep the soil covered for the remainder of the year, over winter and then be used as spring plow-down.
- In livestock systems can be used as forage hay or grazed.
- In vegetable rotations strips of this can be managed for long term management of soil cover and nitrogen building and plowed down as a green manure at various times throughout the year when needed.

- Can be left to grow as a perennial mix through the winter to provide cover and fix nitrogen.
- Great nitrogen source.
- Abundant biomass.
- Red clover and white clover will grow well in cooler and moist conditions and slow down over summer months, yellow blossom sweet clover has the greatest warm-weather biomass production of any legume exceeding even alfalfa. Yellow blossom sweet clover is more drought tolerant than other cover crops.
- Soil structure builder.
- Compaction fighter, extensive taproots grow up to 1 ft long, with branches that may penetrate 5 ft deep to aerate subsoil and lessen negative effects of compaction.
- Flowers of red, white and yellow blossom sweet clover attracts beneficial insects such as honey bees, tachnid flies and large predatory wasps.
- The mix makes it adaptable to many soil types.
- Can be no-tilled drilled into thinning pastures to build up the legume population.
- Can be drilled after Sorghum-Sudan grass comes off.

CARGO MIX - Crimson clover, Annual Rye Grass and Oats

Oats (*Avena sativa*), **Annual Rye Grass** (*Lolium multiflorum*) and **Crimson clover** (*Trifolium incarnatum*)

Sales locations: In the Northeast, Pennsylvania Rt. 78 and south, above this line crimson clover does not **consistently** over-winter, with the exception being some of the Finger Lakes region area and some other New England coastal areas that get buffered by lake or ocean effect.

Planting Windows: Fall planting: seed six to eight weeks before the first killing frost.

Can be seeded from August to end of September in southeastern PA, in southern locations WV, VA and MD it can be planted until the end of October, early seeding being important in northern areas to ensure that the plants (primarily the crimson clover is well established before freezing weather occurs), frost heaving is especially damaging to young clover plants, the oats and annual ryegrass should help to prevent some of the frost heaving.

Zone 7: August 20 – October 1

Zone 6: August 10 – September 20.

Seeding rate: 60 lbs/A, best to drill, ¼ to ½ inch deep, can also be broadcast and cover with roller or harrow.

Note -Crimson clover seed should be inoculated for best performance with nitrogen fixing 'crimson clover' type inoculant.

60% Oats	40 lbs/A - Jerry Oats or lower cost oats
20% Annual Rye Grass	10 lbs/A - M01, which is winter hardy, bred out of Marshall.
<u>20% Crimson Clover</u>	<u>10 lbs/A - Dixie variety, Hard seeded, full season</u>
100% total	60 lbs/A total

BENEFITS

- Used as grass/legume cover crop or green manure in areas where the crimson clover will overwinter.
- Good mix to prevent erosion
- Builds soil organic matter and adds Nitrogen
- A nutrient catch crop, nutrient scavenger and nitrogen fixer
- Annual ryegrass deep roots, scavenge nitrogen and add organic matter deep, helps break up hard soil
- Suppresses weeds
- Can also be used as a pasture for grazing or to make palatable hay.

Broadcaster MIX – Crimson Clover, Annual Rye Grass, Medium Red Clover, Yellow Blossom Sweet Clover and Daikon Radish

Crimson Clover (*Trifolium incarnatum*) variety 'Dixie', **Annual Rye Grass** (*Lolium multiflorum*), **Medium Red Clover** (*Trifolium pretense*), **Daikon Radish** (*Raphanus sativus*) and **Yellow blossom Sweet Clover** (*Melilotus officinalis*)

Sales locations: North Carolina to Maine.

Planting Windows: Over-seed/Broadcast/Aerial seeded into Corn at last cultivation or into Soybeans at leaf yellowing prior to leaf drop. Late summer after vegetable production. Can be seeded from August to the end of September in southeastern PA, in southern locations WV, VA and MD it can be planted until the end of October, early seeding being important in northern areas to ensure that the plants (primarily the crimson clover is well established before freezing weather occurs), frost heaving is especially damaging to young clover plants, the oats and annual ryegrass should help to prevent some of the frost heaving.

Zone 7: August 20 – October 1

Zone 6: August 10 – September 20.

