

Allelopathy and Cover Crops

Missouri Information Sheet

IS-MO-340Allelopathy

Natural Resources Conservation Service (NRCS)
January 2016

Missouri Conservation Practice 340

What is allelopathy?

All plants give off various allelochemicals that can affect the growth of other plants. These active allelochemicals are released by several methods including:

- exuded by living plant roots
- washed off the leaves and shoots into the soil by rainfall
- released by decaying residues

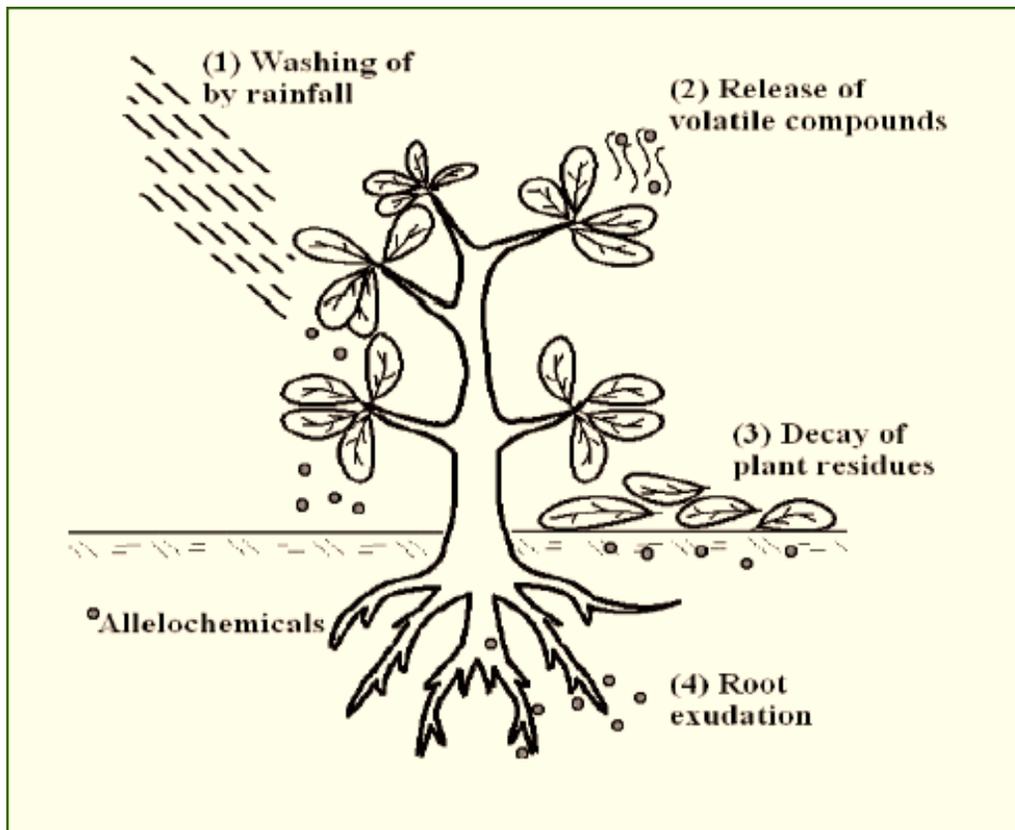


Figure 1. Possible pathways for release of allelochemicals into the environment (Sangeetha and Baskar 2015).

Are these allelochemicals harmful or helpful?

Allelochemicals can be harmful or helpful depending on the objective and species of cover crops. Some of these allelochemicals are potent enough to be considered nature's herbicide. Some of the greatest impacts are on germinating seeds, seedlings, and young plants.

The impacts include:

- retarding growth
- visible damage to roots or shoots
- possible death

Weed control is a positive objective when using a cover crop.

