

# **Cover Crops and Green Manures**

## Farmer-to-Farmer Participatory Training Course

### **Objectives**

- Learn strategies of enhancing soil fertility through cover crops and green manures
- Recognize the importance of protecting the soil with a living cover
- Appreciate the value of cover crops and green manure in building soil organic matter



# Cover Crops and Green Manures

## What are cover crops and green manures?

**Green Manures** are crops principally grown for incorporating their biomass into the soil.

**Cover Crops** are grown principally grown for covering the soil to protect it from the forces of erosion. They include many types of crops which may or may not be harvested.

Since both green manures and cover crops have similar functions and provide many of the same benefits, it is common for a crop to act as both a cover crop and a green manure.

## What are the types of cover crops and green manures?

- 1) **Winter cover crop:** A winter cover crop is planted in late summer or fall to provide soil cover during the winter. Cool-season legumes include: clovers, vetches, medics, and field peas. They are sometimes planted in a mix with winter cereal grains such as rye, or wheat. Winter cover crops can be established by aerial seeding into maturing cash crops in the fall, as well as by drilling or broadcasting seed immediately following harvest.
- 2) **Summer green manure crop:** This crop fills a niche in crop rotations, to improve the conditions of poor soils, or to prepare land for a perennial crop. Legumes such as cowpeas, soybeans, annual sweet clover, may be grown as summer green manure crops to add nitrogen along with organic matter. Non-legumes such as sorghum-sudan grass, millet, or buckwheat are grown to provide biomass, smother weeds, and improve soil tilth.
- 3) **Living mulch:** A living mulch is a cover crop that is interplanted with an annual or perennial cash crop. Living mulches suppress weeds during the growing season by competing for light, moisture & nutrients.
- 4) **Catch crop:** A crop whose primary purpose is to reduce nutrient leaching from the soil profile (i.e. rye following corn).
- 5) **Forage crop:** Short-rotation forage crops function both as cover crops when they occupy land for pasturage or haying, and as green manures when they are eventually incorporated. Some examples include: legume sods of alfalfa, sweet clover, trefoil, red clover, white clover, and grass-legume sods like fescue-clover pastures. For maximum soil-improving benefit, the forage should not be grazed or cut for hay during its last growth period to allow time for biomass to accumulate.
- 6) **Allelopathic plants:** These plants inhibit or slow growth of other nearby plants by releasing natural toxins, or "allelochemicals," examples include rye, sorghum and

sudan grass). The mulch that results from mowing allelopathic cover crops can provide significant weed control in no-till cropping systems.

## **What are the benefits of cover crops and green manures?**

- 1) **Organic Matter Build-up:** Increasing the amount of organic matter in soil recycles nutrients, improves water dynamics, and improves soil structure. However, it takes several years of organic matter cultivation before measurable changes can be observed.
- 2) **Nutrient Enhancement:** Nutrients accumulated by cover crops during a growing season become slowly available to the following crop. Buckwheat, lupine, and sweet clover extract P from soils. Alfalfa and other deep-rooting green manures scavenge nutrients from the subsoil and translocate them to the surface-rooting zone, where they become available to the following crop.
- 3) **Nutrient Production:** Nitrogen production from legumes is a key benefit of growing cover crops and green manures. Nitrogen accumulations by leguminous cover crops range from 40 to 200 lbs./acre. As for green manures, 40 to 60% of the nitrogen in the leguminous plant is made available to the following crop. For example, a hairy vetch crop that accumulated 180 lbs. N per acre prior to ploughing down will contribute approximately 90 lbs. N per acre to the succeeding grain or vegetable crop.
- 4) **Soil Structure:** The breakdown of organic matter by microorganisms, mycelia, mucus, and slime produced by microorganisms helps bind together soil particles as granules, or aggregates. A well-aggregated soil tills easily, is well aerated, and has a high water infiltration rate.
- 5) **Soil Microbial Activity:** Soil microbes multiply to attack the freshly incorporated plant material. During microbial breakdown, nutrients held within the plant tissues are released and made available to the following crop.
- 6) **Rooting Action:** Some cover crops are highly effective in loosening and aerating the soil.
- 7) **Weed Suppression:** Cover crops take up space and light, reducing the opportunity for weeds to establish. The soil-loosening effect of deep-rooting green manures also reduces weed populations that thrive in compacted soils.
- 8) **Pest Management:** Insect and microbial population levels will be more balanced due to the diversity of plant species being grown. Crop residues, pollen, and nectar act as a desired habitat for beneficial insects (i.e. lupines provide beneficial insect habitat as it serves as a smother crop, and releases nitrogen).

- 9) **Water Conservation:** Mulch that results from a mechanically killed cover crop in no-till plantings increases water infiltration and reduces water evaporation from the soil surface.
- 10) **Soil Erosion Control:** Soil cover reduces soil crusting and erosion from wind and water.

### **What are some limitations of cover crops and green manures?**

1. For the immediate growing season, seed and establishment costs need to be weighed against reduced nitrogen fertilizer requirements and the effect on cash crop yields.
2. Water consumption by green manure crops is a concern, especially in areas with less than 30 inches of precipitation per year.
3. There is always additional management required when cover crops of any sort are added to a rotation; turning green manures under or suppressing cover crops requires additional time and expense.
4. Insect communities associated with cover crops work to the farmer's advantage in some crops but create a disadvantage in others. For example, certain living mulches enhance the biological control of insect pests of summer vegetable crops by providing favourable habitats for beneficial insects. On the negative side, winter legumes that harbour insects such as the tarnished plant bug, stink bug, and plum curculio can pose problems in orchards. Nematodes encouraged by certain legumes on sandy soils are another concern of farmers, as are cutworms in rotations following grain or grass crops.

### **Examples of Cover Crops/Green Manures in Rotation**

<u>Spring</u>	<u>Fall</u>	<u>Cover Crop Advantages</u>
Spelt	Oilradish	Relays nutrients to following crop, dies in winter, loosens soil
Oats	Rye	Winters over, mow when flowering to kill-mulch for soybeans
Soy	Sweet Clover	Undersow in soy, legume for corn
Corn	Clover/Grass	Winter cover, forage/hay 2 + years

Buckwheat can follow lettuce and still be tilled down in time for fall broccoli. Overwintered hairy vetch can be killed by flail mowing and tomato sets planted into the mulch. Fall rye can be spread into potatoes and winter wheat after early potatoes.

**ACTIVITY: Group discussion: break the farmers into groups of 5-6 and have them answer the three questions below.**

**1) What experience do you have with green manures or cover crops?**

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**2) What are the benefits of using these techniques?**

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**3) Which of them do you think you could use successfully on your farm in your crop rotations?**

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