Seeding rate: Drill (18-25 lbs/acre), Broadcast (25-30 lbs/Acre), Drill with Small Grains (10-15 lbs/Acre), Drill for thick forage (30-35 lbs/Acre)

BENEFITS

- This mix was formulated especially for over-seeding, broadcasting, aerial seeding or used with a high boy type air for seeding in standing corn or soybeans. In vegetable production fields this mix can be broadcast after late summer production, packing with roller or harrow with improve stand.
- The mix is adaptable for broadcasting to many soil types.
- Use in continuous no-till rotations to add soil organic matter by deep growing roots.
- Use as a cover crop and/or green manure, sequester carbon and help build soil structure.
- Deep growing annual ryegrass roots scavenge and recycle nitrogen break up natural hardpans (fragipans) and manmade plow-pans or compacted layers; roots can grow down 3 to 4 ft. between planting time and the following spring.
- Compaction fighter, both deep growing annual ryegrass roots and extensive taproots of clovers grow up to 1 ft long, with branches that may penetrate 5 ft deep to aerate subsoil and lessen negative effects of compaction.
- Crimson clover germinates fast, grows fall cover and overwinters. Red clover will grow well in cooler and moist conditions and will overwinter. Yellow blossom sweet clover is a biennial that will grow well in cooler and moist conditions and is more droughts tolerant of other cover crops and will also overwinters.
- Improve nutrient cycling, combination of great nitrogen scavenger and nitrogen fixing legumes. Depending on seeding date and growth (30 to 100 lbs/A of N can be recycled and or fixed and made available for following crop.

- After Manure application, nutrients are recycled, less nutrient losses.
 - Ground cover to prevent erosion after Corn is taken off or after vegetables are harvested.
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Daikon Radish (*Raphanus sativus*)

Sales locations: North Carolina to Maine.

Planting Windows: Early spring or early fall, Plant mid August, mid September at latest, will kill when temperatures go to the low 20's F.

Spring planting – avoid cover crop from becoming a weed, monitor flowering and kill to prevent plant from going to seed in spring.

Seeding rate: 14 lbs/A, best to drill in rows 6 to 8 inches apart, ¼ to ½ inch deep, or broadcast into a tilled bed and cultipacked or lightly harrowed less than 1 inch deep. Can be no-tilled planted into a grass sod if the sod is grazed or mowed very close. Herbicides can be used to suppress sod.

Avoid planting in water-logged areas. Rapid growth, establish quickly in cool weather. These radishes grow extremely large roots, when drilled if seeding rates are reduced larger roots will be realized, higher seeding rates produce smaller closer concentrated roots. The roots grow deep and therefore are useful in improving tilth and reducing nitrate loss.

BENEFITS

- **Weed Suppression:** Highly competitive with weeds or other crops seeded with it. Can be planted with other cereal covers in the fall but should be drilled three to four rows apart with rye or oats in between; baffles needed in the drill to do this. Strongly suppresses weeds in early spring before soil disturbance.
 - **Soil Improvement crop:** Often called “biodrills” or “tillage radishes” They develop a thick taproot which can loosen compacted soil and improve soil physical characteristics. They are excellent at breaking up shallow layers of compacted soils. A thinner extension of the tap root can penetrate deep layers of compaction. This is one of the best covers for penetrating plow pans and fragipans.
 - **Bio-Fumigant/“break” crop:** If seeking a bio-fumigation effect, consider incorporating or timing of winter kill for when the plants are about 2 months old. If the residues are turned under and covered with plastic this natural bio-fumigant effect is enhanced. Desirous before potatoes in rotation. When used with other crops in rotation these will “break” or disrupt pest and disease cycles associated with typical grass-legume rotations.
 - **No-till mulch:** Leaves a protective winter killed mulch; the residue can be easily worked in early spring, advantageous for early worked ground for early spring seeded crops. The roots die over winter and leave channels so that the soil dries and warms up faster in the spring. Can be easily no-tilled into in spring.
 - **Catch crop:** Plant in fields for scavenging residual soil nitrate-N after previous cash crop. Radishes are efficient Nitrogen, Phosphorous and Calcium feeders, they will catch and bio-accumulate these nutrients in the soil.
 - **Forage:** Excellent quality as a highly-digestible forage makes them a desirable “dual purpose” crop as cover in livestock systems. Can be grazed or harvested as green chop or silage. Their fiber content is quite low. To avoid bloat and other livestock problems, feed only 50 to 75% of the forage as brassica, the rest being grass pasture or dry hay.
 - **Roots are edible raw or cooked, leaves edible cooked.**
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Braco White Mustard (*Brassica hirta*)

Sales locations: North Carolina to Maine; Midwest area entire region.

Planting Window: Early spring or early fall, (may flower in fall if planted in July or early August, better to plant in early to mid September)

Seeding rate: 8 to 10 lbs/A, can be drilled or broadcast to one-half inch depth.

White mustard can be seeded with Triticale, Rye or hairy vetch cover crop.

White mustard is a cover crop that can be used in vineyards, annual crop rotations or in vegetable rotations. As a natural nematode suppressant, Braco white mustard both interferes with completion of the feeding nematode larvae life cycle and acts as a natural occurring bio-fumigant when turned under into the soil just before or at flowering.

