SEMICAN

DEVELOPMENT | RESEARCH | SPECIALTY CROPS

GREEN MANURE | INTERCROPS

SEED GUIDE

COVER CROPS AND INTERCROPS

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We are pleased to present you our latest edition of the *Cover Crop Guide*. After a number of years devoted to theoretical pursuits, we are excited to include our latest findings in this edition. Indeed, the cover page of the Guide proudly announces the content of what is presented in the pages that follow.

Since a picture is worth a thousand words, we have included some of our favourite photos of the season. The science of cover crops is constantly evolving and is full of surprises. Both Semican and I are proud to contribute to the advancement of this sector.

I would also like to take advantage of this opportunity to thank our partners who contributed to the field work and the writing of this document.

Roselyne Gobeil, agr.
Territory Manager, Semican

TABLE OF CONTENTS

Earthworms were abundant in every shovelful under the plant cover this fall.

Beyond top growth

When it comes time to seed cover crops, the first question is often “How much does it cost?” Although the practice is increasingly widespread, it is difficult to put an exact figure on the return on investment. The theoretical advantages of a crop canopy are numerous and well documented. Once in the field, the critical eye tends to focus on what’s going on above the ground.

But while the action above ground is certainly more visible, the bulk of the work takes place beneath the soil surface. Keeping a root system alive over a long period of time makes it possible to, among other things, feed the populations of microorganisms in the soil. Through its above and below-ground biomass and its contribution to humus, plant cover also builds up soil fertility in fields, essentially stocking the pantry for our crops.

A little bit of digging reveals the tremendous impact of the different root systems on soil structure. A plant that appears small above ground, such as vetch, may surprise you with its astounding root system. So before you underestimate the potential of a cover crop, get out your shovel and dig in!

This photo shows the porosity created by microorganisms in the soil.

The importance of roots

Roots are an oft-neglected aspect of the plant for the simple reason that we don’t see them. And yet, roots are nothing less than the pathway for soil fertility, and the life and production of a crop. The root system supplies water and mineral salts that are accumulated and held in storage in plants. Plants are unfortunately unable to move around to feed, so it’s up to the roots to do the work.

There are three important elements to take into consideration in this system: the health and development of roots, the soil, and the microorganisms that live there. The zone in which these components operate is called the rhizosphere. Roots secrete a compound called root exudate. This compound is largely responsible for creating the soil zone linked to the environment surrounding the roots and rootlets. This phenomenon is visible in a number of photos in the Cover Crops Guide. Root exudate is important because it produces between 1 and 3 tonnes of carbon per hectare annually. It plays a major role, first acting as a “glue” in the formation of clay particles, and also because it feeds the microorganisms in the soil.

Austrian pea

Faba bean

Common vetch

Vitali-T Multi Purpose,
4 weeks of growth

Seeding rate

Although it would be useful, there is no such thing as a one-size-fits-all seeding rate. The estimated length of the growing season should be the first factor you consider. Approximately six weeks of growth are needed to exploit the full potential of most species.

But even if the season isn't long enough, better to seed a crop canopy than to leave the soil bare. Depending on the temperature, some plants produce substantial biomass in the first 3 to 4 weeks of growth. This is why it is important to adjust the seeding rate. If the estimated window for growth is short, it is best to increase the seeding rate by 15 to 20 %. On the other hand, if a growing period of more than 6 weeks is likely, you can reduce your per-hectare cost by using a lower seeding rate. The lower plant density will actually promote growth both above and below ground. The photo below illustrates this effect: the faba bean plants on the right were seeded at a higher rate than those on the left.

The type of seeder also needs to be taken into consideration. When the seed is placed where it should be in the soil, a standard seeding rate can be used. With broadcast seeding, it is sometimes necessary to increase the seeding rate by 15 to 20%, since a portion of the seed may not germinate. Nonetheless, certain conditions benefit seed-to-soil contact: small seed size, a well-prepared seedbed, and rainfall after seeding. If these conditions are in place, there may be no need to increase the seeding rate.

At 8 weeks of growth, the faba bean plants on the right, seeded at a higher density, grew taller to intercept light. However, their above- and below-ground biomass is less developed than that of the plants on the left. Note that this phenomenon is less evident in the first weeks of growth.

Mixture of oats, radish, sunflowers and forage peas,
4 weeks of growth.

Seeding techniques

There are many advantages to seeding a multi-species plant canopy. The challenge, however, lies in the seeding technique. Some species, such as ryegrass, have extremely small seeds, while others, such as faba beans, are large-seed crops. When it comes time to choose which species to seed, it is important to know what type of equipment will be used.

APV or Delimbe air seeders can be installed on various types of equipment. Different sized seed can be mixed in the same seed box. With the seeder mounted on a disc tiller, as shown in the photo below, the crop is seeded at the same time as the soil is tilled and the manure incorporated. Note that the larger the seed box, the more important it is to remix the seed during the operation to prevent seed segregation by size.

Broadcast seeding with a precision fertilizer spreader makes for rapid seeding. On the other hand, it does require a relatively high seeding rate. It is also important to avoid filling the seed box completely and to reduce the spreading width to ensure uniform seeding. Afterwards, the seeds must be covered carefully to avoid burying them too deeply, depending on the species used.

