Potato Progress

Research and Extension for Washington's Potato Industry
Published by Washington State Potato Commission www.potatoes.com
Andrew Jensen, Editor. Submit articles and comments to: ajensen@potatoes.com

Volume II, Number 8 *July 26, 2002*

Response of the Soil Microbial Community to Soil Fumigation and Mustard Cover Crops

H. P. Collins, A. Alva, R. Boydston, A. McGuire, P. Hamm, E. Riga
Phone: 509-786-9250; hcollins@pars.ars.usda.gov

Cover crops may be an alternative to fumigation and mitigate losses to soil and environmental quality. Benefits of cover crops in annual production systems include decreasing soil erosion, sequestering excess soil nitrogen, replenishing soil organic matter reserves, suppressing weeds and nematodes, increasing the size and activity of the soil micro-flora, and enhancing microbial populations antagonistic to pathogenic organisms. The purpose of this project is to:1) Determine the effect of fumigation and cover crop inputs on the seasonal abundance, diversity, and biochemical activities of soil microbial communities; 2) determine N inputs, transfers and losses from potato production systems incorporating cover crops; 3) document the effect of cover crop residue inputs on soil organic matter dynamics. We present here some of our initial findings related to microbial characteristics.

In the initial year of this project (CY 2000-2001) we established cover crop field trials at the USDA-ARS field site near Paterson, WA. We also sampled and analyzed microbial characteristics of a commercial potato field that incorporated fumigation and mustard cover crops in rotation. Preliminary results from these field studies showed fumigation significantly reduced fungal populations but had only minor effects on bacterial populations with no significant loss in the microbial processes measured.

Results of analyses presented below represent time periods preceding and following soil fumigation with metam sodium. Soils at the USDA-ARS Paterson, WA site were fumigated in the fall of 2000 (metam sodium @ 30 gal/ac, Telone @ 15 gal/ac), the commercial field was fumigated in the spring of 2001 (metam sodium 37 gal/ac). There was no fumigation control plot on the commercial field.

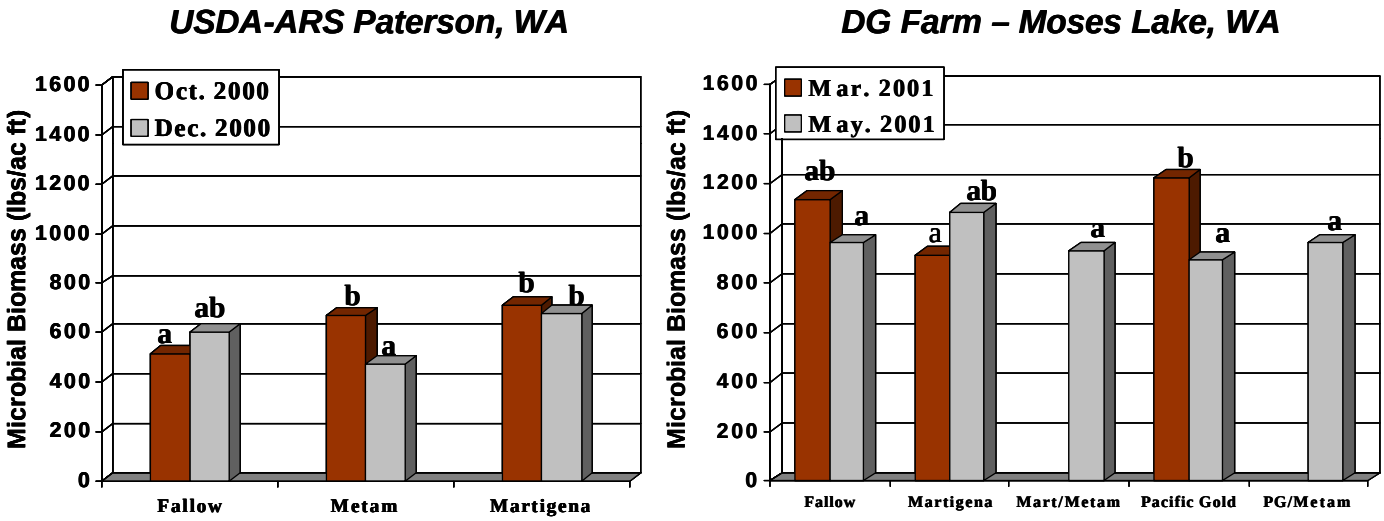
Soil microbial biomass is an important component of the soil environment that regulates the transformation and storage of nutrients and is a function of the soil organic carbon (SOC) content. Comparisons between sample sites are presented in Figure 1. Microbial biomass was 30% greater on the commercial field than the Paterson field trials for all treatments. This difference results largely from the level of SOC present at each site. At Paterson, SOC among the treatments averaged 9 T/ac, with microbial biomass representing 2.6, 3.5 and 3.5 % of the SOC for the fallow, metam, and mustard treatments respectively. On the commercial field SOC was 16 T/ac with microbial biomass averaging 2.8% of the SOC. Therefore, although SOC is greater on the commercial field the proportion of active microbial biomass is similar between sites.

