Colorado State University Extension

Colorado Master Gardener℠ Program

CMG GardenNotes #244

Cover Crops and Green Manure Crops

Outline:

Terms: Green Manure and Cover Crop

A ***cover crop*** is simply a high numbers of plants, usually specific annual, biennial, or perennial grasses and/or legumes, growing and covering the soil surface. When the cover crop is tilled into the soil it is referred to as a ***green manure*** crop. These two terms are often used interchangeably.

Why is Cover Cropping Beneficial?

Cover crops can protect the soil from wind and water erosion, suppress weeds, fix atmospheric nitrogen, build soil structure, and reduce insect pests.

Erosion protection – The primary erosive force for Colorado is wind. Winter winds are especially destructive, carrying away small particles of topsoil from the soil surface. A thick stand of a cover crop protects the soil surface from wind erosion and as the cover crop's roots hold soil in place against water erosion during heavy downpours.

Weed suppression – Cover crops left in place for part or all of a growing season can suppress annual and some perennial weeds. Among the grasses, annual rye has alleopathic properties that prevent weed seeds from germinating and suppress weed seedlings around the root zone of the rye.

Nitrogen fixation – Legumes, inoculated with their specific *Rhizobium* bacteria, will take nitrogen out of the air (present in the soil) and store it in their plant tissues via nodules on the roots of the legume. Some of this nitrogen is available as roots die, but the majority becomes available when the legume is tilled under (green manure).

Soil structure creation – Plant roots exude a sticky substance then glues soil particles together, creating structure. Grasses are exceptional in their ability to do this.

Insect rests reduction – Cover crops encourage beneficial insect populations, often minimizing or eliminating the need for other insect control measures.

Why is Green Manuring Beneficial?

Green manuring enhances soil fertility and soil structure by feeding soil organisms and gluing together soil particles into aggregates.

Soil fertility – When fresh plant material decomposes in the soil, its carbon-to-nitrogen ratio becomes low, allowing the nitrogen to be easily released into the soil chemistry by bacteria. Nitrogen accumulation is greater with legumes, which have nitrogen-fixing *Rhizobium* bacteria growing in nodules on the legume roots [Table 1]. Notice the lower figure for rye.

Table 1. Nitrogen Accruement of Selected Cover Crops

Cover Crop	Nitrogen Accruement*
Hairy vetch	3.2 lbs/1000 ft^2
Crimson clover	2.6 lbs/1000 ft^2
Austrian winter pea	3.3 lbs/1000 ft^2
Winter (annual) rye	2.0 lbs/1000 ft^2

* Nitrogen accumulated in growing crop prior to tilling under
Source: ATTRA: Overview of Cover Crops and Green Manures

Table 2 shows values of nitrogen fixation for legumes. Rates vary due to variations in the activity level of rhizobium.

Table 2. Potential Nitrogen Fixation Rates of Selected Legumes for Colorado

Legume Crop	Pounds N per 1000 ft^2
Crimson clover	1.6-3.0
Field peas	2.0-3.4
Hairy vetch	2.0-4.6
Medics	1.1-2.8
Red clover	1.6-3.4
Sweet clover	2.0-3.9
White clover	1.8-4.6

Source: *Managing Cover Crops Profitability*, Sustainable Agriculture Network

Soil structure – Microorganisms decomposing plant material and the plant material itself produce substances that glue soil particles together. These substances include slime, mucus and fungal mycelia, which contain gums, waxes, and resins. These aggregate soil particles, thereby enhancing the tilth, porosity, and water holding capabilities of soil.

Basic Recipes for Cover Crops and Green Manure Crops in a Garden

Spring-Planted

Most gardeners do not have enough space to forfeit to a cover crop for an entire growing season. However, if you do, a spring seeded clover would give your soil a great boost. Some seed companies will "rhizo-coat" seed with the specific *Rhizobium* for you. If not, apply *Rhizobium* as specified on the bag. *Rhizobium* comes in a black powder specific to the species of clover. It also has a definite shelf life, so check the expiration date. Broadcast the seed/*Rhizobium* mix at a specified rate after the last frost with a hand held broadcaster (often used with pelleted fertilizer) into a loose seedbed and incorporate shallowly and water until germinated. Monitor water as you would in a lawn.

Till under at least two weeks prior to planting. Decomposing plant material consumes soil oxygen and can create plant health problems if not tilled in ahead of time. More than one tilling may be necessary to get an acceptable kill of the clover.

Fall-Planted for Spring Till

Most will opt for a fall cover crop tilled under as a spring green manure. Seeding dates should be done by mid-October at the latest. Mid-September is ideal on the Colorado Front Range. In mountain elevations, plant in August or earlier. A rye/Austrian winter pea or rye/hairy vetch mixture will overwinter in Colorado. Hairy vetch is hardier than winter pea. Rye is extremely winter hardy. Prepare as above and broadcast at the rates in Table 3.

Table 3. Seeding Rates for Selected Winter Cover Crops

Cover Crop	Ounces per 100 Square Feet	Pounds per 1000 Square Feet
Winter rye	4 – 6	2.5 – 3.75
Austrian Winter pea	4 – 6	2 – 4
Hairy vetch	2 – 3	1 – 2

Source: *Managing Cover Crops Profitability,* Sustainable Agriculture Network

Over-wintered cover crops become a veritable salad-bar to geese and deer. A cover crop that is well established prior to winter temperature extremes should rebound from wildlife grazing in late winter/early spring.

