

# Winter Cover Crops

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## INTRODUCTION

Winter cover crops (WCC) are important universal tools that can be used to conserve environmental sustainability. Cover crops are grown to protect the soil from erosion and losses of nutrients via leaching and runoff. The term "winter cover crop" is used to describe a crop grown to protect the soil during the winter fallow period. Despite acceptance of the name, winter cover crops do not necessarily need to be used during winter and can be used even during summer, especially in the tropics. A cover crop can also be used on a more permanent basis during the entire year, e.g., a cover crop planted between papaya trees (*Carica papaya* L.). Management for these permanent cover crops is additionally complex because of the potential for cover crop competing with the main crop for nutrients and water. A permanent cover crop can also have a role in increasing beneficial insects in integrated pest management systems and reducing the off-site transport of soil, nutrients, and chemicals such as in intensively managed horticultural crops, especially on undulating terrain. Furthermore, if a legume is used, it can potentially fix atmospheric  $N_2$  and enhance soil N reserve.

## TOOL TO REDUCE EROSION AND FOR WATER CONSERVATION

Here we expand Reeves<sup>[1]</sup> definition of winter *cover crops* to include those crops that are grown for improving soil, air, and water conservation and quality; nutrient scavenging, cycling, and management; increasing beneficial insects in integrated pest; and/or for short-term (e.g., over winter) animal-cropping grazing systems.<sup>[2]</sup> Winter cover crops serve as a soil conservation tool by sheltering the soil against wind and water erosion and reducing the off-site transport of soil particles, nutrients, and soil organic matter by erosive processes. Winter cover crops

1) improve air quality by reducing the aerial transport of light soil particles due to wind erosion and the chemicals associated with them due to wind erosion; 2) improve water quality and conservation by increasing N use efficiency, which reduces the potential for  $NO_3-N$  leaching; 3) serve as "catch crops" to scavenge  $NO_3-N$  from the soil profile that may already have been leached below the root zone of a previous shallower rooted crop and/or by reducing the off-site transport of soil particles, chemicals, and nutrients that can impact water bodies; 4) increase water conservation by increasing infiltration and reducing evaporation losses of soil water in conservation tillage; and 5) leguminous species can fix atmospheric  $N_2$  and serve as green manures as they have a lower C/N ratio and higher N fertilizer equivalent.<sup>[3]</sup> Among other benefits of growing cover crops are weed suppression, carbon sequestration, grazing for animals,<sup>[2,4]</sup> and integrated pest management.<sup>[5]</sup> A detailed review on the use of WCC for weed suppression and integrated pest management is presented by Dabney et al.<sup>[5]</sup>

It is well known that bare soil is more susceptible to erosion forces that detach and transport soil particles. Erosion can contribute to the off-site transport of soil particles, associated nutrients, and, in the case of water erosion, dissolved nutrients. Erosion can also contribute to the transport of organic matter and other agrochemicals such as pesticides. Winter cover crops enhance soil aggregation and shelter soil particles and protect them against the forces that result in soil erosion due to wind and water,<sup>[2,6,7]</sup> thereby contributing to soil and water conservation.

Winter cover crops can significantly reduce potential water and wind erosion. Rainfall erosion from conventional tillage cotton in Mississippi was reduced from 74 to 20  $Mg\ ha^{-1}\ yr^{-1}$ .<sup>[7]</sup> Wind erosion in the great plains was reduced by winter cover rye to below 11.2  $Mg\ ha^{-1}\ yr^{-1}$  in sandy loam.<sup>[6]</sup> Winter cover crops reduced potential wind erosion from 45 to 21  $Mg\ ha^{-1}\ yr^{-1}$  for a loamy sand and from 75 to 35  $Mg\ ha^{-1}\ yr^{-1}$  sandy loam of South Central Colorado.<sup>[2]</sup>



carbon inputs into agricultural systems. Winter cover crops are very important tools in the management of soil  $\text{NO}_3\text{-N}$  and can scavenge  $\text{NO}_3\text{-N}$  leached from a previous crop and decrease  $\text{NO}_3\text{-N}$  leaching in the following crop, therefore increasing the NUE of a given system. Winter cover crops are also an excellent source of grazing for animals and can contribute to the development of sustainable animal-cropping systems. Winter cover crops are a viable tool for soil and water conservation.

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