



# Soil Cover – A Soil Health Principle

Maninder Kaur Walia, Assistant Professor – Field Crop Specialist;  
Ericka R. Kay, University of Nevada, Reno

## Healthy Soil

Healthy soils sustain productivity, maintain water and air quality, and support plant and animal health. Healthy soils will have sufficient nutrients, a diverse population of microorganisms, low weed pressure, and good soil tilth and drainage. Soil organic matter is critical to soil health. It retains nutrients and moisture, contributes to soil aggregation, reduces compaction and surface crusting, and increases water infiltration. Soil organic matter contains carbon and nitrogen, which are the source of energy and protein for soil microorganisms. One way of promoting healthy soils is by keeping the ground or soil covered, while also providing the raw material for soil organic matter and additional benefits outlined below.

## Soil Cover and Its Benefits

Soil cover refers to vegetation, such as annual and perennial crops, cover crops, green manures and crop residues, left on the surface to cover the ground. Soil cover provides multiple benefits to producers by conserving soil, water and nutrients, and therefore reducing inputs. Some of these benefits include:

- Protecting soil from wind and water erosion, thus preventing the loss of valuable soil organic matter and nutrients from the soil.
- Moderating soil temperatures by keeping the soil warmer in cold weather and cooler in hot weather.

- Reducing evaporation rates by holding more moisture and making it available for plants to use. This reduces overall irrigation demands and conserves limited water resources.
- Reducing surface crusting from rainfall, and thus preventing water from running off and allowing water to infiltrate the soil.
- Limiting weed growth by reducing the amount of sunlight reaching weed seedlings, thus reducing herbicide needs.
- Providing food and habitat for soil organisms.

## Maximize Soil Cover

Soil cover can be maximized by planting cover crops, living mulches, annual crops and perennial crops, and by leaving crop residues on the ground. These practices maintain an armor to protect the soil year-round, extending the period of soil cover and decreasing nutrient and soil loss by lengthening the cropping periods. Soil cover can be maximized by including some of the following practices in the cropping system.

### 1. Cover Crops

Cover crops can be an integral part of a soil health management system by increasing soil cover. Cover crops can be composed of an individual plant species or a mixture. Planting mixtures of cover crops further increase plant

diversity, improving soil health and increasing crop yield. However, mixtures will typically require greater management and may cost more. The selection of a cover crop species depends upon the planting time and their use. Many cover crop species can be included in crop rotations. Cover crops can be divided broadly into two major categories, depending upon their ability to fix nitrogen (legumes) or not (non-legumes).

Cover crops are usually planted after an early and main crop harvest 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 can provide unique benefits to address identified issues or resource concerns specific to a farm or field. However, they should be considered a long-term investment to improve soil health.

Research has shown that cover crops increase resilience in both erratic and extreme weather conditions including drought and intensive rainfall, both of which are predicted to increase in the future. "Cover crops help when it doesn't rain, when it rains, and when it pours," says Sarah St. John, district technician with Wood County Soil and Water Conservation District.

## **2. Green Manure**

Green manure is a cover material that is plowed into the soil before planting the main crop, and will add carbon and other nutrients to the soil.

## **3. Mulches**

Mulches include any organic or inorganic material placed over the surface of the soil as protection, and can

consist of grass clippings, bark mulch, etc. However, living mulches are recommended to build soil and feed its microorganisms. Living mulches can be cover crops or plants grown between rows of the main crop to suppress weeds by competing for resources, including sunlight, water and nutrients. They can also reduce erosion.

## **4. Perennial Crops**

Perennials can replace annual cash crops, as they are grown for several continuous years from a single planting. An added benefit of perennials is reduced tillage, thus reducing soil compaction and loss of soil organic matter. Perennial crops also have more established root systems and can withdraw nutrients from a larger soil volume.

## **5. Crop Residues**

Crop residue is dead plant matter remaining from a previous harvest. Crop residue's physical presence improves water infiltration and soil aeration, and alleviates compaction. It is also a physical barrier that reduces wind and water erosion.

## **Conclusion**

Soil cover is one of the five principles that revitalize and maintain soil health and buffer the effects of climate change. The variety of options provides producers with flexibility, from leaving biomass from the main crop standing until the next season to tilling a cover crop in as green manure if the market value of the cover crop is low. So, growers are encouraged to start thinking about the inclusion of these practices in their systems to maintain or improve soil health for future use.

## References

- Barrett, R., McGhee, N. 2019. Considerations for Building Cover Crop Mixtures. USDA Natural Resources Conservation Service – Americus, Georgia.  
<https://www.nrcs.usda.gov/plantmaterials/gapmctn13524.pdf>
- Chalise, K.S., Singh, S., Wegner, B.R., Kumar, S., Perez-Gutierrez, J.D., Osborne, S., Nleya, R., Guzman, J., Rohlia, J.S. 2018. Cover Crops and Returning Residue Impact on Soil Organic Carbon, Bulk Density, Penetration Resistance, Water Retention, Infiltration, and Soybean Yield. Crop residue workshop University of Nebraska, Lincoln.  
<https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=3149&context=usdaarsfacpub>
- Clark, A. 2015. Cover Crops for Sustainable Crop Rotations. Sustainable Agriculture Research and Education Outreach.  
<https://www.sare.org/resources/cover-crops>
- Dorana, J. Zeiss, M. 2000. Soil health and sustainability: managing the biotic component of soil quality, Applied Soil Ecology, Volume 15, Issue 1, Pg. 3-11
- Kaspar, T.C., Kladivko, E.J., Singer, J.W., Morse, S., Mutch, D. 2008. Potential and limitations of cover crops, living mulches, and perennials to reduce nutrient losses to water sources from agricultural fields in the upper Mississippi basin. In: Final Report: Gulf Hypoxia and Local Water Quality Concerns Workshop. St. Joseph, Michigan, American Society of Agricultural and Biological Engineers. p.129-148.  
[https://www.epa.gov/sites/default/files/2015-07/documents/2006\\_8\\_25\\_msbasin\\_10\\_covercrops.pdf](https://www.epa.gov/sites/default/files/2015-07/documents/2006_8_25_msbasin_10_covercrops.pdf)
- Owens, C. 2017. Unlocking the Secrets in Soil: How soil works and the management principles of high functioning soil. USDA Natural Resources Conservation Service.  
[https://wmswcd.org/wp-content/uploads/2017/05/201704APR08\\_SoilSchool.pdf](https://wmswcd.org/wp-content/uploads/2017/05/201704APR08_SoilSchool.pdf)
- USDA Natural Resources Conservation Service. 2013. Unlock the secrets in the soil Basics & Benefits.  
<https://nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=968>
- Walia, MK. 2019, Benefits of cover crops. University of Nevada, Reno Extension, [FS-19-11](#).

The University of Nevada, Reno is committed to providing a place of work and learning free of discrimination on the basis of a person's age (40 or older), disability, whether actual or perceived by others (including service-connected disabilities), gender (including pregnancy related conditions), military status or military obligations, sexual orientation, gender identity or expression, genetic information, national origin, race (including hair texture and protected hairstyles such as natural hairstyles, afros, bantu knots, curls, braids, locks and twists), color, or religion (protected classes). Where discrimination is found to have occurred, the University will act to stop the discrimination, to prevent its recurrence, to remedy its effects, and to discipline those responsible.