

Cover Crops for Soil Improvement in Horticultural Crops

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Cover crops maintain and improve soil health. They prevent soil erosion and increase organic matter, improving microbiotic activity, soil structure, and water infiltration rates. Cover crops also aid in nutrient cycling, reduce soil temperature fluctuations, provide habitat for beneficial insects, and suppress weed populations.

When soil is covered with forage, it is held in place. Cover crops are planted on fields that will not be in production to prevent erosion of the bare soil.

The biomass produced from growing a cover crop can be disced into the soil, increasing the organic matter content. This biomass is often referred to as green manure. Soils in eastern Oklahoma generally have a low organic matter content of 1 to 2%. Healthier soils have an organic matter content of 4 to 6%. When the organic matter content is above 4%, it can buffer many of the soil problems that affect plant growth. It also improves soil texture and increases the soil's ability to hold nutrients.

When a cover crop is planted, water infiltration is increased in several ways. Deep-rooted cover crops penetrate hardpans, opening up passages for water to flow through. Discing cover crops into the soil increases humus and organic matter content, improving soil texture, decreasing crusting of the soil surface, and increasing pore space for water infiltration.

Leguminous cover crops increase soil nitrogen by fixing nitrogen from the air with the aid of bacteria of the genus *Rhizobium* that inhabits the roots of the legume. The bacteria store nitrogen in small nodules on the roots. Some legumes can fix up to 200 lb of nitrogen per acre per year. The average is closer to 100 lb per acre per year, depending on environmental conditions. The inoculum that contains the rhizobium can be purchased with the seed. The correct strain must be used for each legume. The inoculum is added to the seed before planting. The seed is placed in a tub or pail and moistened with milk or sugar water. The inoculum is in the form of a powder, and the moisture causes it to stick to the seed.

Cover crops serve as habitat for overwintering insects, and blooming crops provide an alternative food source for insects. The increased insect population will include both

beneficials and pests. An ecological balance of beneficial and pest insects may not be achieved for several years.

Many cover crops can suppress the growth of weeds. Some produce thick canopies that prevent light from reaching the surface of the soil. This can weaken competing weed species and suppress weed seed germination. Cover crops have also been reported to exhibit allelopathic effects. Allelopathy is the beneficial or harmful influence of one plant on another plant by the secretion of a chemical or toxic substance. For example, annual rye releases a chemical through its roots that prevents certain seeds from germinating.

Take soil tests before cover crops are planted. These tests provide a baseline of information for future reference. Yearly soil testing provides information about the basic elements of nitrogen, phosphorus, and potassium, organic matter content, and pH level. This information can be used to evaluate crop fertility requirements and to help track the progress of a cover cropping program.

Cover crops are placed in two different categories. Warm-season cover crops grow during the warm

months of the year. Cool-season cover crops grow during the cool months. Cover crops can be further classified as legumes and nonlegumes. The distinct difference between the two is that legumes can fix nitrogen in the soil; nonlegumes are used primarily for weed suppression and for increasing organic matter through biomass production.

Cover crops can be planted by several methods. Seeding rates are shown in Table 1 and Table 2. The most effective method is to use a drill that places the seeds in rows. Most field drills are spaced on a 6-in center. The drill has a calibrated setting that allows the operator to plant seed at a given rate. The seed is planted and covered with soil until it germinates.

Seeds can also be broadcast. A hand-held seeder can be employed for small areas, or a tractor-mounted spreader can be used for larger areas. The seeding rate should be increased 20% to compensate for seed that will not be spread evenly. A drag should be pulled across the planting area to cover the exposed seed. Several tires tied together or an old set of bed springs are effective drags.

Table 1. Cover crops for spring and summer seedling

	Seeding Rate (lb/ac)	Seeding Rate (lb/1000 sq ft)	Depth to Cover Seed (in)	Adapted to Soils of Low Fertility	Areas of U.S. Where Best Adapted	Comments
Legumes						
Alfalfa	20	1	1/2		all	has deep roots and is excellent for mulch; needs a pH of 6 or higher; should grow a full season
Beans, Snap before		15	1 1/2		all	broadcast in wide rows; harvest turning under
Beans, Soy allowed	90	5	1 1/2		all	can be turned under early or be to mature and be harvested
Clover, Alsike	10	1/2	1/2		Noah	good for areas too wet or acid for red clover
Clover, Red grow	10	1/2	1/2		North and Central	needs a pH of 6 or higher; should a full season; can be cut for mulch
Clover, White manure	10	1/2	1/2		all	needs a pH of 6 or higher; the giant variety, Ladino, is best for green
Cowpeas	90	5	1 1/2	o	South and Central	fast-growing crop for hot, dry weather drought resistant
Hairy Indigo	10	1/2	1/2	o	Deep South	needs warm, well-drained soil; high resistant to root-knot nematode
Lespedeza soil	25	1	1/2	o	South	good for restoring poor, eroded, acid
Sweet clover, white full	15	1/2	1/2	o	all	needs a pH of 6 to 7; should grow a season; has strong, deep taproot
Sweet clover, yellow	15	1/2	1/2	o	all	similar to white variety but does better under dry conditions
Nonlegumes						
Buckwheat grows weeds	75	2	1/4	o	all	fast-growing warm-season crop; in most any soil and can smother
Millet, Pearl	30	1	1/2	o	all	fast-growing warm-season crop; good for smothering weeds
Sudan Grass the	35	1	1/4		all	makes rapid, vigorous growth during hottest part of the summer

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Seeds must be planted when adequate moisture is available for germination. Seeds that lack moisture are

Cover crops should be disced into the soil at first bloom, when they are at peak biomass production. After this

more susceptible to pest problems and drought stress. An overabundance of moisture causes seed rot and soil heaving.