A grain drill is also often used to seed cover crops, but this method requires more time than the other two options, and small seed must be separated from larger seed.

Seeding depth varies from one type of plant to another. When seeding a mixture, it is best to conform to the needs of the species that require shallower seeding. Seeding depth should also be adjusted according to the conditions at seeding time. In cold, wet conditions, as well as when the length of the growing season is limited, shallower seeding is recommended. In contrast, during a warm, dry fall, it is preferable to avoid shallow seeding and increase seeding depth so as to reach moist soil.

An APV air seeder mounted on a disc tiller is an excellent option for seeding cover crops.

The two photos of cover crops termination above show shallow tilling with plant matter lightly incorporated into the soil.

Termination

In an approach aimed at soil conservation, fields should not be tilled and cover crops should be left in the field over the winter. The root system will help prevent soil erosion and allow water to infiltrate the soil. While the benefits of winter plant cover are indisputable, there are some factors to consider when deciding whether or not to terminate a cover crop.

If the plants have benefited from a long growing season, they may be at an advanced stage come fall. Species with a rapid growth cycle, such as mustard, radish and buckwheat, for example, should not be allowed to set viable seed. It may be possible to shred the crop without tilling the soil. Established perennial species, such as red clover, may continue growing.

A cover crop comprised mostly of grasses may be another reason to terminate the crop. At the heading stage, the carbon to nitrogen ratio of grasses increases significantly as the stems lignify. At this stage, the plants require nitrogen to decompose. A thick stand will also act as a mulch, which may delay soil warming. Note that this effect can also be an advantage in some production systems.

If you choose to terminate the crop, make tilling as shallow as possible. This will be sufficient to bring plant matter into contact with soil microorganisms while leaving some roots undisturbed, which will continue to facilitate the infiltration of surface water.

Spring management

Plants that are able to survive the winter should be terminated early in the spring to avoid drying out the seedbed.

If you plan to seed corn after a green manure crop of fall rye, you may need to delay seeding. Fall rye has an allelopathic effect that may suppress germination. Hence it is best to wait 10 to 15 days before seeding corn or, alternatively, terminate the cover crop after seeding the corn. Seeding immediately after plowing under a growing cover crop is not recommended. Soil microorganisms may confuse the decomposing cover crop with germinating corn and mistakenly attack the corn seed and emerging roots.

Species selection

A multitude of cover crop options are available and it is easy to get lost when trying to decide what type of crop to seed. Every situation is unique and growers need to consider a number of factors before getting started.

Depending on the crop rotation, how many days of growth does the crop have? What crop follows in my rotation? How can I control the plants? What seeding equipment do I have at my disposal? What are my goals? How is the crop fertilized? … This section provides information on some of the species available.

You have more questions?

Just call on your representative!
He or she will be happy to help you out!

From left in the photo: forage pea, common vetch, Crimson clover, Austrian pea, faba bean, phacelia, oats, ryegrass, sunflower and Daikon radish.

Legumes

Legumes are widely used as green manure, primarily because of their ability to fix atmospheric nitrogen. Small-seed species, such as perennial clovers, alfalfa and hairy vetch, are slower growing crops that require a longer growth period to develop fully.

In contrast, larger-seed species, such as peas, common vetch and faba beans, develop more rapidly, similar to cereals, which makes them excellent partners. Legumes have an abundant root system that develops rapidly early in the season and structures the soil near the surface. Legumes also have good frost tolerance, which allows late-season growth.

Left on the soil surface in the fall, a crop canopy composed of legumes breaks down quickly in the spring with no mulching effect.

In this photo of an Austrian pea plant, the nodules that fix nitrogen are visible after 8 weeks of growth.

Pure species | Legumes

From left, two plants of each species: common vetch, faba beans, Crimson clover, Austrian peas and forage peas.

Common vetch

Seeding rate for pure stands: Common vetch: 40 to 50 kg/ha (36 to 45 lbs/acre)
Hairy vetch: 30 kg/ha (27 lbs/acre)
Seeding depth: 1 - 1½ in.
Frost tolerance: -15°C

A member of the Fabaceae family, common vetch is an annual that does not survive the winter. Because it is easy to use, it is now included in our Vitali-T mixes. Hairy vetch is a biennial legume that often overwinters if established early in the season. As a seasonal plant, hairy vetch may grow back if moved.

Common vetch grows well in sandy soils and is drought-tolerant once established. Seeded in a mix with a grass or a cruciferous species, its growth may be limited by the other species, particularly when combined with an application of liquid manure. Don't be deceived by the top growth - the roots of this plant develop rapidly, and it is worth digging up a specimen to appreciate its potential. Without a doubt one of my favourites for the summer!

Common vetch, 6 weeks

Common vetch, 8 weeks

Faba beans

Seeding rate for pure stands: 150 to 200 kg/ha (137 to 178 lbs/acre)
Seeding depth: 1 - 1½ in.
Frost tolerance: -5°C

A member of the Fabaceae family, faba beans are a cool season crop. The plants grow rapidly at the beginning of the season, making this species an excellent companion for cereals. In the first weeks of growth, the weight of the plant's root system surpasses that of its above-ground mass.