BENEFITS

- Suppresses nematodes, other soil-borne organisms and weed seed germination.
- Rapid growth suppresses growing weeds.
- Used as a break crop to suppress diseases and pathogenic nematodes for growers of root crops like potatoes and sugar beets.
- Increases soil tilth, mustard tap roots grow to the depth of 1 to 3 ft.
- Increases soil organic matter.
- Produces a large amount of high protein green material, if plowed down it will recycle nitrogen and reduce the N needs for the following crop.
- Flowers attract honeybees, and hover flies (Syrphidae), most larvae of the hover flies are predators of many soft bodied insects such as aphids, scale insects, thrips and caterpillars.
- White mustard will typically winter kill, making a desirable mulch to accommodate early spring-sown vegetables.
- Quick spring cover crop - can be frost seeded in March or early April in corn stubble before planting Soybeans, incorporate or kill after flowering.
- Quick spring cover crop - Frost seed in March or Early April, incorporate or kill after flowering before May planted vegetables. tomatoes, peppers, potatoes, sweet corn (Don't use before other brassicas like Cauliflower in rotation).
- Used for disease control after onions, lettuce or garlic.
- Suppresses verticillium in potato and reduces weeds in the following crop.

Bio-fumigation technique, utilizing white mustard

- 1) Allow 60 to 70 days of growth before cutting.
- 2) Flail mow or chop to reduce the particle size
- 3) Incorporate the plant material into the soil with a disk 5 to 6 inches deep with disk

Triticale varieties: Tricale 815, Tricale 718, Forerunner

Triticale (*X Triticosecale*)

Sales locations: North Carolina to Maine.

Planting Window: Early Fall to Oct 20 in Southeastern PA,

Central PA and north late August to mid September.

Seeding rate: 80 to 150 lbs/A, seeding depth ½ to ¾ inch deep, if mixed with legumes, crimson clover or hairy vetch, use 60 lbs/A of this in the mix.

This is an excellent cover crop and forage crop planted in the fall it provides soil cover over winter.

BENEFITS

- Its winter hardiness allows it to grow longer in the fall and resume growth earlier in the spring.
- Rapid prostrate early growth crowds out and out-competes winter annual weeds better than rye and its allelopathy and residue provides some weed control for summer weeds.
- Hardiness and erect stature make it a good companion crop or nurse crop.
- Fibrous root system helps improve soil tilth and slow erosion, increases soil organic matter.
- Catch crop used to prevent leaching of excess soil nitrogen.
- Plow under as a green manure in spring while young.
- Can be grown in strips between vegetable beds and used as an effective wind-break.
- Can be grown in-between vegetable beds and mowed to cover black plastic which acts to prevent UV degradation and extends black plastics lifespan.
- It produces a lot of biomass which translates into a long lasting residue cover for conservation tillage systems.
- If left to grow until anthesis (flowering) it can be mowed to create a mulch or rolled down to create a no-till mulch mat for no-till soybeans, or no-till pumpkins.
- Mixed with hairy vetch and/or crimson clover it can be rolled down to supply nitrogen and make a mulch mat for no-till planting pumpkins, tomatoes, peppers or sweet corn.
- Green straw can be used for horse bedding.
- Used as a break crop in vegetable systems.
- Can be let grown to flowering then mowed or rolled down to use as walkways in between vegetable beds.
- Can be broadcast underneath fall late growing vegetable crops (cauliflower, broccoli).
- Can be utilized as forage when young cut at flag leaf stage, either grazed or harvested as baleage.

Triticale Plus cover crop mix

Triticale & Annual Rye Grass, this mix will include a 2nd Annual Ryegrass (MO1, winter hardy, bred out of Marshall) as opposed to Zorro Annual Ryegrass.

Sales locations: North Carolina to Maine

Planting Window: Early Fall to Oct 20 in Southeastern PA,

Central PA and north late August to mid September.

Seeding rate: 80 to 100 lbs/A, seeding depth ½ to ¾ inch deep, if mixed with legumes, Crimson Clover or Hairy vetch, use 60 lbs/A of this mix.

This combination is an excellent non-leguminous cover crop mix.

Option – can include Crimson Clover 10 lbs/A as well with this mix in southern locations, Hairy Vetch 15 lbs/A in northern locations.

BENEFITS

- Ground cover provides excellent soil cover to prevent erosion.
 - Helps dry out wet spots in fields in spring.
 - Scavenges and recycles nitrogen with triticale cereal crop roots and annual ryegrass deep growing fibrous roots.
 - Carbon sequestration – off season builds lots of soil carbon with grass roots in the soil. .
 - When grass roots die this will make channels for rain to infiltrate and subsequent crop to grow deeper roots.
 - Above ground heavy biomass producer. .
 - Provides weed suppression.
 - Can be tilled into the soil as a spring green manure.
 - Doubles as a high quality forage crop. .
 - Excellent Nitrogen scavenger after corn or vegetable crops.
 - Breaks disease and pests cycles in vegetable rotation. .
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Marshall, MO1 Annual Rye Grass (*Lolium multiflorum*) - Monoculture, (straight stand) cover crop option.

