



COVER CROPS

From the Clemson Cooperative Extension Home and Garden Information Center

A cover crop is a crop specifically planted to:

- protect the soil from erosion
- suppress weeds
- maintain soil moisture
- increase organic matter in the soil
- recycle soil nutrients

Cover crops or “green manures” are not harvested, but rather contribute to soil improvement in the place where they are grown. Most gardens benefit from the use of cover crops when not planted, instead of leaving the garden fallow (unplanted). If the garden is in use for most of the

year, arrange crops into warm- and cool-season groups. This makes it possible to rest a portion of the site for cover cropping. Cover cropping is a valuable component within a crop rotation plan for pest and disease management.

Cover crops are divided into two primary groups: legumes and non-legumes (see Table).

Legume Cover Crops

Legumes have the ability to “fix” atmospheric nitrogen gas into “soil nitrogen”, which is available to plants. It is advised to inoculate legume seeds at the time of planting with beneficial species-specific bacteria (rhizobacteria) for nitrogen fixation to occur. Rhizobacterium maximize the amount of nitrogen fixed in legume root nodules. Nitrogen fixation will be low without the presence of the rhizobacterium. The fixed nitrogen will be available in the soil after the legume is terminated and starts to decompose. This fixed nitrogen allows the garden to rely less on added synthetic fertilizer. Cover crops will not supply all of the nitrogen needed for the following year, but over time will improve soil structure and nutrient levels for long-term sustainable growth.

Non-Legume Cover Crops

Non-legumes are planted primarily to provide biomass, i.e. carbon-based plant material that includes stems, roots and leaves. This biomass improves the structure and water holding capacity of the soil while feeding beneficial soil microbes. Non-legumes consist mostly of grain crops such as oats, rye, and buckwheat, but several brassica crops like mustard, turnip, and daikon radish are also valued

non-leguminous cover crops. Natural chemicals (glucosinolates) produced in the roots of



Figure 1: Cereal oats are often used as a cool-season non-leguminous cover crop.

particular brassica crops have shown promise for the management of some soil borne pathogens like nematodes, but results are inconsistent, and research is ongoing.



Figure 2: Buckwheat is a warm-season non-leguminous cover crop with blooms that are very attractive to pollinating insects.

Within legume and non-legume groups there are both warm- and cool-season cover crop species to choose from. Cool-season legumes include Austrian winter peas, hairy vetch, crimson clover, and red clover. Cool-season non-legumes include barley, oats, rye, winter wheat, and the brassicas.

Warm-season legumes include cowpeas and soybeans. Warm-season non-legumes include buckwheat and sorghum-sudangrass.

A mixed planting of legume and non-leguminous cover crops is preferred for most situations. This mixture delivers the optimum benefit of nitrogen fixation and biomass production. For example, a mixed planting of crimson clover (legume) and cereal rye (non-legume) is a popular fall/winter cover crop combination in South Carolina. Likewise, cowpeas and buckwheat are a common summer combination. Many seed catalogs sell premixed cover crop combinations, but mixes can be made by using the lower recommended seeding rate (see Table) for each crop in the mix.

Proper use of cover crops will improve the overall productivity of the soil. While the cover crop is growing, it will help prevent soil erosion and assist in weed control. The organic matter provided when a cover crop decomposes will improve soil structure and aeration, water and nutrient-holding capacity, and supply a portion of the nutrient requirements for subsequent crops. The type of cover crop and the length of time it is growing will determine how much organic matter and nutrients are returned to the soil. A legume may provide more nitrogen, but less total organic matter than a vigorously growing non-legume like sorghum-sudangrass.

Cover Cropping Basics

Before sowing the cover crop, turn over the garden with a rotary tiller. Clear the area of weeds and any remaining refuse from the vegetables or flowers that were not previously removed from the site. Level the soil with a garden rake. Sow seed by hand for small areas, broadcasting as evenly as possible. Broadcast back and forth over the area several times in an attempt to distribute the seed evenly. Lightly cover seeds by raking to ensure good seed to soil contact. Larger areas may require seeding equipment. In some years, irrigation may be necessary to ensure a good stand.

For maximum benefit, a cover crop should be terminated (killed) while in the flowering stage. At this point, the crop will return the greatest amount of biomass and nutrients to the soil. If cover crops are not terminated before seed formation, then their seeds may become weeds in a later crop.

Once terminated, the cover crop can either be left on the soil surface



Figure 3: Mowing is one option for terminating a cover crop.

to decompose as a mulch (known as “no-till”), or it can be tilled into the soil where it will decompose below the soil surface. If the no-till option is used, the cover crop will need to be mowed or crimped down prior to planting of the vegetable crop.

Soil microbes convert the decomposing cover crop into organic matter for addition to the soil profile. Regular use of cover crops over a period of years will slowly raise the organic matter level in the soil and increase the activity of soil organisms such as earthworms and fungi in the soil. As these organisms decompose the organic materials, they help improve soil structure and tilth, making the soil a more favorable place for root development. It is important to understand

that organic matter is continually decomposing and cannot be built up permanently in the soil. Soil building is a continual process in the garden.