It is also impressive to see to what extent its root system has a structuring effect on the soil. With an abundance of nodules, faba beans are the champion when it comes to fixing nitrogen. For use as a cover crop, faba beans are limited by two main factors: cost and seed size.

This photo shows the faba bean's impressive root system, which contributes to good soil structure; 6 weeks.

6 weeks

Faba bean plants at 4 weeks of growth. Notice the above and below-ground biomass!

Austrian peas (left) and forage peas (right). This photo shows 5 weeks of growth.

Forage peas (left) and Austrian peas (right). This photo was taken after 8 weeks of growth.

Austrian pea, 8 weeks

Austrian and forage peas

Seeding rate for pure stands: 75 to 100 kg/ha (67 to 89 lbs/acre)
Seeding depth: 1 - 1½ in.
Frost tolerance: -9°C

Peas are among the most widely grown cover crops. The main reasons for this are their ability to fix nitrogen and their rapid growth that extends late into the season. To demystify forage peas (4010 is one of the best known varieties) and Austrian peas, both crops were tested in the field this fall. Forage peas are an annual crop with an above-ground biomass that increases rapidly. During the first 5-6 weeks of growth, forage peas visibly surpass Austrian peas, a biennial legume that grows more slowly at the start of the season. Nonetheless, Austrian peas tolerate much colder temperatures than forage peas, an advantage later in the season. The above-ground portion of the Austrian pea is impressive and grows close to the ground while its root system develops quickly despite the cold. A mixture of these two varieties is an excellent choice. If a late planting is planned, Austrian peas are the better option.

Austrian pea, 6 weeks

Austrian pea, 6 weeks

Austrian peas

Forage peas

Crimson clover

Seeding rate for pure stands: 15 to 20 kg/ha (13 to 18 lbs/acre)
Seeding depth: ¼ - ½ in.
Frost tolerance: -13°C

Crimson clover is a biennial plant that tends to behave as an annual in our growing conditions. Termination is rarely required the following spring. For fall planting, Crimson clover is preferred over perennial clovers as it establishes more rapidly. Although broadcast seeding is not ideal, it is more tolerant of this system than are other varieties. As a low-growing plant, it is not a champion in terms of above-ground biomass.

Crimson clover supplies approximately 50 units of nitrogen, a substantial contribution. With a much finer root system than other legumes, this clover complements the root growth of other crops.

Crimson clover plants after 8 weeks of growth.

The 2 photos above illustrate the complementary growth of clover roots with those of oats and other legumes.

Red clover

Seeding rate for pure stands: 10 kg/ha (9 lbs/acre)
Seeding depth: ¼ - ½ in.
Frost tolerance: -15°C

Red clover is a perennial species used primarily in intercropping because it establishes relatively slowly. Grown over a long period of time, it has the highest potential nitrogen return. Its tap root is a good complement to Huia white clover, a more drought-tolerant species.

Red clover is an excellent choice in combination with cereals, as the earlier harvest of the main crop gives red clover a long growing season in the fall. Intercropped with corn, it will perform better in a silage field than in a grain crop. This is due to the growth of clover, which benefits more rapidly from the light once the crop has been harvested. With the arrival of cold weather, red clover quickly stops growing.

Red clover intercropped with wheat

Huia white clover

Seeding rate for pure stands: 6 to 10 kg/ha (5 to 9 lbs/acre)
Seeding depth: ¼ - ½ in.
Frost tolerance: -15°C

Huia white clover warrants a closer look. Because of its small seed size, this small-scale clover establishes more readily than some of the other similar clover species in this category. It is well suited to intercropping because it is unlikely to grow as tall as the cereal crop.

Huia white clover has a shallow stoloniferous root system that structures the soil. Likewise, it is relatively tolerant to drought conditions. Its white inflorescence attracts a number of insect pollinators.

Grasses

Grasses have a high carbon content and are a significant source of cellulose. They therefore lend themselves well to increasing the humus content of a soil. Moreover, because they develop a deep, dense root system, grasses are able to recycle nutrients.

Because legumes have shallower root systems than grasses, grass-legume combinations work well. The association is advantageous because a grass plowed under at a later growth stage requires nitrogen to decompose, and the legume crop readily supplies the nitrogen. When the grass crop is not associated with a legume, soil nitrogen is immobilized in the spring.

It is important to take this into consideration, particularly when seeding species that require nitrogen early in the season, like spring cereals. The different grasses all make good use of fall fertilizer applications. Grasses require considerable amounts of nitrogen fertilizer to achieve their full growth potential.

A mixture of annual ryegrass and fall rye

8 weeks of growth

Oats

Seeding rate for pure stands: 40 to 70 kg/ha (37 to 62 lbs/acre)
Seeding depth: ½ - 1½ in.
Frost tolerance: -3°C

Although all spring cereals can be used as cover crops, oats are more tolerant to wetter and more acid soils. Oats establish quickly, providing some control over weeds and protecting against soil erosion.