Sales locations: North Carolina to Maine;

Planting window: In the Northeast: Mid-August to the end of September.

For locations north of Rt. 78 in central PA and farther north, target a seeding by the middle of September. In West Virginia, North Carolina, Southern Maryland the seeding date can be pushed to the 2nd week of October.

Seeding in August or Early September is critical if it will be used for fall forage. Early seeding option after wheat, vegetables or corn silage with manure application can produce very high quality forage.

Typically, Annual ryegrass needs 60 days of growth before the first hard killing frost.

Snow cover over the winter reduces winter kill.

Seeding rate: 20 lbs/A, can be drilled ¼ to ½ inch deep, conventional drill or no-till drill, use main box.

- 35 lbs/A if aerial seeded or broadcasted, if seeding in October or if used as a dormant seeding.
- Drill setting for Annual ryegrass at 20lb/A is the equivalent drill setting for tall fescue at 15 lbs/A.

Aerial seeding: into a standing crop (soybeans) at leaf yellowing just prior to leaf drop. Watch weather forecast, upcoming showers – Adequate soil moisture is needed for germination; successful stands have been realized with moist soils/and or rainfall after aerial seeding.

Airflow seeder: Mix the seed with fertilizer, this provides even distribution. Run a fluffing harrow (Salford, Phillips, Phoenix, turboTill or To the Max) after the Airflow to get seed to soil contact and cover.

Airflows can also be mounted to these above implements to distribute seed and fluff the soil.

In dry years running a cultipacker with or after these implements will improve seed to soil contact and result in better germination rates.

Broadcasting: Use a fertilizer truck with spinner, split the middles to get an even seed distribution since the annual ryegrass seed is light weight and will only spread half the distance as fertilizer.

Sprayer booms with spinner boxes added have been utilized to overseed annual ryegrass.

Annual Ryegrass can be mixed with liquid manure, sprayed on and use a rolling tine aerator (Aerway) to provide incorporation.

BENEFITS

- Deep growing roots break up natural hardpans (fragipans) and manmade plow-pans or compacted layers.
 - Cover crop used for transition to continuous no-till.
 - Use with continuous no-till to add soil organic matter by deep growing roots.
 - After two to three years in corn-soybean rotations annual ryegrass roots can grow down 3 to 4 ft. between planting time and the following spring.
 - Improve nutrient cycling, great nitrogen scavenger (30 to 90 lbs/A of N can be recycled and made available for following crop.
 - Biological activity of roots makes Phosphorous more available.
 - After Manure application, nutrients are recycled, less nutrient losses.
 - Ground cover to prevent erosion after Corn silage, wheat or vegetables.
 - Reduces Soybean cyst nematode.
 - Carbon sequestration – off season builds lots of soil carbon with grass roots in the soil.
 - When grass roots die this will make channels for rain to infiltrate and subsequent crop to grow deeper roots.
-

Winter cereal rye (*Secale cereal*)

Huron Brand ‘VNS’ Rye, Ryman Rye & ‘Aroostook’ variety Rye

Sales locations: North Carolina to Maine; Midwest area entire region.

Fall planting – Rye is the most cold tolerant of the commonly used cover crops and has been extensively used throughout the Northeast and Midwest in a wide range of cropping systems.

Planting window:

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

Rye germinates and grows very rapidly even in cold weather, outgrowing wheat, oats and other annual ryegrasses. It's the last chance cover crop when seeding dates for other cover crops has been passed. It can be seeded in the fall later than other cover crops. If sown late, it is especially important to insure good seed to soil contact for an adequate stand.

Seeding rate: 60 to 200 lbs/A

As a green manure: 90 – 160 lbs/A, if seeded late increase seeding rate up to 300 lbs/A to provide adequate cover.

If it going to be used as a rolled down no-till mulch, seed at 196 to 224 lbs/A.

In mixtures with legumes lower the seeding rate to 50 to 60 lbs /A, 56 lbs/A with clover, 60 lbs/A with hairy vetch.

Drill or no-till drill $\frac{1}{2}$ to $\frac{3}{4}$ inch deep.

Cereal rye can be aerial seeded or broadcast into tasseling and silking corn.

As a green manure till under when it is about 8 inches in height.

Rye can be killed by mowing or rolling if plants have initiated flowering. Early fall planting provides an earlier flowering date in spring.

Suppression of crops has been observed following incorporated rye residue, this may be due to tie-up of soil Nitrogen and/or allelopathic chemicals in the rye. This is avoided by turning the rye under 2 to 3 weeks before seeding the next crop. Incorporating rye before its 18 inches tall while it is still in its juvenile and vegetative succulent stage will help avoid tie-up of nitrogen.