Estimates of viable soil bacterial and fungal populations are shown in Figure 2. Bacterial

and fungal populations both show declines in numbers following fumigation and the incorporation of the mustard cover crop. But populations following the incorporation of mustard were still equivalent to or greater than the fallow plots. Soil fumigation significantly reduced viable soil fungal numbers. Changes in numbers of pathogenic fungi *Verticillium*, *Pythium*, and *Fusaria* are shown in Tables 1 and 2 for the USDA-ARS and commercial field sites.

Figure 3 shows the effects of soil fumigation (metam sodium) and mustard cover crops on N-mineralization potential in soils for the two sites. These data estimate the activity of the soil microflora based upon the conversion of organic sources of N to NO_3. The data show that fumigation with metam and bio-fumigation with mustards did not adversely affect the N-mineralization potential at either site.

Figure 1. Effect of soil fumigation (metam sodium) and mustard cover crops (Martigena and Pacific gold varieties) on soil microbial biomass in soils from the USDA-ARS Paterson field site and a commercial potato field. Plots were



fumigated November 16, 2000 at Paterson and April 30, 2001 on the commercial field.

Table 1. Colony forming units (CFU) of selected soil pathogens at the USDA-ARS, Paterson, WA field site.

		Pythium	*Verticillium*	*Fusaria*
			CFU's / g soil	
Oct. 2000 (Pre-Fumigation)	Fallow	97	10	5113
	Metam	11	4	1656
	Martigena	105	9	5098
Jan. 2001 (Post-Fumigation)	Fallow	106	11	5479
	Metam	0	0	120
	Martigena	30	6	4320