With an upright form that covers a small surface area, a higher seeding rate is recommended if the growing season is short. As the plant matures, its carbon content increases accordingly, which in turn increases the stable organic matter content of the soil.

cm

Fall rye

Seeding rate for pure stands: 75 to 100 kg/ha (67 to 89 lbs/acre)
Seeding depth: ½ - 1½ in.
Frost tolerance: -15°C

Fall rye is known for its hardiness and can be seeded late in the season. Once the crop has reached the 1 to 2 leaf stage, it is likely to survive the winter and continue growing in the spring, providing live cover over an extended period of time. A versatile plant, fall rye can be terminated in the spring, harvested for forage, harvested as grain and straw, or rolled flat to provide a surface mulch for no-till soybean seeding. Fall rye has an impressive, deep, dense root system that enables it to recycle nutrients.

Care should be taken when seeding to corn in the spring after plowing down a fall rye cover crop, since the latter has an allelopathic effect that inhibits germination. It is best to wait 10 to 15 days before seeding corn or, alternatively, terminate the cover crop after seeding.

Rye rolled at the flowering stage to provide a mulch for an organic soybean crop. Ferme Germanie Inc.

Annual ryegrass

Seeding rate for pure stands: 15 to 20 kg/ha (13 to 18 lbs/acre)
Seeding depth: ¼ - ½ in.
Frost tolerance: -8ºC to -15ºC

Ryegrass has an extremely dense and fibrous root system that is known for its beneficial effect on soil structure. This dense root system can become an inconvenience, however, when preparing the seedbed in the spring. Ryegrass is a nitrogen-loving grass that requires fertilizing to reach its full potential. Hence, ryegrass helps limit nitrogen losses due to leaching and competes well with weeds that have similar nitrogen requirements. Ryegrass prefers fine to medium-textured soils and establishes best under moist conditions. Although ryegrass is an annual, it may overwinter if well established. If this is the case, the crop will need to be controlled in the spring.

Intercropped with corn, ryegrass tolerates both shade and competition. Its growth is limited during the summer, but explodes after the silage harvest. Its greatest advantage is that it improves the weight-bearing capacity of the soil for farm equipment in the fall when harvest conditions are not always ideal.

Ryegrass in a mixture with peas and vetch

Pearl millet

Seeding rate for pure stands: 10 to 15 kg/ha (9 to 13 lbs/acre)
Seeding depth: ½ - 1 in.
Frost tolerance: -1°C

For the past 15 years now, pearl millet has been the subject of trials aimed at reducing nematode populations, in rotation with potatoes or strawberries, for example.

Considerably reducing the incidence of verticillium wilt in potatoes, pearl millet is one of the rare plants that limits nematode reproduction. In a six-year study in the early 2000s, researchers noted that several species, including rye, not only maintained but even increased nematode populations in the field.

Because millet gets off to a relatively slow start, it is not very competitive with weeds. Preferring warm and well-drained soils, millet is also very sensitive to frost. Grown as a seasonal crop, its above-ground biomass is impressive, and its well-developed root system extends throughout the soil profile.

Pearl millet (left) and Japanese millet (right), Ferme Gaston Bouchard in St-Ambroise

Brassicas

Mustard plot

White or yellow mustard

Seeding rate for pure stands: 8 to 10 kg/ha (7 to 9 lbs/acre)
Seeding depth: ¼ - ¾ in.
Frost tolerance: -7°C

White mustard grows well in cooler conditions, reaching 24 inches in height at maturity. Although tolerant to mild frost, it does not overwinter. Mustard is a low-cost option, but requires adequate fertilization for good growth. It readily captures nitrogen and makes good use of fall manure applications. Flowering occurs 50 to 60 days after seeding.

To avoid problems, mustard must be terminated before it sets seed.

cm

Daikon radish

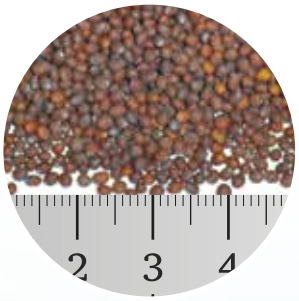
Seeding rate for pure stands: 8 to 12 kg/ha (7 to 11 lbs/acre)
Seeding depth: ¼ - ¾ in.
Frost tolerance: -15°C

Daikon radish is the most frequently used as a cover crop. Developed from forage radish, Daikon radish was bred for its imposing root system, which improves soil aeration. In a compacted field, such as the one in the first two photos below, roots will not grow as deeply and will even be visible above ground. Compacted soils should be tilled appropriately prior to seeding. Subsoiling is ideal for Daikon radish. When left in the ground over the winter, the crop disappears by spring. The holes left by the crop facilitate the infiltration of surface water. Studies conducted in recent years have shown that radish has a suppressive effect on nematodes that attack vegetable crops.

Radish established in the summer in a compacted soil (10 weeks of growth). The root has pushed up out of the soil or stopped growing.

Radish after 8 weeks of growth

Brown or oriental mustard



Seeding rate for pure stands: 3 to 4 kg/ha (2.5 to 3.5 lbs/acre)
Seeding depth: ¼ - ¾ in.
Frost tolerance: -7°C

With agronomic characteristics comparable to those of white mustard, brown mustard is used as a biofumigant. Brown mustard has a high glucosinolate content. As the plant decomposes, this compound changes into isothiocyanates, which are volatile and toxic for some soil organisms.

To ensure that this process is successful, some conditions must be respected. The crop should be plowed under when plants are in full bloom, as the glucosinolate content drops considerably at seed set. Avoid plowing down in hot sunny conditions; morning or evening incorporation is recommended. The fumigant effect is lessened if the crop is plowed down at temperatures below 10°C. The crop should be crushed and incorporated immediately into the first 6 inches of soil.