BENEFITS

- Best cover crop to fit into full season cropping system and still get germination and growth late in season.
- Its winter hardiness allows it to grow longer in the fall and resume growth earlier in the spring.
- Rapid growth crowds out and out-competes winter annual weeds and its allelopathy and residue provides some weed control for summer weeds.
- Hardiness and erect stature make it a good companion crop or nurse crop.
- Fibrous root system helps improve soil tilth and slow erosion, increases soil organic matter.
- Catch crop used to prevent leaching of excess soil nitrogen.
- Plow under as a green manure in spring while young.
- Can be grown in strips between vegetable beds and used as an effective wind-break.
- Can be grown in-between vegetable beds and mowed to cover black plastic which acts to prevent UV degradation and extends black plastics lifespan.
- It produces a lot of biomass which translates into a long lasting residue cover for conservation tillage systems.
- If left to grow until anthesis (flowering) it can be mowed to create a mulch or rolled down to create a no-till mulch mat for no-till soybeans, or no-till pumpkins.
- Mixed with hairy vetch and/or crimson clover it can be rolled down to supply nitrogen and make a mulch mat for no-till planting pumpkins, tomatoes, peppers or sweet corn.

- Green straw can be used for horse bedding.
 - Used as a break crop in vegetable systems.
 - Can be let grown to flowering then mowed or rolled down to use as walkways in between vegetable beds.
 - Can be broadcast underneath fall late growing vegetable crops (cauliflower, broccoli).
 - Can be utilized as forage when young cut at flag leaf stage, either grazed or harvested as ryelage.
-

Early Spring Cover Crops

Spring Champion Mix - Pea, Hairy Vetch and Oats

Pea, (*Pisum sativum*), Hairy Vetch (*Vicia villosa*) and Oats (*Avena sativa*)

Sales locations: Northeast: North Carolina to Maine;

Planting Windows: Up to April 15 in Southeast PA, up to April 30 in Northern PA and New York and north

56% Peas	70 lbs/A Spring Field Peas
32% Oats	40 lbs/A - Jerry Oats or lower cost oats
12% Hairy Vetch	15 lbs/A Hairy Vetch

Seeding rate: 125 lbs/A drilled $\frac{3}{4}$ to 1.5 inch deep.

Hairy Vetch seed and peas should be inoculated for best performance with nitrogen fixing pea-vetch inoculant; the same inoculant is used for both.

Drill into the ground as soon as soil conditions permit in early spring (March to April), late February in very southern locations.

Once the soil warms up in spring this mix germinates and grows rapidly to grow quick spring nitrogen. The spring oats act as a nurse crop and then provide support for the peas and hairy vetch, once the peas and hairy vetch get established they will crowd out weeds and fix nitrogen.

BENEFITS

- Pea-Oat-Vetch is a fast growing spring planted cover crop mix.
- Grass –Legume mix build soil organic matter and feeds soil microorganisms.
- Left grow into mid June, turned under as a green manure, it can provide nitrogen for summer planted vegetables.
- Can grow nitrogen rich biomass for summer planting of vegetables, 2nd planting of sweet corn or tomatoes, peppers, broccoli or for late planted potatoes, or even late planted field corn.
- It can be cut as forage after oats are at flag leaf stage.
- Beneficial early spring weed suppressor.
- Recycles nutrients in spring as soils warm up.

- Good crop for cover if fall cover crop window was missed.
 - Can be grown in the rotation before Sorghum-Sudan grass or sorghum grain.
 - If left grown to late summer, it can provide 8000 lbs/acre of dry matter biomass.
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3 Way Clover Mix - Red clover, Yellow blossom sweet clover and Ladino white clover

Red clover (*Trifolium pretense*), Yellow blossom sweet clover (*Melilotus officinalis*), Ladino white clover (*Trifolium repens*)

Sales locations: North Carolina to Maine;

Planting Windows: February and March - Frost seeded in small grains (wheat, barley, rye, triticale and spelt)

Early spring, (March-April) Seeded along with spring oats, spring barley utilizing grass seed box on the drill. Overseeded/broadcast into corn at last cultivation or at layby time. (Check herbicide labels – should be at least 6 to 7 weeks after application of per-emergent herbicides such as atrazine.

Overseeded/aerial seeded into Soybeans at leaf yellowing prior to leaf drop.

Late summer planting with oats or with pasture/forage grasses.

33% Red Clover

44% Yellow blossom sweet clover

23% Ladino white clover

100%

Red clover and White clover use clover type inoculants, Yellow Blossom Sweet clover uses Alfalfa/Sweet clover type inoculant

Seeding rate: Drill this mix at 10 to 15 lbs/A, ¼ to ½ inch deep.

Broadcast at 15 to 20 lbs/A

Drill with small grains 10 to 12 lbs/A with the spring sown grains.