Allelopathic effects strong enough to contribute significantly to weed control in field conditions have been documented for cereal rye and other winter cereal grains, sorghums, and sorghum-sudangrass hybrids, brassica family, including rapeseed, mustards, and radishes. Other broadleaf species include buckwheat, and a legume species includes subterranean clover (Boydston and Hang 1995, Putnam and Tang 1986, Rice 1995).

Allelopathic substances and interactions can be plant specific. Cereal rye and its residues are quite active against weed species of pigweeds, lambsquarters, purslane, and crabgrass and far less against ragweed, sicklepod, and morning glories. Sorghums can suppress bermuda grass and nutsedge (Schonbeck 2015).

How long do these allelochemicals persist for weed suppression?

Weed suppression of small-seeded annual weeds can persist for a few weeks after the cover crop is terminated. If cover crop residue is left on the soil surface the residue can last for several weeks depending on weather conditions. In a no-till cropping situation the allelopathic effects are at the soil surface (Schonbeck 2015).

Are these allelochemicals harmful to the cash crop?

Cereal rye residue on the surface is responsible for suppression of weeds due to factors such as shading out sunlight for weed seeds and biomass accumulation on soil surface.

Susceptibility to allelochemicals is indirectly related to seed size based on research. Smaller seeds are more susceptible to the allelopathic chemicals of the plant. The large seed of corn and its deep planting depth should minimize the impact of allelochemicals released by the cover crop (Hartzler 2014).

What factors from a cereal rye cover crop can negatively affect corn?

The cereal rye residue on the surface alters the soil environment in a way that inhibits corn growth. The residue delays soil warming and drying, less favorable conditions for corn growth. The decaying cereal rye may tie up soil nitrogen if the soil is lacking in nitrogen. Under investigation is the possibility that cereal rye could be a host for pathogens that move to corn seedlings (Schenck et al. 2014).



What management factors can be recommended to minimize these negative effects?

Terminate cereal rye 10 to 14 days prior to planting corn. Terminating the cereal rye in the vegetative stage aids in breakdown and surface drying. This also helps keep Carbon and Nitrogen more in balance (C: N ratio of 24:1).

Mature cereal rye flowering and setting seed can have a C:N ratio of 80:1; which means soil microbes will find additional nitrogen to breakdown the excess carbon in the cereal rye. The microbes will consume more nitrogen to be in balance.

Use a corn planter with a nitrogen starter that is banded near the corn row to overcome nitrogen deficiencies at planting.

Soybeans can tolerate heavy amounts of cereal rye residue. Cereal rye does not need to be terminated early before soybeans.

Question on the information sheet contact: Jerry Kaiser USDA NRCS, Missouri, Plant Materials Specialist, jerry.kaiser@mo.usda.gov or Jodie Reisner USDA NRCS, Missouri, Conservation Agronomist, jodie.reisner@mo.usda.gov

References

Boydston, Rick A, and Ann Hang. 1995. "Rapeseed (Brassica napus) green manure crop suppresses weeds in potato (Solanum tuberosum)." *Weed technology*:669-675.

Hartzler, B. 2014. Cereal Rye Cover Crops, Allelopathy and Corn.

Putnam, Alan R, and Chung-Shih Tang. 1986. *The science of allelopathy*. John Wiley & Sons Inc.

Rice, Elroy Leon. 1995. *Biological control of weeds and plant diseases: advances in applied allelopathy*. University of Oklahoma Press.

Sangeetha, C, and P Baskar. 2015. "Allelopathy in weed management: A critical review." *African Journal of Agricultural Research* 10 (9):1004-1015.

Schenck, Lara, Thomas Kaspar, Thomas Moorman, Matthew Bakker, and Thomas Loynachan. 2014. "Winter rye cover crop effect on corn seedling pathogens." ASA-CSSA-SSSA Annual Meeting Abstracts.

Schonbeck, M. 2015. "How Cover Crops Suppress Weeds." eExtension <http://articles.extension.org/pages/18524/how-cover-crops-suppress-weeds>.