For vegetable production, irrigation may be required if soil conditions are dry. Lastly, the fumigant effect will be greater if the crop is plowed under when pests are present in the soil.

Others

Sunflowers

Family: Asteraceae
Seeding rate for pure stands: 8 to 10 kg/ha (7 to 9 lbs/acre)
Seeding depth: 1 in.
Frost tolerance: -1°C

Sunflowers have both a tap root and an abundant root system that develops in the first 12 inches of soil. When conditions are favourable and the crop is established for an entire season, the tap root can reach a considerable depth. Sunflowers have high needs in terms of soil structure and are more sensitive to soil quality and depth than to fertilizer requirements. Growth may be limited by a phosphorus or potassium deficiency however. With a preference for warm temperatures, cooler fall temperatures will slow the development of the crop. Sunflowers are also very sensitive to early frost. Because sunflowers are susceptible to sclerotinia, it is best to terminate the crop once it has reached full bloom, especially if the disease has been detected in the field in the past. This is rarely an issue when the crop is seeded in the fall, as the plant will not reach the critical stage.

Like buckwheat, sunflowers absorb a form of phosphorus that other plants are unable to assimilate, and the phosphorus is returned to the soil as the crop decomposes.

A sunflower plant in the Belgian mixture, Les Fermes R. Pigeon et fils inc., in St-Rémi

Sunflower plants at 5 weeks of growth

Phacelia

Family: Hydrophyllaceae
Seeding rate for pure stands: 10 to 12 kg/ha (9 to 11 lbs/acre)
Seeding depth: ¼ - ¾ in.
Frost tolerance: -7°C

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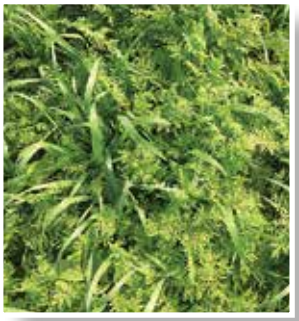

This photo of phacelia in combination with oats after 6 weeks of growth demonstrates the competitiveness of its foliage once the crop is well established.

A very popular plant in Europe, phacelia is still underused in Eastern Canada, mainly because it is costly and sometimes used inappropriately. Extra care must be taken when seeding. Phacelia is photosensitive, which means it does not germinate when exposed to light. Because germination is temperamental and shallow seeding is required, broadcast seeding is not recommended. To ensure a firm seedbed, rolling before or after seeding is highly recommended.

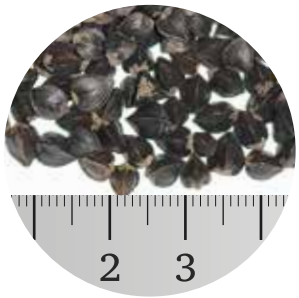

Phacelia, 6 weeks


Phacelia, 8 weeks

Because phacelia develops slowly in the first three weeks, it is best to avoid dense seeding and competition with other fast-establishing species. Once established, however, its abundant foliage is competitive and will suppress weed growth. In addition to a taproot, phacelia has a fine, well-developed secondary root system that enhances soil structure in the top inch or so all soil. In trials conducted last fall, phacelia had the highest nitrogen content following a liquid manure application. Phacelia also has the ability to absorb potassium from the soil and restore it to the crop the following year, making it an excellent candidate for recycling nutrients. Phacelia is also considered to be a nematicidal plant and is useful for controlling aphids by attracting the insect's predators. An excellent melliferous plant, phacelia begins to flower about 8 weeks after seeding.

Buckwheat

Family: Polygonaceae
Seeding rate for pure stands: 50 to 75 kg/ha (45 to 67 lbs/acre)
Seeding depth: ½ - 1 in.
Frost tolerance: -2°C



Buckwheat is a plant that adapts well to all types of soil and climate. Nonetheless, very dry, wet or compacted soils should be avoided.

Because buckwheat is extremely sensitive to frost, plan to seed at least 4 weeks before first frost. Buckwheat develops an abundant root network that promotes soil aggregation. It is a fast-growing plant that covers the soil quickly, choking out annual weeds and shading and suppressing perennials. Flowering begins 3 to 5 weeks after seeding and because, it is an indeterminate plant, it will extends crop from a 10 weeks period. To prevent the crop from producing viable seed, it should be terminated 7 to 10 days after flowering.

Buckwheat has the added advantage of being able to absorb large quantities of phosphorus that other plants are unable to assimilate, and then release it back into the field for the subsequent crop. Buckwheat leaves minimal residue on the soil surface.


Buckwheat should not be allowed to reach the stage shown here, where black seeds are visible.

