

Mustard Green Manures

Farmers and researchers are investigating several types of mustard for their ability to suppress soilborne disease, nematodes, and weeds, and to build soil quality. Described below are the practices typically used by farmers for mustard green manure crops in the Columbia Basin.

Types of Mustard

There are two types of mustard being used in the Columbia Basin, white mustard (*Sinapis alba*, also called Brassica hirta or yellow mustard), and oriental mustard (*Brassica juncea*, also called Indian or brown mustard). Commercial varieties are used to produce table mustard, oil, and spices. Blends of the two types of mustard, most with a high proportion of oriental mustard, are often planted for green manuring.

Uses

Farmers are using mustard green manures, mainly before potatoes, to:

- *Suppress soilborne diseases and nematodes:* When used as a green manure, researchers have found that mustards can suppress some diseases such as *Verticillium dahliae* and *Aphanomyces euteiches* (common root rot). Mustard green manures have also been found to suppress Columbia root-knot nematodes and may be effective against other types of nematodes, but until more research is done, mustard cover crops should be used to *enhance*, not eliminate, chemical control of nematodes. Fall incorporation seems to be best for control of nematodes and soilborne diseases and oriental mustard may be better for this use than white mustard. Research is ongoing.
- *Suppress weeds:* Weed control using mustard green manures has been variable. The level of suppression seems to depend on the combination of mustard type and weed species, and on the management of the green manure crop.
- *Biofumigation:* Reductions in the numbers of nematodes, disease problems, and weeds are

thought to be due in part to the presence of glucosinolates in mustards. When the crop is incorporated into the soil, the breakdown of glucosinolates produces other chemicals that act against pests. These chemicals are similar to the active chemical in the commercial fumigant metam sodium.

- *Improve soil quality:* Use of mustard green manure crops, with reduced tillage, has been found to increase infiltration rates and soil organic matter in a potato-wheat cropping system.

Crop Characteristics and Requirements

Soils

Tolerate saline soils as well as barley. pH 5.5–8.3

Temperature

Healthy mustard plants can withstand temperatures into the low 20s°F.

Herbicide Sensitivity

Mustards are sensitive to glyphosate as well as to 2,4-D and various other broadleaf herbicides. They may also be affected by carryover from herbicides used on previous crops.

Growth and Biomass

A mustard cover crop, planted in early to mid August, will generally be in full bloom by the end of September in the Moses Lake area. Cool temperatures in September and October usually prevent it from producing viable seed before it is incorporated or freezes in late October or November. With approximately 100–140 lbs available N and irrigation, mustards will produce up to 9,000 lbs of dry matter per acre.

Management

Seeding Rates

The following seeding rates are the minimum recommended rates for white mustard green manures. Seeding rates for oriental mustard, which has smaller seed, may be reduced by 1/3. Some producers are experimenting with higher seeding rates which will produce smaller stems and roots that decompose more quickly when incorporated.

Seeding Methods/Rates

- **Drilled:** Drill 8–10 lbs seed per acre through wheat straw using a minimum or no-till drill, or a drill with offset, double-disk openers.
- **Aerial seeding:** fly on the day before wheat harvest at 10–15 lbs/ac. Keep surface wet until crop has emerged after 5–10 days. Rolling and/or packing the field before irrigation will result in better stands.
- **Broadcast:** same rate as aerial seeding.

Wheat Straw

If possible when following wheat, leave the standing stubble to be incorporated with the mustard. This reduces the volunteer wheat emergence, avoids nitrogen immobilization by the straw and the resulting need for additional nitrogen, and may reduce winter leaching by immobilizing N released by mustard residues.

Seeding Depth

For quick emergence, which improves weed control, a depth of 1/8"–1/4" is recommended for center-pivot irrigated fields, or down to 1" where overhead irrigation is not available.

Seeding Dates

The optimal seeding time is during the second week of August; otherwise, up to the end of August. With current varieties, planting in July is not recommended, as the mustard will mature quickly and require early incorporation to prevent production of viable seed.

Varieties and Sources

Several varieties and blends of both types of mustard are currently available. Check with your local extension office for green manure trial results.

The mustards that are currently being used do not have hard or dormant seed. Cover crop varieties may not be acceptable for commercial purposes.

Seed Cost

\$2.00–2.40/lb. Commercial varieties may be less expensive, but may also be lower in glucosinolates. Ask your seed dealer.

Fertilization

Test soil to determine residual soil nitrate available to crop. For optimum growth, 120 lbs available N per acre total (100–140 range) is needed over the season, with sulfur at 6:1 N:S ratio. Early applied N will help the mustard compete with weeds and volunteer wheat.

Irrigation

To attain maximum benefits, maintain adequate soil moisture throughout growing season.

Weed Control

Because mustard does not compete well early, weed control may be needed. For best mustard growth, control the volunteer wheat and other grassy weeds with selective herbicides. Broadleaf weeds, like pigweed, that emerge at the same time as the mustard are difficult to control, although the mustard often outgrows the weeds. In addition, large weeds that may be left after wheat harvest should be controlled before mustard emergence. Check to see what herbicides are currently labeled for use with mustard.

Incorporation

Fall practices such as fumigation or irrigation water shut-off can dictate the timing of incorporation. For maximum biomass production, wait until late October to early November in the upper Columbia Basin, or 3–6 weeks before spring planting. Flail chopping followed immediately by disking to incorporate into top 6" of soil is recommended for maximum effects. Leave sufficient residue—mustard, straw, or both—where wind erosion may be a problem. Do not let soil dry out in the fall because this will inhibit breakdown of the incorporated cover crop.

Growers of mustards have a responsibility to either incorporate or otherwise kill plants which survive in fields or field borders to prevent potential cross-pollination with seed crops.

Compared with spring-incorporated cover crops, fall-incorporated mustards will scavenge less soil-N and therefore may result in nitrate leaching in some conditions.

Possible Problems

- *Insects*: There is the potential for increased soil insect populations after incorporation. Incorporate in fall or 4–6 weeks before planting spring crops to avoid these problems. In very mild winters, when the mustard does not winterkill, green peach aphids may overwinter on mustards. To avoid this, kill cover crop before spring warm-up.
- The effects of mustard green manures may vary due to differences in soil texture, organic matter levels, and quality; crop rotation; mustard variety and growth; initial pest levels; and other biological factors.

Other Resources

Cover Crop Fact Sheets: Sudangrass/Sorghum-Sudangrass Hybrids

Dale Gies System Profile

On-farm Research Results, 1999–2001, Dale Gies Farm

Using Green Manures in Potato Cropping Systems

This publication and those listed above are available online at <http://grant-adams.wsu.edu>.

Prepared by Andy McGuire
Ag Systems Educator
WSU Grant-Adams County Extension

Copyright 2003 Washington State University

WSU Extension bulletins contain material written and produced for public distribution. You may reprint written material, provided you do not use it to endorse a commercial product. Alternate formats of our educational materials are available upon request for persons with disabilities. Please contact the Information Department, College of Agricultural, Human, and Natural Resource Sciences, Washington State University for more information.

You may order copies of this and other publications from the WSU Bulletin office, 1-800-723-1763, or online at <http://pubs.wsu.edu>.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, national or ethnic origin; physical, mental or sensory disability; marital status; sexual orientation; and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local Extension office. Trade names have been used to simplify information; no endorsement is intended. Published April 2003. Revised October 2006. Subject codes 351, 353, 371, and 374. EB1952E