This is a versatile mix that can be frost seeded, spring seeded or fall seeded, aerial seeded or broadcast at corn layby or just prior to soybean leaf drop. With its diversity, the white clover and red clover will grow in long cool springs and in the fall and the yellow blossom sweet clover grows well in the summer or in dry spells.

BENEFITS

- Can be frost seeded easily, begins growing with the small grain crop and delivers a summer cover that can be cut for hay or grazed.
- Can be turned under in fall for fall planted vegetables or let to grow over winter for spring plow downs.
- If frost seeded in grain rotations, after small grain harvest, this mix can be left to grow to keep the soil covered for the remainder of the year, over winter and then be used as spring plow-down.
- In livestock systems can be used as forage hay or grazed.

- In vegetable rotations strips of this can be managed for long term management of soil cover and nitrogen building and plowed down as a green manure at various times throughout the year when needed.
 - Can be left to grow as a perennial mix through the winter to provide cover and fix nitrogen.
 - Great Nitrogen source.
 - Abundant biomass.
 - Red clover and white clover will grow well in cooler and moist conditions and slow down over summer months, yellow blossom sweet clover has the greatest warm-weather biomass production of any legume exceeding even alfalfa and yellow blossom sweet clover is more drought tolerant of other cover crops.
 - Soil structure builder.
 - Compaction fighter, extensive taproots grow up to 1 ft long, with branches that may penetrate 5 ft deep to aerate subsoil and lessen negative effects of compaction.
 - Flowers of red, white and yellow blossom sweet clover attracts beneficial insects such as honey bees, tachnid flies and large predatory wasps.
 - The mix makes it adaptable to many soil types.
 - Can be no-tilled drilled into thinning pastures to build up the legume population.
 - Can be drilled after sorghum-sudan grass comes off.
-

Mid-Spring to Early Summer Cover Crops

Mid-Spring and throughout Summer

Buckwheat (*Fagopyrum esculentum*)

Sales locations: North Carolina to Maine;

Planting Windows: Plant after all dangers of frost are gone, this is mid may in central PA and south and the end of May in northern PA and to the North.

Seeding rate: Drill: 50 to 60 lbs/A, seeding depth ½ to 1½ inch deep. (In dryer soil conditions drill at the deeper depths)

- For quicker canopy development seed up to 80 lbs/acre.
- Broadcast: up to 100 lbs/acre for a fast growing smother crop.

Don't plant buckwheat after using these **herbicides** on the season's first crop: Atrazine, Pursuit (imazethapyr), Sandea and Permit (halosulfuron) and Reflex (fomesafen)

There are no carryover problem with these materials: Basagran (bentazon), Command (clomazone), Dual Magnum (S-metalochlor), Eptam (EPTC), Prowl (pendimethalin), Raptor (imazamox), Roundup (glyphosate), Sencor (metribuzin), Treflan (trifluralin)

Buckwheat can be sown after vegetables or other crops any time from early June through mid August.

BENEFITS

- Reduces weed pressure and improves soil conditions.
- Buckwheat is a quick cover; it establishes blooms and reaches maturity in just 70 to 90 days.
- Used to suppress summer annual weeds for over 400 years in the Northeast.
- Buckwheat extracts Phosphorous from the soil and makes it more available to the following crop.
- Use as a nurse (companion) crop for late summer-sown forages such as (alfalfa or alfalfa-grass mixtures), summer seeding made in late July through mid August. Rapid buckwheat establishment will suppress summer annual weeds; mowing buckwheat provides mulch against winter annual and biennial weeds.
- After early vegetables have been harvested. Buckwheat fits in rotation to suppress weeds and improve soil conditions. (Open field long enough 6-7 weeks between vegetable harvest and fall crop.)
- Use to bring idle land back into production, double crop buckwheat.
- Prepare for strawberries- full growing season in beds before Strawberries.
- Perennial weeds, especially quack grass, are weakened by mid-summer tillage and recover poorly in a stand of buckwheat.
- The buckwheat's shallow white blossoms attract beneficial insects that attack or parasitize aphids, mites, and other pests.
- The beneficial insects attracted by Buckwheat include hover flies (Syrphidae), predatory wasps, minute pirate bugs, insidious flower bugs, tachinid flies and lady beetles.
- Buckwheat flowering may start within three weeks of planting and continue for up to 10 weeks.
- Buckwheat will do well on poor soils and improve soil quality.
- Buckwheat's abundant fine roots leave the soil loose and friable.
- Can be easily no-tilled into.
- With winter annual crops, buckwheat frost kills.

Late Spring – Early Summer – Summer Cover Crops

Quickcover – Sorghum-Sudangrass hybrid

Quickcover is a non BMR hybrid, to be used as quick growing summer cover crop.

Sales locations: North Carolina to Maine;

Planting Windows: Plant as a summer cover crop after soil temperatures have reached 60°F and rising. Plant Late spring (mid-May) or early summer once soil has warmed up. Rule of thumb is to plant no earlier than 2 weeks after corn planting.

