

2004 Mustard Green Manure Field Day

The Benefits of Mustard Green Manures
And the Basics of Mustard Management

Also Sponsored by

- High Performance Seed, Moses Lake, WA.
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On-farm Research Results are available at
<http://grant-adams.wsu.edu>



The Benefits of Mustard Green Manures

1. Suppression of *Verticillium dahliae* in potato production equal to metam sodium fumigant
See research paper for details
2. Increased water infiltration
See research paper for details
 - a. Other soil quality improvements
3. Improved resistance to wind erosion
See handout for 2003 results
4. Nematode suppression
See handout of 2003 results
5. Potential benefits
 - a. Weed suppression
 - b. Nutrient cycling
 - c. Increased soil organic matter

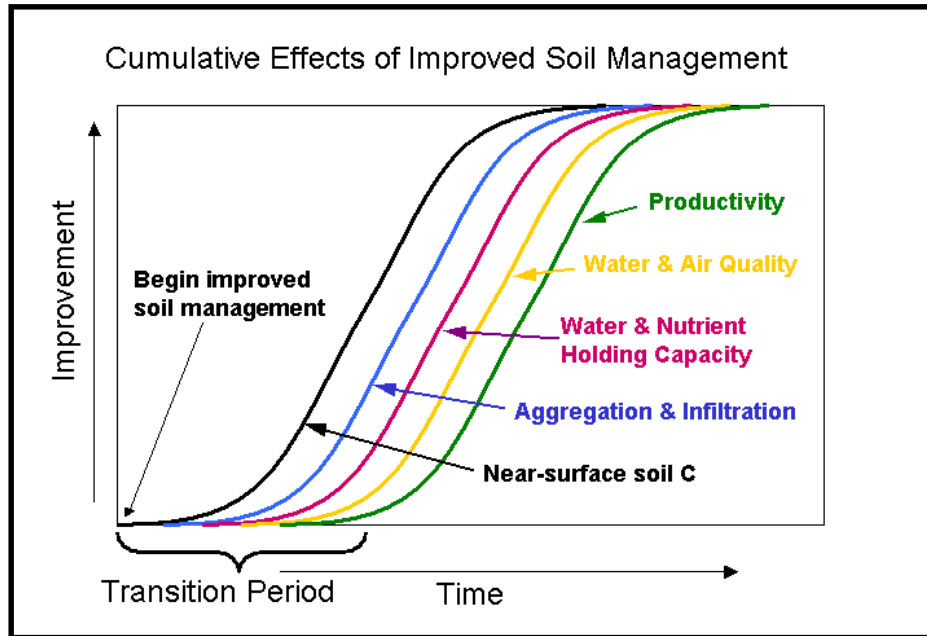
These benefits are the result of a mustard green manure that has been managed well (see management recommendations section). Poor management of the mustard or following crop can reduce or eliminate some or all of these benefits.

Cost of a Mustard Green Manure:

Item	Unit	Cost/unit	Quantity	Mustard cost/ac	Normal cost/ac ¹
Seed	lb.				
Planting	acre				
Fertilizer	lb.			C	
Herbicide	acre				
Irrigation power	acre-in				
Chopping	acre				
Disking/packing	acre				
Total:				A	B
				Mustard cost over normal practice:	
				Mustard cost over normal practice, without half of fertilizer costs:	
				Fumigant (metam sodium) cost:	
				Potential Savings:	
					A-B
					A-B-0.5C=D
					E
					E-D

¹ Costs normally incurred following wheat harvest

Benefits are Cumulative as Soil Quality Improves



Basics of Mustard Green Manure Management

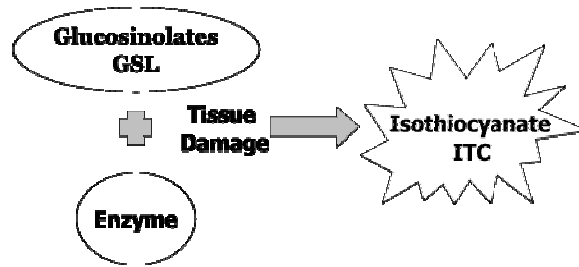
1. Incorporation Methods

a. Potential Mechanisms – See details in *Using Green Manures in Potato Cropping Systems* publication

i. Feed Beneficial Microorganisms

1. Green manure serves as an energy source
2. Beneficial microorganisms multiply and out-compete pathogens (*Verticillium*) for position in the rhizosphere OR they interfere somehow with the infection process of *V. dahliae*
3. Exclusion, or some other mechanism related to beneficial microorganisms, prevents infection