Things to consider when choosing a cover crop:

- Growing season
- Nitrogen fixation for the following crop
- Reduction of synthetic fertilizer costs
- Addition of organic matter
- Improvement of soil health resulting in increased yield
- Weed control
- Reduction of herbicide use
- Prevention of soil erosion
- Conservation of soil moisture
- Water quality protection
- Pollution reduction
- Habitat for beneficial organisms
- Sustainability

Suggested Cover Crops

Crop	Sow (lbs.) / 1,000 sq. ft.	Sow	Terminate Crop	Effects
Austrian Winter Peas <i>(Pisum sativum sub. arvense)</i> Notes: Mix with wheat, rye or barley for vine support.	2 to 3	August to early-October	Spring	N source, weed suppression, flowers benefit honeybees

<p>Cowpeas (<i>Vigna unguiculata</i>) Notes: Heat and drought tolerant, seeds rot in cold soils, weedy if allowed to reseed</p>	1 to 2	April to August	Summer to Frost	Quick summer cover, weed suppression, excellent N source, prevents erosion
<p>Clover, Crimson (<i>Trifolium incarnatum</i>) Notes: Rapid growth in spring, will reseed if not killed, may harbor some insect pests, not reliably hardy or drought-tolerant, lime if pH is low</p>	½ to 2/3	August to October	Spring, during bloom	N source (fixes 2-3 lbs. N/100sq ft./yr.), prevents erosion, living mulch, flowers support beneficials and pollinators
<p>Clover, Red (<i>Trifolium pratense</i>) Notes: Clovers perform best with soil pH is between 6.0 and 7.0.</p>	¼ to ½	August to October	Spring	N source, suppresses weeds, builds soil, attracts beneficial insects
<p>Soybeans (<i>Glycine max</i>) Notes: More susceptible to drought and pests than cowpea.</p>	1 to 3	April to August	Fall or Frost	N source, high biomass
<p>Vetch, Hairy (<i>Vicia villosa</i>) Notes: Slow to establish, irrigation improves germination, weedy if allowed to reseed, residue may be difficult to mow/incorporate, fairly hardy</p>	½ to 1	August to early-October	Spring	N source (fixes 2 lbs. N/1000 sq. ft. /yr.), suppresses weeds, reduces runoff and erosion, loosens topsoil
<p>Barley (<i>Hordeum vulgare</i>) Notes: Overwinters in SC, more drought-tolerant than oats, prefers medium-rich loam soil, lime if pH is low, not as hardy as rye</p>	1½ to 3	September to October	Spring	Prevents erosion, nutrient scavenger, suppresses weeds, biomass

<p>Buckwheat (<i>Fagopyron esculentum</i>) Notes: Weedy if allowed to reseed, good “emergency” cover crop due to rapid germination and cover</p>	1½ to 2½	May to September	Within 7 to 10 days after flowering begins	Weed suppression, quick cover, loosens topsoil, nutrient scavenger, rich in potassium, flowers attract beneficial insects
<p>Oats (<i>Avena sativa</i>) Notes: Great companion to legume cover crops, may winter-kill during cold winters</p>	2½ to 4	September to October	Spring	Prevents erosion, nutrient scavenger, suppresses weeds, biomass
<p>Rye, Cereal (<i>Secale cereale</i>) Notes: Overwinters in SC, grows rapidly in spring, can plant until late fall/early winter</p>	2 to 4	September to Mid-November	Early-spring	Excellent N scavenger, prevents erosion, weed suppression, high biomass
<p>Ryegrass, Annual (<i>Lolium multiflorum</i>) Notes: Weedy if allowed to reseed.</p>	½ to 2	August to October	Spring	Prevents erosion, nutrient scavenger, improves soil structure and drainage, suppresses weeds
<p>Sorghum-Sudangrass (<i>Sorghum bicolor</i> X <i>Sorghum bicolor</i> var.<i>sudanese</i>) Notes: Mow down to 6 inches when 3 to 4 feet tall to reduce fibrous residue.</p>	1 to 2	April to September	Fall or Frost	Loosens subsoil, builds soil structure (high biomass), suppresses weeds and nematodes
<p>Wheat, winter (<i>Triticum aestivum</i>) Notes: Overwinters in SC, less weedy and easier to kill than barley or rye</p>	1½ to 4	September to Mid-November	Spring	Prevents erosion, nutrient scavenger, suppresses weeds, biomass, improves soil structure
<p>Mustard (<i>Brassica juncea</i> & <i>Sinapsis alba</i>)</p>	¼ to ½	August to October	Spring	Weed, nematode and soil borne disease suppression

<p>Notes: May reach 6 feet tall or more.</p>				
<p>Radish, Daikon, Forage and Oilseed <i>(Raphanus sativus)</i> Notes: May be killed by temperatures below 25 °F.</p>	<p>½ to 1</p>	<p>August to October</p>	<p>Spring</p>	<p>Alleviates soil compaction, weed suppression, high biomass, N scavenging</p>
<p>Rapeseed <i>(Brassica napus & B. rapa)</i> Notes: Will usually overwinter in SC.</p>	<p>¼ to 2/3</p>	<p>August to October</p>	<p>Spring</p>	<p>Weed, soil borne disease, and nematode suppression</p>
<p>Turnip <i>(Brassica rapa var. rapa)</i> Notes: May be killed by temperatures below 25 °F.</p>	<p>¼</p>	<p>August to October</p>	<p>Spring</p>	<p>Alleviates soil compaction, improves water infiltration</p>