Widely adapted – Sorghum-Sudangrass hybrids can be grown throughout the U.S. wherever rainfall is adequate and soil temperatures reach 65°F to 70°F at least two months before frost.

Seeding rate: 50 to 60 lbs/A, seeding depth $\frac{3}{4}$ to 1½ inch deep. Drill using large seed box. Firming the seed after seeding is desirable if it is dry or if rainfall is not anticipated before seedling emergence. This will help to conserve moisture and optimize seed to soil contact.

Sown at higher rates 70 to 90 lbs per acre this makes an excellent smother crop.

BENEFITS

- Excellent summer cover crop, catch crop and weed suppressant.
 - Sorghum-Sudan has a high demand for nitrogen, which makes it a good catch crop, scavenging excess nitrogen in the soil, preventing it from leaching out.
 - QuickCover Sorghum-Sudangrass is clean seed; free of Shattercane and Johnsongrass weed seeds.
 - As a smother crop, Sorghum-Sudangrass will suppress such annual weeds as velvetleaf, large crabgrass, barnyardgrass, green foxtail, smooth pigweed, common ragweed, redroot pigweed and purslane.
 - Non-BMR type good for short season addition of organic matter in warm weather
 - Sorghum Sudangrass hybrid will produce the most biomass compared to other summer annuals.
 - Once established, will tolerate some drought.
 - Due to its rapid and dense growth habit, sorghum-Sudangrass can out-compete weeds, providing a mulch, and erosion control and improving soil tilth.
 - Very useful as a mid-summer cover and weed control before fall planting.
 - Vegetable fields with weed problems can be rotated in a series of short-season covers that include small grains in the fall and sorghum-Sudangrass during the summer. (each cover is incorporated into the soil before the next cover is planted)
 - Subsoil aerator – Mowing whenever the stalks reach 3 to 4 ft tall increases the root mass five to eight times compared with unmowed stalks, and forces the roots to penetrate deeper into the soil.
 - After mowing tops grow back green and vegetative until frost and tillering creates up to six new, thicker stalks per plant.
 - Nematode and disease fighter-Sorghum Sudangrass is not a host crop for many nematodes and other pests, by planting this crop in rotation it break disease and insect pest cycles.
-

Teff (*Eragrostis tef*)

Teff is a summer annual forage grass, utilizable as a summer cover crop.

Sales locations: North Carolina to Maine;

Planting Windows: Plant as a summer cover crop after soil temperatures have reached 60°F and rising. Plant Late spring (mid-May) or early summer once soil has warmed up.

Widely adapted – Teff can be grown throughout the U.S. wherever rainfall is adequate and soil temperatures reach 65°F to 70°F at least two months before frost.

Seeding rate: 6 to 8 lbs/A, seeding depth- shallow 0 to ¼ inch deep. Drill using the small seed box. Drilling into a firm seed bed is desirable, When seeding teff, prepare the seedbed in much the same manner as for alfalfa — the firmer the better. Broadcast Planting using a Brillion grass seeder and cultipacker combination, or a spinner type grass seeder is optimal. Some seed should be seen on the surface after planting with a drill. **The most critical mistake when planting teff is planting it too deep.** Firming the seed after seeding is desirable if it is dry or if rainfall is not anticipated before seedling emergence. This will help to conserve moisture and optimize seed to soil contact.

BENEFITS

- Excellent summer cover crop, catch crop.
- With adequate moisture, Teff seed germinates rapidly after planting. It reaches the heading stage in about 8 weeks.
- In vegetable rotations after early vegetables come off it can be seeded, May through July.
- It can double as forage and be harvested for hay or grazed.
- Teff can be established as a summer cover between vegetable beds and let grow to recycle nutrients and prevent erosion.
- Teff can be grown, in most locations, without insecticides or fungicides. It is for the most part, considered a low input crop.
- Teff hay is high in calcium as well as phosphorus, iron, copper, aluminum, barium, and thiamine. Potassium levels have been reported in some hays in the 2.5-3.0% range. This makes it valuable not only as forage hay but also the cut material can be used as a nutritive mulch in vegetable systems or turned under as an excellent summer grown green manure recycling nutrients and breaking disease cycles in vegetable production systems between spring planted greens and fall planted vegetables.
- Excellent crop for erosion control, Strips can be grown in between other row crops or vegetable crops on the slope to prevent erosion during the summer.

Buckwheat (*Fagopyrum esculentum*)

Sales locations: North Carolina to Maine

Planting Windows: Plant after all dangers of frost are gone, throughout the summer until mid August.

Seeding rate: Drill: 50 to 60 lbs/A, seeding depth ½ to 1½ inch deep.

For quicker canopy development seed up to 80 lbs/acre.

Broadcast: up to 100 lbs/acre for a fast growing smother crop.