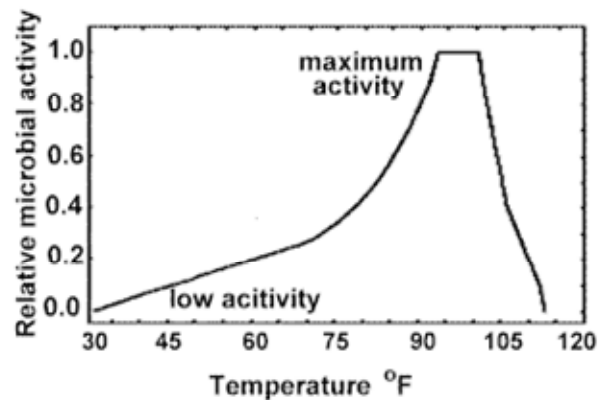
i. Biofumigation



1. Glucosinolates must be present
 - a. See variety selection below
2. Plant cells must be ruptured
3. ITCs must affect target pests

b. Timing

- i. Late incorporation dates *may* provide more benefits than early incorporation dates. Potential benefits of late incorporation:
 1. Postpone breakdown of green manure material



2. A hard frost, below ~25°F, will rupture many plant cells
 3. GSL to ITC reaction takes place more slowly
- ii. While there is no scientific data to support this, it may be beneficial to aim for a later incorporation date where it will not hinder other goals.
- iii. Incorporate mustard that has passed full bloom to prevent production of viable seed and to preserve green plant material.
- iv. Incorporate into moist soil.
- v. Start with planned incorporation date and work backwards about ~75 days (60 minimum) for target planting date, which generally should fall in August for the Columbia Basin.

- a. Methods
 - i. Flail chopping
 - 1. May not be needed if mustard experiences a hard freeze
 - 2. Breaks plant cells
 - 3. Slow operation
 - ii. Disking, once or twice
 - 1. As soon after chopping as possible. **Suppression of *Verticillium* is related to incorporation of fresh, green plant material, not dry crop residues.**

Mustard growers have the responsibility to incorporate or otherwise kill all mustard plants in their fields, and border areas, in the fall. This will prevent overwintering of insects on these plants and will prevent problems with the existing seed industry.

2. Mustard Growth – *See Mustard Fact Sheet for Details*

For maximum biomass, do not allow the mustard crop to be stressed due to lack of nutrients or water. If mustard is stressed, it will bloom early and reduce biomass production.

- a. N requirements: For optimum growth, 120 lbs available N per acre total (100–140 range) over the season.
- b. Thick stands of volunteer wheat can reduce mustard biomass production and should be killed using a selective herbicide.

3. Mustard Planting

a. Method:

- i. After wheat: Drill it into undisturbed stubble.
- ii. Benefits of not incorporating the wheat stubble:
 - 1. reduces the amount of N needed for the mustard
 - 2. reduces the volunteer wheat pressure
 - 3. may reduce the leaching potential over the winter
 - 4. may enhance soilborne disease suppression
- iii. To facilitate this:
 - 1. cut the wheat as high above the ground as you can
 - 2. spread the chaff as evenly as you can
 - 3. get mustard seed into the soil, if only 1/8". Then keep it wet until it emerges.
- iv. Other acceptable options:
 - 1. Flying seed on before wheat harvest
 - 2. Broadcast seed (with or without fertilizer) after straw removal or incorporation