Vitali-T Multi Purpose

Mixtures

Vitali-T Multi Purpose with Oats (3000)

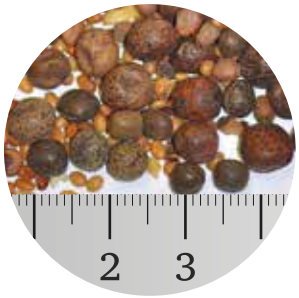
Oats | Crimson clover | Common vetch | Peas | Daikon radish

- Versatile
- Balanced use of manure applications and atmospheric nitrogen
- Excellent predecessor to a crop with nitrogen requirements

Seeding rate : 65 to 85 kg/ha (58 to 76 lbs/acre)

Vitali-T Multi Purpose (4000)

Crimson clover | Peas | Commun vetch | Daikon radish



- Grass-free mixture that takes into account threshing residue

Seeding rate : 45 to 65 kg/ha (40 to 58 lbs/acre)

Management
- Will winterkill
- Terminate before radish seeds mature

Vitali-T Balanced Radish, 6 weeks

Vitali-T Balanced Radish, 4 weeks

Mixtures

Vitali-T Balanced (7000)

Crimson clover | Forage peas | Oats

- Rapid soil coverage
- Good predecessor to a crop with nitrogen requirements
- Good balance among species

Seeding rate: 75 to 95 kg/ha (67 to 85 lbs/acre)

cm

Vitali-T Balanced Radish (7001)

Peas | Oats | Daikon radish | Crimson clover

- Identical to the mixture above, with the addition of Daikon radish

Seeding rate : 75 to 95 kg/ha (67 to 85 lbs/acre)

Management
- Will winterkill
- Terminate before radish seeds mature

Vitali-T Balanced, 8 weeks

Vitali-T Simplified

Mixtures

Vitali-T Simplified (1000)

Ryegrass | Crimson clover | Daikon radish

- Easy to use owing to uniform seed size and low seeding rate
- Avoid seeding in hot, dry conditions; ryegrass and clover establishment may be jeopardized

Seeding rate : 12 to 16 kg/ha (11 to 14 lbs/acre)

Management
- Will winterkill
- Monitor regrowth of ryegrass in spring if not terminated in the fall

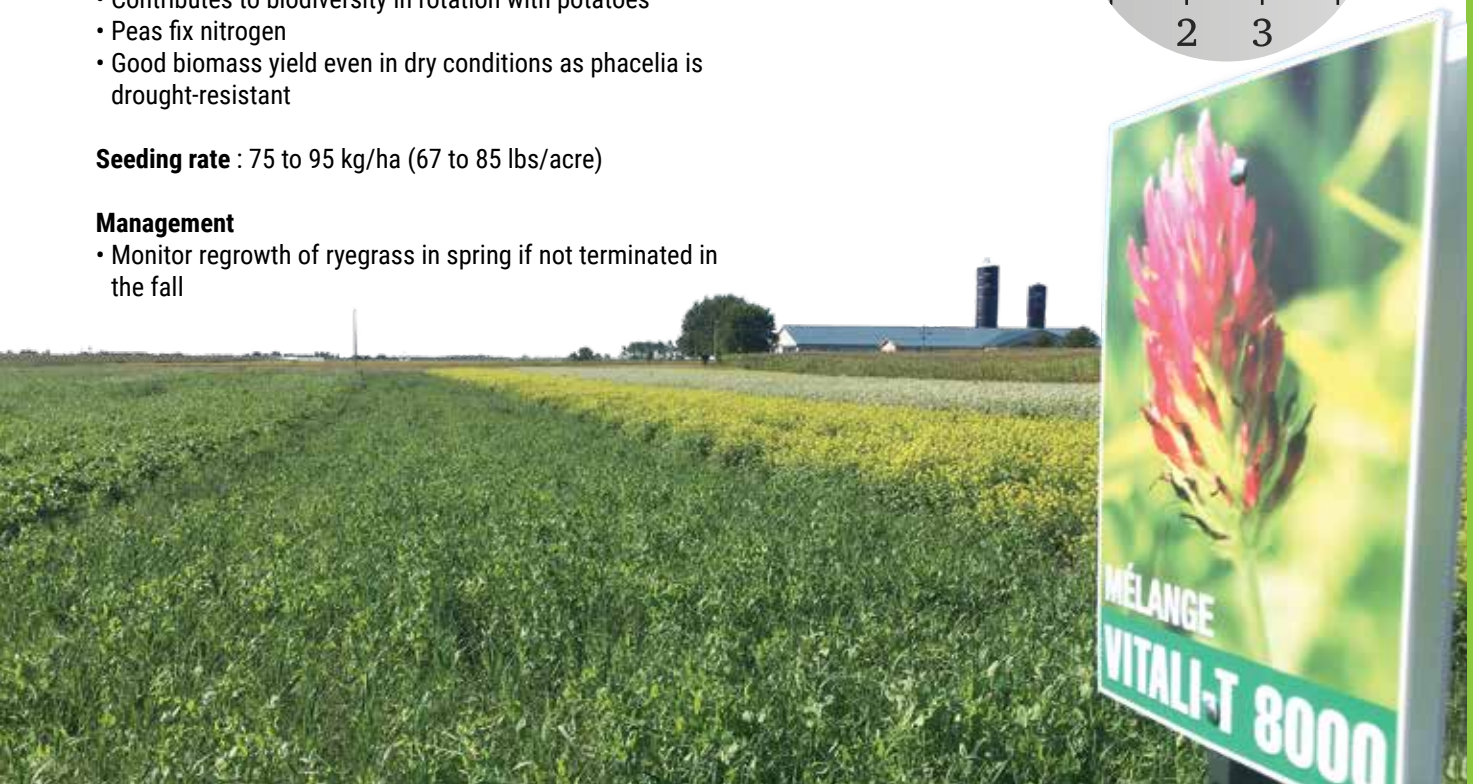
Vitali-T Seasonal (8000)