Don't use buckwheat after using these herbicides on the season's first crop: Atrazine, Pursuit (imazethapyr), Sandea and Permit (halosulfuron) and Reflex (fomesafen)
There are no carryover problems with these materials: Basagran (bentazon), Command (clomazone), Dual Magnum (S-metolachlor), Eptam (EPTC), Prowl (pendimethalin), Raptor (imazamox), Roundup (glyphosate), Sencor (metribuzin), Treflan (trifluralin)

Buckwheat can be sown after vegetables or other crops any time from early June through early August.

BENEFITS

- Reduces weed pressure and improves soil conditions.
- Buckwheat is a quick cover; it establishes blooms and reaches maturity in just 70 to 90 days.
- Used to suppress summer annual weeds for over 400 years in the Northeast.
- Buckwheat extracts Phosphorous from the soil and makes it more available to the following crop.

- Use as a nurse (companion) crop for late summer-sown forages such as (alfalfa or alfalfa-grass mixtures), summer seeding made in late July through mid August. Rapid buckwheat establishment will suppress summer annual weeds; mowing buckwheat provides mulch against winter annual and biennial weeds.
- After early vegetables have been harvested. Buckwheat fits in rotation to suppress weeds and improve soil conditions. (Open field long enough 6-7 weeks between vegetable harvest and fall crop.)
- Use to bring idle land back into production, double crop buckwheat.
- Prepare for strawberries- full growing season in beds before Strawberries.
- Perennial weeds, especially quack grass, are weakened by mid-summer tillage and recover poorly in a stand of buckwheat.
- The buckwheat's shallow white blossoms attract beneficial insects that attack or parasitize aphids, mites, and other pests.
- The beneficial insects attracted by Buckwheat include hover flies (Syrphidae), predatory wasps, minute pirate bugs, insidious flower bugs, tachinid flies and lady beetles.
- Buckwheat flowering may start within three weeks of planting and continue for up to 10 weeks.
- Buckwheat will do well on poor soils and improve soil quality.
- Buckwheat's abundant fine roots leave the soil loose and friable.
- Can be easily no-tilled into.
- With winter annual crops, buckwheat frost kills.

Braco white mustard (*Brassica alba* or *B. hirta*.)

Sales locations: North Carolina to Maine

Planting Window: Early spring, summer or early fall, (it may flower in fall if planted in June or July, if it is not tilled in, better to plant in early to mid September if desired to be left as a winter-killed mulch). Plant as a summer cover crop or break crop in-between small grains or vegetables.

Seeding rate: 8 to 10 lbs/A, can be drilled or broadcast to one-half inch depth. 15 to 20 lbs/A as a summer smother crop or to grow much biomass to till in as a bio-fumigant.

In late summer/early-fall White mustard can be seeded with Triticale, Rye or hairy vetch cover crop.

White mustard is a cover crop that can be used in vineyards, annual crop rotations or in vegetable rotations. As a natural nematode suppressant, Braco white mustard both interferes with completion of the feeding nematode larvae life cycle and acts as a natural occurring bio-fumigant when turned under into the soil just before or at flowering.

BENEFITS

Suppresses nematodes, other soil-borne organisms and weed seed germination.

- Rapid growth suppresses growing weeds.
- Used as a break crop to suppress diseases and pathogenic nematodes for growers of root crops like potatoes and sugar beets and for small grain rotations.
- Increases soil tilth, mustard tap roots grow to the depth of 1 to 3 ft.
- Increases soil organic matter.

- Produces a large amount of high protein green material, if plowed down it will recycle nitrogen and reduce the N needs for the following crop.
- Flowers attract honeybees, and hover flies (Syrphidae), most larvae of the hover flies are predators of many soft bodied insects such as aphids, scale insects, thrips and caterpillars.
- White mustard will typically winter kill, making a desirable mulch to accommodate early spring-sown vegetables.
- Quick spring cover crop - can be frost seeded in March or early April in corn stubble before planting Soybeans, incorporate or kill after flowering.
- Quick spring cover crop - Frost seed in March or Early April, incorporate or kill after flowering before May planted vegetables: tomatoes, peppers, potatoes, sweet corn (Don't use before other brassicas like Cauliflower in rotation).
- Used for disease control after onions, lettuce or garlic.
- Suppresses verticillium in potato and reduces weeds in the following crop.
- In small grain after small grain rotation: Plant after barley or wheat harvest, let grow until early October, mow and turn in green material as a bio-fumigant break crop.
- Winter killed cover crop which produces winter killed mulch for early spring planting.

Bio-fumigation technique, utilizing white mustard

- 4) Allow 60 to 70 days of growth before cutting.
- 5) Flail mow or chop to reduce the particle size.
- 6) Incorporate the plant material into the soil with a disk 5 to 6 inches deep with disk.

Appendix – USDA Plant Hardiness Zone Maps Maine to North Carolina