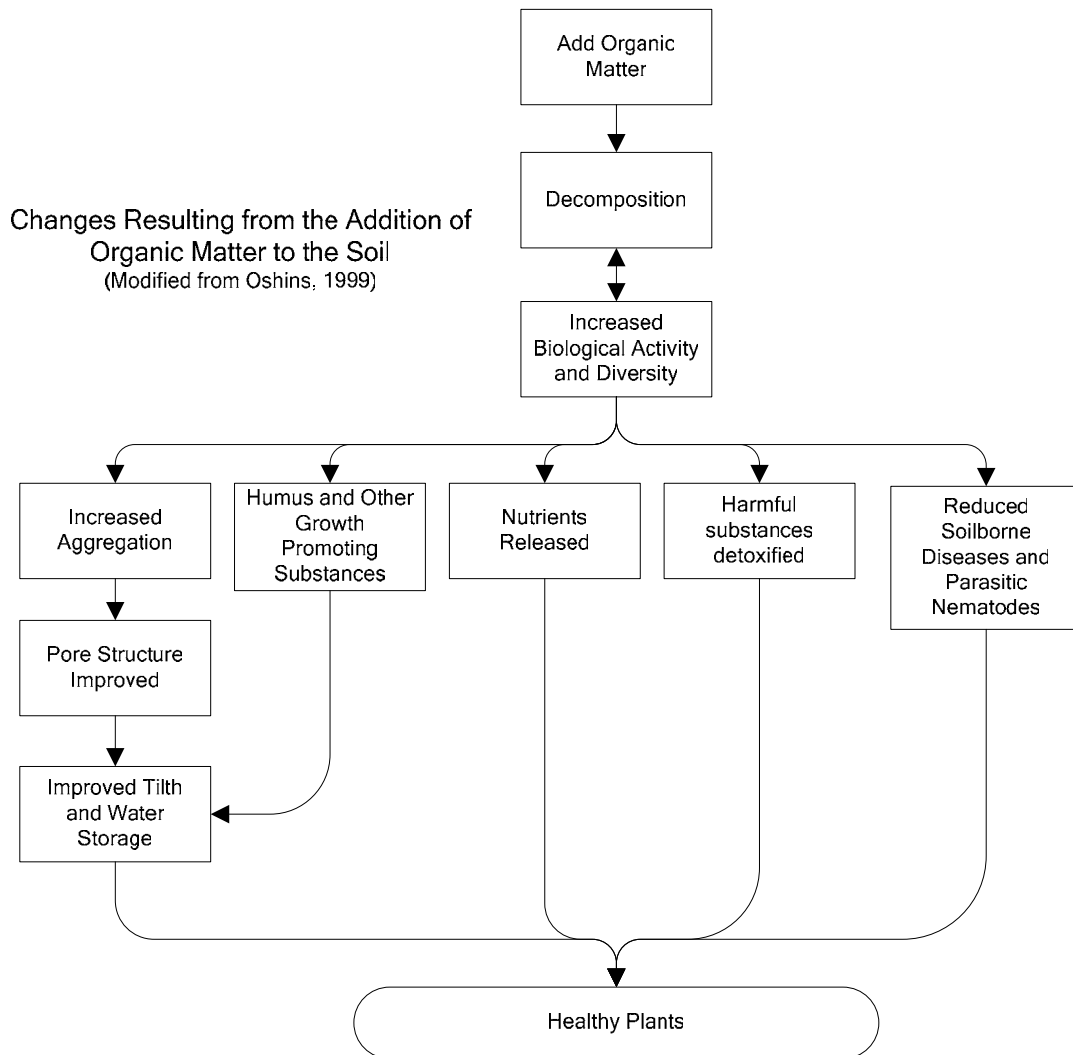
- b. Planting date: August is the recommended planting period, with the second week being optimum in most years for late-October incorporation.

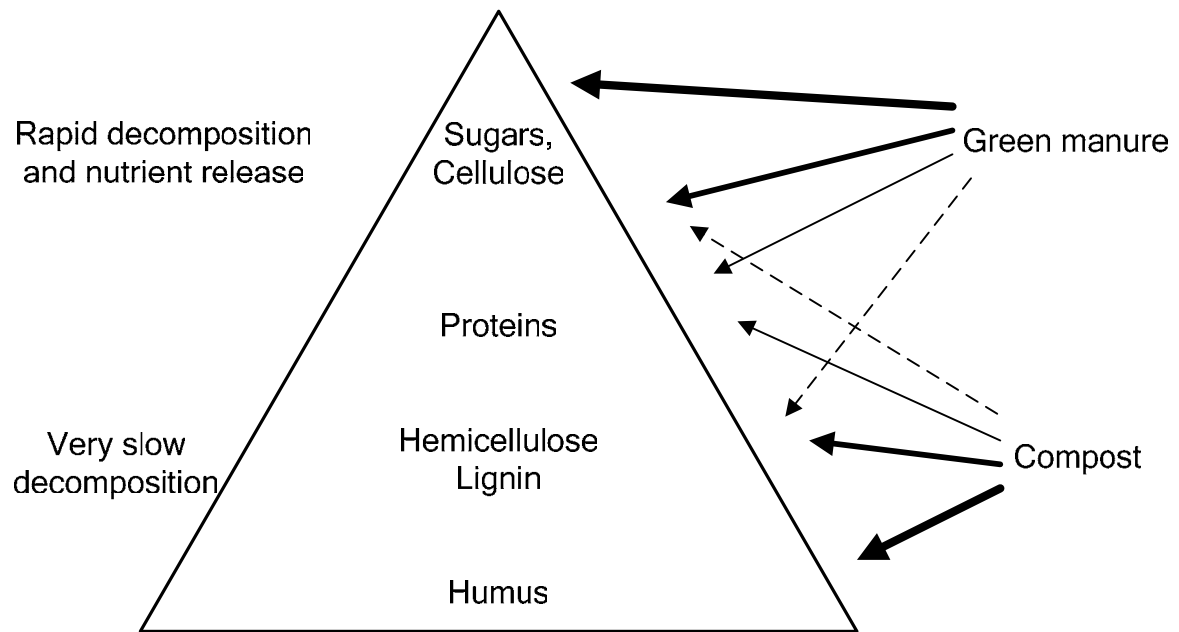
- a. Variety selection: *See Mustard Variety Trial data online*
 - i. What to look for:
 1. High biomass production
 2. High glucosinolate concentration
 3. Delayed bloom

