



## Crop residues provide valuable protection for soil

**Removing wheat and sorghum** crop residue after harvest, such as stalks, stubble and leaves, may cause more harm than good according to new research. Results indicate that removing residue can increase nutrient and sediment levels in water runoff, and decrease organic carbon stored in the soil.

**Crop residue left after harvest** performs several ecosystem services. In particular it protects the soil from rain and runoff. However, removing it for livestock feed and, more recently, bio-ethanol may reduce these services. This raises questions about using these residues for biofuel production. Although it does not specifically address the use of residues, the EU has stipulated that biofuels must meet agreed sustainability criteria to count towards the targets of the Renewables Directive.

The research assessed the impacts of removing wheat and sorghum crop residue from farmland in western Kansas, USA. The soils varied in their till-management in four ways: untilled wheat, freshly-tilled wheat, spring-tilled sorghum and freshly-tilled sorghum. The study varied the amount of residue removed from between 0 to 100 per cent and simulated heavy, short rainstorm on the land.

Compared with plots where no residue was removed, complete removal increased water runoff dramatically in the tilled plots: in the freshly tilled wheat runoff increased by 61 per cent, in the freshly tilled sorghum plot by 94 per cent and in the spring-tilled sorghum plot by 225 per cent. Increases in run-off from the untilled wheat plot were not as significant.

Residue removal increased soil erosion and therefore the loss of sediment (rock fragments) contained in the soil in all types of crop and tillage. Complete removal doubled the sediment loss to 14 tonnes per hectare for tilled wheat and increased it from 0.9 to 7.2 tonnes per hectare for untilled wheat. As a result, organic carbon in the soil that is bound to the sediment was also lost causing significant soil degradation, since soil organic matter is a source of nutrients and plays a fundamental role in the global carbon cycle. Besides the loss of fertile lands, sediments can cause problems when deposited in downstream lakes and rivers or on roads or clogging drainage systems, for example.

Downstream water quality also worsened when nutrients, such as nitrogen and phosphorus, escaped from soil in surface runoff. Removal rates of above 75 per cent of residue increased the losses of total nitrogen and of total phosphorus threefold in freshly tilled plots and eightfold in untilled plots.

The researchers recommend that no residue be removed from tilled soils, especially if they are on sloping lands (6 per cent slope) as slopes increase water runoff. Untilled wheat plots tend to have an advantage over freshly tilled plots, but excessive removal of residue can undo the erosion protection that untilled management provides. The results suggest that 25 per cent may be the maximum amount of residue that can be removed from untilled wheat soils before they suffer similar losses to tilled soils.

1. See [http://europa.eu/legislation\\_summaries/energy/renewable\\_energy/en0009\\_en.htm](http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm)

**Source:** Blanco-Canqui, H., Stephenson, R.J., Nelson, N.O. & Presley, D.R. (2009). Wheat and Sorghum Residue Removal for Expanded Uses Increases Sediment and Nutrient Loss in Runoff. *Journal of Environmental Quality*. 38:2365-2372.

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