Cover Crops and Green Manure Crops

Manjula Nathan
nathanm@missouri.edu (mailto:nathanm@missouri.edu)

Tim Reinbott
reinbottt@missouri.edu (mailto:reinbottt@missouri.edu)

PUBLISHED: AUGUST 1, 2011

A Gardener's goal is have a productive garden every year. Applying synthetic fertilizers during the growing season is not sufficient for maintaining a sustainable soil. After harvesting crops, a good management practice is to buildup and maintain the soil during the off season so that it will be more fertile and productive for the next growing season. Growing cover or green manure crops is a key for this desired goal since they help maintain soil fertility, soil health and productivity instead for harvesting. The terms cover crops and green manure crops are sometimes used interchangeably based on the growers perspective. A cover crop is usually a specific annual, biennial, or perennial grasses or legumes or a combination of two or more grown between regular growing seasons for the purpose of mainly to prevent soil erosion by protecting and improving the soil. When cover crops are tilled into the soil, it is referred to as green manure crop. A green manure crop is usually grown to help maintain soil organic matter and nitrogen availability.

Why grow cover/green manure crops? Cover crops can protect soil from wind and water erosion, suppress weeds, fix atmospheric nitrogen, scavenge soil nitrogen, build soil structure, reduce surface crusting, improve water infiltration, break hardpan, improve soil/ water quality and reduce insect pests. Benefits from these crops depend on biomass productivity before the soil is prepared for the next crop. When cover crops are buried and tilled into the soil, the green manure that is added enhances soil fertility and structure by feeding soil microbial populations and which also glue together soil particles to form soil aggregates. When plant material is decomposed by soil microbes, they break down and release nitrogen and other nutrients to the soil. Nitrogen accumulation and release is greater with legumes, which have nitrogen fixing bacteria in roots (Table 1)

Table 1: Nitrogen accumulation of selected cover crops.

Cover Crop	Nitrogen Accumulation*
Hairy vetch	3.2 lbs/1000 sq. ft
Crimson clover	2.6 lbs/1000 sq ft

Austrian winter pea	3.3 lbs/1000 sq ft
Winter (annual) rye	2.0 lbs/1000 sq ft
*Nitrogen accumulated in growing crop prior to tilling under Source: ATRA: Overview of Cover Crops and Green Manures	

Selection of cover crops: Success in the growth of cover crops requires proper selection of the cover crop, correct timing of seeding and management practices. Species selection depends on targeted planting date and the purpose for growing it. Legume cover crops have a symbiotic relationship with bacterial that fix atmospheric nitrogen into a form plants can use. Non legumes species scavage existing soil nitrogen and other nutrients and reduce leaching losses. There are many traditional cover crops to select from, including annual rye grass, cereal rye, winter wheat, oats, white clover, sweet clover, crimson clover hairy vetch and buck wheat. Grasses are easier to establish than legumes such as clover as they germinate quickly and do not require inoculation.

Early vegetable harvest begins in mid to late (spring?). Rather than leaving the ground open to weeds, the land can be improved by planting over crops. For planting in July/August the main choices are buckwheat, clovers and Sudan grass. These cover crops are best when sown during July through early August. If garden space becomes available after harvest in late August and September, barley, annual rye grass, oats and clover can be successfully established. The last date by which cover crops can be planted in Missouri will be end of October to early November. Winter annual grasses such as cereal rye and wheat can be planted by the beginning to mid October.

Given the growing conditions in Missouri, annual rye grass (I would not use annual rye, it comes up in the spring and is only good til mid summer) should be considered first for a garden cover crop. Winter rye is another good choice that is best for late planting.

Establishment of cover crops are similar to planting any garden seed including raking the garden area and remove the residues. Next broadcast the cover crop seed of your choice and lightly rake the soil to incorporate the seeds with the surface soil and water the soil surface lightly to provide the required moisture for germination.

When to kill cover crops in spring?
Early to mid April is the best time to kill over wintering grass cover crops whereas legumes should be allowed to grow longer into the spring. They can be killed with an herbicide or plants can be killed by plowing them in to the soil.. To get the most of nitrogen out of grains such as rye, the best time to kill is when they have greened up after winter and are about 6 inches tall. When rye is larger than 6" nitrogen can get tied up in soil by a process referred to as nitrogen immobilization which can prevent it from being available when your plants needs. To get the full nitrogen benefit from legumes they must be allowed to grow until they begin to bloom. Afterward they can be killed by shallow tillage.

The chart provides an overview of cover crops at a glance adopted from Cornell University Gardening Resources with Cover Crops fact sheet. Seeds can be purchased at your local garden center or garden section of stores that sell garden products.

POPULAR AND USEFUL CHOICES OF COVER CROPS

	Vigor of germination& establishment	Seed cost to plant 1000sqft	Time of planting	Over-winter ability	Growth amount	Ease of incorpor-ation	Soil structure improve-ment	Applic. rate; oz/ 100sq ft	Comments
Annual Ryegrass	***	*	Aug - Sept	NO	**	**	***	2	Overall an easy crop to establish
Perennial Ryegrass	**	**	Aug-mid Sept	***	**	*	**	1	Faster establishment than other perennials. Extensive root system
Winter Rye	***	**	Aug - Oct	***	***	*	**	3	Can Grow at low pH and at cool temperatures
Oats	***	**	Aug - Sept	NO	*	***	*	4	Requires good soil drainage, but tolerates low pH
Winter Wheat	***	**	Aug - Oct	***	***	*	**	3	Requires fertile soil; avoid wet or low pH soil

Sweet Clover	*	*	Summer	***	***	**	**	1	Better with high pH than other clovers
White Clover	*	*(*)	Summer	***	*	***	**	1	Good for low pH soil, treat with inoculant
Tall Fescue	*	***	Spring	***	*	**	**	1	Persistent, may become weedlike
Buckwheat	***	**	Spring	NO	**	***	*	3	Do not allow to mature,or reseeding will occur
*** = Relatively High			** = Moderate				* = Relatively Low		
Note: Packages of Ryegrass Usually Contain a Mixture of Annual & Perennial Types									

References:

1. Cornell Gardening Resources: Improve your soil with cover crops. Fact sheet
2. ATTRA: Overview of Cover Crops and Green Manure
3. Why use cover crops in vegetable rotations, Cover Crops guide, Cornell University
4. Cover Crops and Green Manure Crops. GMG Garden Notes #244. Colarado State university Extension Publication.