Incorporating mustard green manures into a soil quality improvement plan

How to build soils for healthy crops:

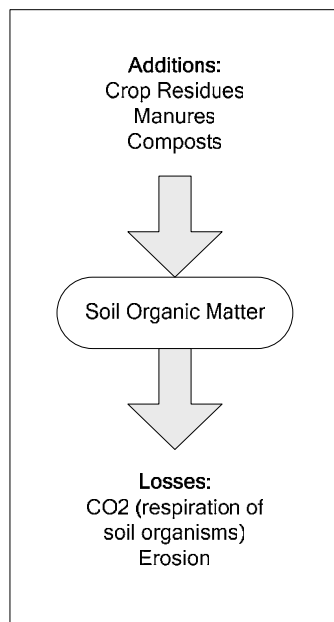
1. Add various types of organic matter
2. Conserve organic matter
3. Eliminate compaction





Effects on Soils of Different Types of Organic Matter (thicker lines indicate more material, dashed line indicates small percent of that type, modified from Oshins, 1999)

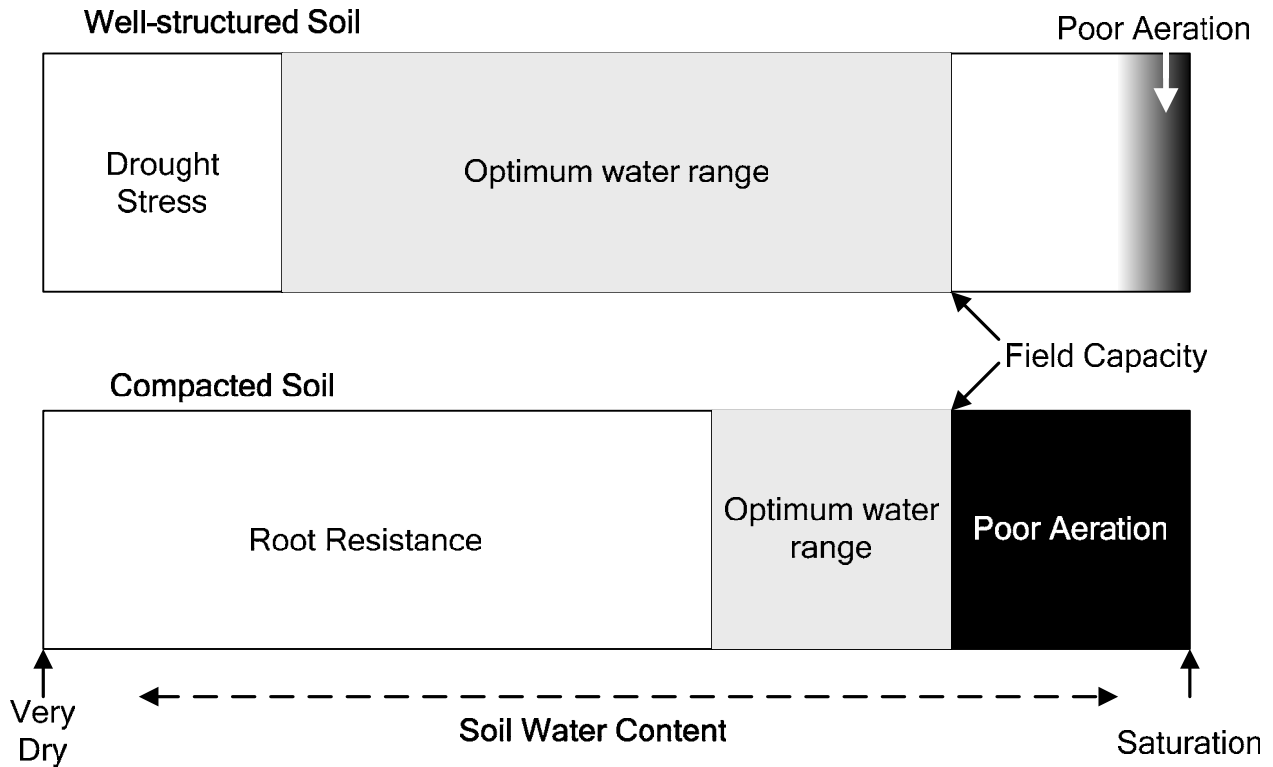
2. Conserve Organic Matter



Additions and Losses of Organic Matter from Soils

3. Eliminate Compaction

The Optimum Water Range for Crop Growth of Well-structured and Compacted Soils



New Activities

1. Fumigant replacement prediction from soil measurements
2. Wind erosion trials
3. Late vs. Early Incorporations (starting next year)