Phacelia | Ryegrass | Peas | Oats

- Mixture adapted to a longer growing season due to late flowering of some species
- Contributes to biodiversity in rotation with potatoes
- Peas fix nitrogen
- Good biomass yield even in dry conditions as phacelia is drought-resistant

Seeding rate : 75 to 95 kg/ha (67 to 85 lbs/acre)

Management
- Monitor regrowth of ryegrass in spring if not terminated in the fall



Vitali-T All-terrain

Vitali-T Fall

Mixtures

Vitali-T Fall (9000)

Oats | Crimson clover | Mustard

- Oats and mustard benefit from fall manure applications
- Rapid growth of oats ensures good weed control
- Well adapted to cooler regions

Seeding rate : 45 to 60 kg/ha (40 to 53 lbs/acre)

Management
- Terminate before mustard seeds mature

cm

Vitali-T All-terrain (10 000)

Forage peas | Oats | Buckwheat

- Well adapted to a wide range of soil types
- Rapid growth of oats and buckwheat ensures good weed control
- Buckwheat has the ability to assimilate phosphorus from the soil

Seeding rate : 75 to 90 kg/ha (67 to 80 lbs/acre)

Management
- Terminate before buckwheat seeds mature

Vitali-T for Honey Production (12 000)

Buckwheat | Phacelia | Mustard | Daikon radish

- Includes a number of species that attract pollinators

Seeding rate : 28 to 35 kg/ha (23 to 31 lbs/acre)

Management
- Terminate before buckwheat, mustard and radish seeds mature

Vitali-T for Honey Production

Vitali-T Belgian, 8 weeks

Mixtures

Vitali-T Belgian

Oats | Sunflowers | Phacelia

- Named in honour of its creator, this mixture combines three species, each with its own distinct qualities
- Phacelia readily assimilate potassium from the soil and sunflowers do the same with phosphorus
- Phacelia and oats excel at using nitrogen from fall fertilization
- Opting for a lower seeding rate allows phacelia to develop fully to cover the soil

Seeding rate : 25 to 30 kg/ha (20 to 27 lbs/acre)

Management
- Broadcast seeding is not recommended

Vitali-T Nitrogen

Common vetch | Austrian peas | Forage peas | Crimson clover | Oats | Faba beans

- Contains a high proportion of legumes
- Excellent choice when no fall fertilization

Seeding rate : 70 to 85 kg/ha (62 to 76 lbs/acre)

Management
- Will winterkill

Intercropping

Seeding a crop between the rows of another crop maintains a crop canopy over a greater proportion of the soil and over a longer period of time. The intercrop is rarely seeded at the same time as the main crop to avoid limiting herbicide treatment options.

Nonetheless, it is important to seed before the main crop covers the rows. Most species require light and moisture to germinate and establish well enough to survive through the growing season of the main crop. Broadcast seeding is always risky unless it rains in the hours after seeding. Seeds left on dry soil are much less likely to germinate.

Although it takes more time, a light tillage to incorporate the seed is recommended, for example with a spring tine harrow. Herbicide use in the rotation requires particular care, since some herbicides have residual effects on broadleaf plants and so could affect clover and radish.

Annual and Fabio (biennial) ryegrass are offered in the mixtures that follow. Although less expensive, annual ryegrass may grow to a considerable height and set viable seed in the year of seeding if light and moisture conditions are adequate. This rarely occurs when plant density is high enough and corn is growing well. If the aim is to cover the soil over the winter and the following spring, Fabio ryegrass is the better option.

Delimbe air seeder mounted on a tool bar with weeding tines for intercropping with corn.

Photo: Olivier Martin, Semences Beauregard

Oats intercropping with red clover. The intercrop is used for the entire season, while the cereal will be terminated in mid-summer.

Mixtures

Red Clover (1)
Seeding rate: 7-8 kg/ha (6 to 7 lbs/acre)

Ryegrass (certified annual or Fabio)
Seeding rate: 15-20 kg/ha (13 to 18 lbs/acre)

Inter-Mix Clover (2)
Red clover / Huia white clover
Seeding rate: 7-8 kg/ha (6 to 7 lbs/acre)

Inter-Mix Annual
Ordinary annual ryegrass / Crimson clover
Seeding rate: 20-22 kg/ha (18 to 20 lbs/acre)

Inter-Mix Biennial (7)
Certified Fabio ryegrass / Crimson clover
Seeding rate: 20-22 kg/ha (18 to 20 lbs/acre)

Inter-Mix Perennial
Ordinary annual ryegrass / Red clover
Seeding rate: 18-20 kg/ha (16 to 18 lbs/acre)

Inter-Trio Annual (8)
Ordinary annual ryegrass / Crimson clover / Daikon radish
Seeding rate: 20-22 kg/ha (18 to 20 lbs/acre)

Inter-Trio Biennial
Certified Fabio ryegrass / Crimson clover /Daikon radish
Seeding rate: 20-22 kg/ha (18 to 20 lbs/acre)