Cool-season cover crops are planted between 15 September and 15 October. For best results, plant as early as possible. The temperature should be warm enough to provide adequate growth before winter. Cool-season crops can also be planted in spring; but weather conditions in spring often hamper field planting. Warm-season cover crops are planted between 15 April and 15 June.

period, green manure production decreases. If the crop is allowed to produce seed, it can become a weed problem. Some cover crops will require only one pass with a disc, while some of the more fibrous crops may need several passes. Plant the next crop in four to six weeks after the cover crop has adequately decomposed in the soil.

Producers should choose cover crops based on their particular crop rotations and environmental conditions. Cover crops can provide many of the components necessary to maintain a healthy soil.

Table 2. Cover crops for late summer and fall seedinga

	Seeding Rate (lb/ac)	Seeding Rate (lb/1000 sq ft)	Depth to Cover Seed (in)	Adapted to Soils of Low Fertility	Areas of U.S. Where Best Adapted	Comments
Legumes						
Bur Clover allowed to	30	1	1/2		South	will reestablish itself each fall if go to seed every five years
Crimson Clover New	30	1	1/2		South and Central	one of the best winter annuals from Jersey southward
Lupine, Blue	100	2 1/2	1		Gulf Coast	most widely used of the lupines; need moderate fertility
Lupine, White	150	4	1		Deep South	the most winter-hardy lupine; needs neutral, fairly fertile soil
Lupine, Yellow on	80	2	1		Florida	least winter-hardy of lupines; does well on moderately acid, infertile soil
Pea, Field 5.5;	90	5	1 1/2		South	needs well-drained soil with pH above 5.5; can be spring-planted in the North
Sweet clover, Yellow Southwest; Annual (Sourclover)	15	1/2	1/2		South	a good winter annual for the South; needs a pH of at least 6
Vetch, Common less	60	2	1/4		South	less winter-hardy than hairy vetch and hairy vetch is more suitable for sandy soil
Vetch, Hairy best	40	1 1/2	1/4		all	the most winter-hardy vetch and the best for most situations
Vetch, Hungarian	60	2	1/4		South	better adapted to heavy, poorly-drained soils than other vetches
Vetch, Purple	60	2	1/4		Gulf Coast	least winter-hardy but produces more green material than other vetches
Nonlegumes						
Barley	100	2 1/2	1/4		all	prefers pH 7 to 8; spring varieties must be used in the North
Bromegrass, Smooth hardiness	30	1	1/2		North	a fibrous root system and cold-hardiness make this a good winter cover crop
Kale	15	1/2	1/2		all	plant in late summer and it will grow into the winter; can be eaten anytime
Oats used	100	2 1/2	1		all	tolerates a wide pH range; not good on heavy clay; spring varieties must be used in the North
Rye	100	2 1/2	1/4		all	winter rye is the most hardy of the

small

crop

grains and an important winter cover

Ryegrass, Annual
grows

35

1

7/4

all

one of the best winter cover crops;
rapidly in the fall; dies before spring i

the

North and is easy to till under

Wheat
winter

100

2 1/2

7/4

all

prefers pH 7 to 8.5 and fertile soil;
variety is cold-hardy

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Selected Seed Sources

Local garden centers or farm stores may carry seeds for several of the cover crops listed in the tables. If seeds are not available locally, contact one of the sources listed below. (No endorsement of the companies or their products is intended.)

Adams-Briscoe Seed Co.
P.O. Box 18
Jackson, GA 30233
(770) 775-7826

Johnny's Selected Seeds
305 Foss Hill Road
Albion, ME 04910
(207) 437-4301

C. M. Payne & Sons Seed Co.
9410 Payne Road
Sebring, FL 33870
(813) 385-4642 (Fax)

Johnston Seed Co.
P.O. Box 1392
Enid, OK 73702
(405) 233-5800

Earl May Seed & Nursery Co.
208 North Elm Str.
Shenandoah, IA 51603

Peaceful Valley Farm Supply
P.O. Box 2209
Grass Valley, CA 95945

Hale Dean Seed Co.
P.O. Box 1458
Winter Garden, FL 34787
(407) 877-3333

(916) 272-4769
R. H. Shumway Seedsman
628 Cedar Str.
Rockford, IL 61105

Henry Field Seed & Nursery Co.
1723 Oak Str.
Shenandoah, IA 51602
(605) 665-9391

(803) 663-9771

James E. Horne, President

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P.O. Box 588, Hwy. 271 S., Poteau, Oklahoma 74953, (918) 647-9123

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