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Benefits of Cover Crops

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A cover crop is a crop of grasses, small grains, legumes or their mixtures grown between cropping seasons, primarily for the purpose of covering the ground. Cover crops are usually planted after the harvest of an early and main crop to improve soil health by reducing erosion and runoff losses, preventing weed incursion, and improving soil fertility. They are also used for livestock grazing or forage.

Cover crops are known to add organic matter to the soils through their incorporation back into soils or decomposition of their root mass. Thus, their inclusion can help producers to maintain long-term productivity of their land. Native Nevada soils have less than 1 percent organic matter, which results in poor soil structure and lower water- and nutrient-holding capacities. Thus, to improve the quality of soils, farmers should focus on increasing the organic matter content of the soils.

One way to improve organic matter in soils is to include cover crops in crop rotations. The selection of a cover crop species depends upon the time of planting and their use. There are many cover crop species that can be included in crop rotation. Cover crops can be divided broadly into two major

categories, depending upon their ability to fix nitrogen (legumes) or not (non-legumes) (Table 1). However, planting a combination of two or more species of cover crops is always beneficial for early establishment and better growth. Thus, cover crops play an important role in sustainable farming systems. This publication summarizes the primary benefits of growing cover crops.

Table 1: List of some legume and non-legume cover crops.

Legumes (Nitrogen fixers)	Non-legumes (Not nitrogen fixers)
Soybean	Foxtail millet
Hairy vetch	Brassicas (radish, turnip, canola, rape, or mustards)
Clovers	Annual grasses (wheat, barley, oats, ryegrass, cereal rye, triticale)
Peas (field peas and Austrian winter peas)	Buckwheat
Alfalfa	Pearl millet
Cowpea	Sorghum-Sudan grass

Benefits of cover crops

Soil protection

Cover crops can provide an excellent ground cover while soil is not being used by the main crop. This ground cover will protect the soil from wind and water erosion losses. Erosion of soil through these forces (wind and water), leads to loss of particles, such as clay and organic matter from the soil, that are very important to maintain soil fertility. Soils in Nevada are susceptible to erosion losses by wind, and this leads to significant loss of soil particles blown away from the field. Thus, keeping the soil covered by planting cover crops when no main crop is growing will help to protect loss of soil through wind erosion, and thus will improve soil fertility.

Soil organic matter and nutrients addition

Carbon (C) in soil plays an important role in maintaining the overall health of agricultural soils. Incorporation of cover crops back into the soils helps to increase soil organic matter (OM), thus improving water- and nutrient-holding capacities in soils. Commonly, organic matter is calculated from organic carbon by using a conversion factor of 1.72 as:

$$\text{OM (\%)} = \text{Total organic C (\%)} \times 1.72$$

Both soil carbon and nitrogen (N) are needed to form organic matter in soils. Grasses (Figure 1) add more carbon to soils than legumes, due to a higher carbon-to-nitrogen (C:N) ratio. However, cover crops with a higher C:N ratio (>35:1) decompose and release nutrients more slowly than crops with a lower C:N ratio, such as legumes (pea, lentil, cowpea, soybean, clovers, etc.). In

addition to the C:N ratio, the process of decomposition and release of nutrients also depends upon the growth stage of the crop and the crop species (Table 1). The younger and immature crop residue will decompose and release nutrients faster than matured crop residues.

Legume cover crops also add nutrients to the soil through the process of nitrogen fixation. Legume crops form symbiotic associations (relationships between two interacting organisms) with bacteria called rhizobia, which help to produce nitrates from atmospheric nitrogen. These nitrates (one of the available forms of nitrogen) are then taken up by the legume crop. This nitrogen becomes available to the following crop after the legume dies and is incorporated into the soil. Legume cover crops can help to increase soil N by adding about 50-200 pounds of N per acre (depending upon the species), thus reducing the cost of production of the following crop by saving money on synthetic fertilizer costs, fuel costs for their transportation, and application labor costs.



Figure 1: Pearl millet as a cover crop. Photo by Maninder K. Walia.

Pest pressure

The infestation of pests may increase or decrease with use of cover crops. Cover crops are shown to reduce the populations of some weeds and soil-borne pathogens. For instance,

- a) Annual ryegrass and cereal rye cover crops reduce the populations of soybean cyst nematodes significantly.
- b) Brassica crops reduce nematode pressure in soil through the soil fumigation (a practice to control soilborne pests) process.
- c) Using winter camelina as a cover crop following harvest of sugar beet has been shown to provide excellent control of water hemp and pigweed (Figure 2).
- d) Cereal rye has been shown to have smother and allelopathic effects (inhibition of one plant or organism by another) on weeds for up to six weeks.



Figure 2: Weeds (left) and mature winter camelina (right). Photo adapted from University of Minnesota Extension Crop News.

In addition to weed suppression, cover crop inclusion can also increase

economic benefits by reducing the need to apply pesticides.

Soil health

Cover crops can significantly improve soil properties. Cover crop incorporation improves water infiltration and soil aeration, and reduces surface crusting and soil compaction (soil bulk density). Use of cover crops improves the formation and stability of soil aggregates, and increases soil microbial biomass and enzymatic activity in soils. Soil microbial diversity is also improved through addition of cover crops in crop rotations.

Livestock grazing or forage

Cover crops are usually planted in the fall, after the harvest of the main crop. They are killed or incorporated back into the soil in the spring, before planting of the next main crop. However, cover crops (winter rye, triticale, wheat, etc.) can be grazed or harvested before planting of the subsequent crop. This will help to increase pasture acreage in between the main crop growing seasons. In addition, rotational or strip grazing of cover crops will help to increase utilization while decreasing soil compaction.

Conclusions

Integration of cover crops into crop rotations can provide many benefits. However, there are many considerations, such as species or variety selection, seed cost, and time of termination, that need to be addressed before their large-scale adoption. In addition, drought or availability of water can also be a challenge when implementing any cover cropping system in drier regions such as Nevada.

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