Ryegrass-corn intercropping, Christian Martin, October 2018

A mixture of ryegrass and red clover intercropped with corn, Christian Martin, October 2018

Inter-Mix Clover mixture intercropped with Scotia wheat

COMPARATIVE TABLE OF SPECIES

	LEGUMES								
	COMMON VETCH	FABA BEANS	AUSTRIAN AND FORAGE PEAS	CRIMSON CLOVER	RED CLOVER	HUIA WHITE CLOVER	SWEET CLOVER	BIRDSFOOT TREFOIL	SUNN HEMP
Seeding rate for pure stands (lbs/acre)	36 - 45	137 - 178	53 - 89	13 - 18	9	5 - 7	9 - 13	9 - 13	18 - 22
Seeding depth (in.)	1/2 - 1 1/4	1 - 1 1/2	1 - 1 1/2	1/4 - 1/2	1/4 - 1/2	1/4 - 1/2	1/4 - 1/2	1/4 - 1/2	1/2 - 3/4
Water requirements	✤✤✤	✤✤	✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤	
Nitrogen source	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Fertilizer nitrogen uptake	✤✤	✤✤	✤✤	✤✤	✤✤	✤✤	✤✤	✤✤	✤✤
Mulch persistence	✤✤	✤✤	✤✤	✤✤✤	✤✤	✤✤	✤✤✤✤		
Soil builder	✤✤✤✤	✤✤✤✤✤	✤✤✤✤	✤✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤✤	✤✤✤✤	✤✤✤✤
Rapid growth	✤✤✤	✤✤✤	✤✤✤✤	✤✤✤	✤	✤	✤✤	✤✤	✤✤✤✤
Compaction reduction	✤✤✤	✤✤✤✤	✤✤✤	✤✤✤	✤✤	✤✤	✤✤✤✤✤	✤✤✤	✤✤✤
Weed suppression	✤✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤	✤✤	✤✤✤✤
Allelopathic effect	✤✤✤		✤✤				✤✤✤✤✤		
Ease of termination	✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤	✤✤	✤✤	✤✤	✤✤✤✤
Use of mycorrhiza	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤	✤✤✤✤
Small seed drill				✔	✔	✔	✔	✔	
Grain drill	✔	✔	✔						✔
Broadcasting*	✔	✔	✔	✔			✔	✔	✔

Legend

Poor	✤	Very good	✤✤✤✤
Mediocre	✤✤	Excellent	✤✤✤✤✤
Good	✤✤✤		

Table inspired from the Caravane Santé des Sols brochure available on Agri-Réseau.

* A number of factors must be taken into account to ensure a successful crop – refer to the section on seeding techniques.

COMPARATIVE TABLE OF SPECIES

	GRASSES					BRASSICAS		
	OATS	FALL RYE	ANNUAL RYEGRASS	PEARL MILLET	SORGHUM	WHITE MUSTARD	BROWN MUSTARD	DAIKON RADISH
Seeding rate for pure stands (lbs/acre)	31 - 53	62 - 89	13 - 22	11 - 13	13 - 27	7 - 9	3 - 4	7 - 11
Seeding depth (in.)	1 - 1 1/2	3/4 - 1 1/2	1/4 - 1/2	1/2 - 1	1/2 - 1 1/2	1/4 - 3/4	1/4 - 3/4	1/4 - 3/4
Water requirements	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤	✤✤✤✤✤	✤✤	✤✤	✤✤✤✤✤
Nitrogen source	✤	✤	✤	✤	✤	✤	✤	✤
Fertilizer nitrogen uptake	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Mulch persistence	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤	✤✤✤	✤✤
Soil builder	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤	✤✤✤	✤✤✤✤✤
Rapid growth	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Compaction reduction	✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤✤	✤✤✤✤✤
Weed suppression	✤✤✤✤✤	✤✤✤✤✤	✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Allelopathic effect		✤✤✤✤✤	✤✤✤		✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Ease of termination	✤✤✤✤✤	✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤	✤✤✤✤✤	✤✤✤
Use of mycorrhiza	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤	✤	✤	✤
Small seed drill			✔	✔		✔	✔	✔
Grain drill	✔	✔		✔	✔			
Broadcasting*	✔	✔	✔	✔	✔			✔

	OTHERS		
	SUNFLOWERS	PHACELIA	BUCKWHEAT
Seeding rate for pure stands (lbs/acre)	6 - 9	7 - 11	45 - 62
Seeding depth (In.)	1/2 - 1	1/4 - 1	1/2 - 1
Water requirements	✤✤✤✤✤	✤✤	✤✤✤✤✤
Nitrogen source	✤✤	✤✤	
Fertilizer nitrogen uptake	✤✤✤✤✤	✤✤✤✤✤	✤✤
Mulch persistence	✤✤✤		✤
Soil builder	✤✤✤✤✤	✤✤✤	✤✤✤
Rapid growth	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Compaction reduction	✤✤	✤	✤
Weed suppression	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Allelopathic effect		✤✤	✤✤✤✤✤
Ease of termination	✤✤✤✤✤	✤✤✤✤✤	✤✤✤✤✤
Use of mycorrhiza	✤	✤✤✤✤✤	✤
Small seed drill		✔	
Grain drill	✔		✔
Broadcasting*	✔		✔

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