Till the cover crop in mechanically or turn it under with a spade a month before you plan to plant/seed into that area. Decomposing plant material consumes soil oxygen and can create plant health problems if not tilled in ahead of time.

Landscape Uses

Bare soil presents erosion and aesthetic issues for homeowners. During droughty periods, watering restrictions and the lack of natural precipitation may make turf establishment difficult or impossible. A temporary cover crop or long-term xeric grass may be the answer.

In this scenario, the homeowner has to understand that a cover crop will not look or feel like a healthy Kentucky bluegrass lawn, but should satisfy the need to cover the soil.

Annual Species Options

These are cool season grains that should be broadcast at 2-3 pounds per 1000 square feet in February or March. Natural precipitation may be sufficient to get them established. They are suited for non-traffic areas, as they will grow to 2 feet tall and brown-out in the heat of summer. The Sterile Triticale will not produce viable seeds so may be a good idea for areas that will eventually be put into turf or garden space. Winter rye seeds can be a weed problem in seeded turf grass and gardens. [Table 4]

Table 4. Annual Species

Name	Bunch or Sod	Cool or Warm Season	Annual or Perennial	Turf?	Reseed?
Winter rye	Bunch	Cool	Annual	No	Yes
Pioneer sterile triticale	Bunch	Cool	Annual	No	No

Perennial Species Options

These are non-native grasses often used on roadsides for stabilization and cover. They are perennial and will be persistent (i.e., – difficult to kill) once they are established. Water requirements for both are 9-10 inches of precipitation per year. Streambank wheatgrass has a slightly higher water requirement but is tolerant of very clayey soils, unlike Crested wheatgrass. Broadcast in February or March at 3-5 pounds per 1000 square feet. [Table 5]

Table 5. Perennial Species

Name	Bunch or Sod	Cool or Warm Season	Annual or Perennial	Turf?	Reseed?
Streambank wheatgrass	Sod	Cool	Perennial	Yes	Some
Crested wheatgrass	Bunch	Cool	Perennial	Yes	Some

Native Species Options

These have the lowest water requirements at 8 inches of precipitation per year and should be considered for areas of a landscape that are being converted to xeric management. This is a long-term management decision as the price of these seeds is more than the other options. These grasses will not feel like Kentucky blue grass and will brown out like other cool season grasses. Seed as per perennial species options specifications. Seed for native species will be available from local seed sources, such as Pawnee Buttes Seeds. [Table 6]

Table 6. Native Species

Name	Bunch or Sod	Cool or Warm Season	Annual or Perennial	Turf?	Reseed?
Indian ricegrass	Bunch	Cool	Perennial	No	Some
Squirreltail bottlebrush	Bunch	Cool	Perennial	No	Some

Establishment and Care

Before seeding – Prepare a seedbed for fine grass seed, ideally amending the soil with compost and tilling as deeply as possible. If possible, fence off the area from traffic.

Seeding – Water area prior to seeding if possible to establish ample soil moisture levels.

Broadcast the correct amount of seed per area onto a loosely tilled, fine (no soil pieces bigger than 1/4 inch) seedbed. Shallowly incorporate seed with garden rake (not a leaf rake) to a depth of 1/4 to 3/4 inch deep.

For larger areas consider hydromulching the seed. This will save time and increase germination of seeds.

After seeding – Consider laying a thin layer (<1" deep) of seed-free straw to hold in moisture and increase germination and survival of grass seedlings. Bird netting over the straw fastened to the ground with landscape fabric staples will keep the straw from blowing away.

Check moisture levels in the upper inch of soil at least every other day (soil should feel as moist as a wrung out sponge) and water if necessary (and if possible).

Mowing – If necessary, mow as high as possible.

Removing cover crops – For winter rye, either till under, mow and mulch heavily, or spray herbicide before it goes to seed. A seed bank can be sodded over or watered, germinated and killed. Perennial grasses can be either mowed and mulched heavily prior to sodding, or sprayed with herbicide and sodded, or sprayed with herbicide, tilled and seeded.

Additional Information – *CMG GardenNotes* on Soils, Fertilizers and Soil Amendments:

#211	Introduction to Soils	#232	Understanding Fertilizers
#212	The Living Soil	#233	Calculating Fertilizer Rates
#213	Managing Soil Tilth	#234	Organic Fertilizers
#214	Estimating Soil Texture	#241	Soil Amendments
#215	Soil Compaction	#242	Using Manure
#218	Earthworms	# 243	Using Compost
#219	Soil Drainage	#244	Cover Crops and Green Manure Crops
#221	Soil Test	#245	Mulching with Wood/Bark Chips, Grass Clippings and Rock
#222	Soil pH		
#223	Iron Chlorosis	#246	Making Compost
#224	Saline Soils	#251	Asking Effective Questions About Soils
#231	Plant Nutrition		

Authors: Adrian Card (CSU Extension) with David Whiting (CSU Extension, retired), Carl Wilson (CSU Extension, retired), and Jean Reeder, Ph.D., USDA-ARS (retired)

- Colorado Master Gardener *GardenNotes* are available online at www.cmg.colostate.edu.
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