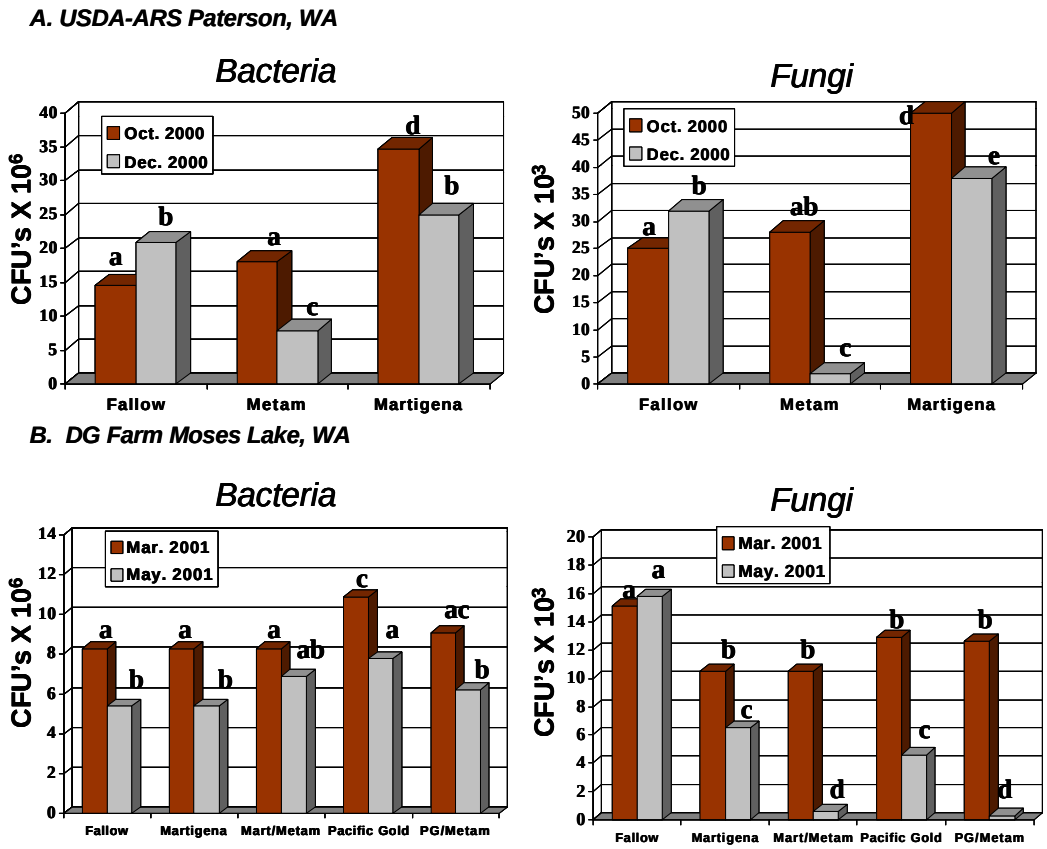


Figure 2. Effect of soil fumigation (metam sodium) and mustard cover crops (Martigena and Pacific Gold varieties) on bacterial and fungal counts for the USDA-ARS Parterson, WA (A) and commercial potato field (B.)

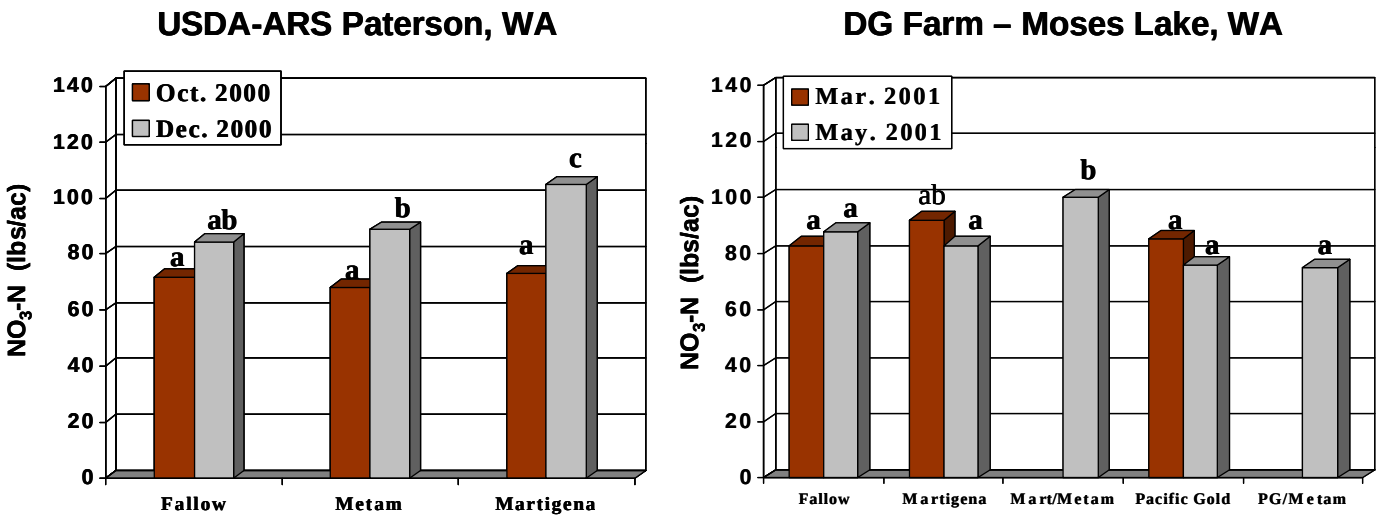


Figure 3. Effect of soil fumigation (metam sodium) and mustard cover crops (Martigena and Pacific Gold varieties) on N-mineralization potential in soils from the USDA-ARS Paterson field site and a commercial potato field. Plots were fumigated November 16, 2000 at Paterson and April 30, 2001 on the commercial field. (Mart/Metam - fumigated Martigena plots; PG/Metam - fumigated Pacific Gold plots). No soil samples were collected from the Mart/Metam or PG/Metam plots prior to fumigation.

Table 2. Colony forming units (CFU) of selected soil pathogens at the commercial (DG) field site,Moses Lake, WA.

Post Fumigation		*Pythium*	*Verticillium*	*Fusaria*
			CFU's / g soil	
April 4, 2001	Fallow	34	18	1929
	Mustard	30	22	1549
	Mustard/Metam	0	10	170
May 23, 2001				
	Fallow	6	22	1768
Pacific Gold	Non-Fumigated	23	21	1547
	Mustard/Metam	3	9	875
Martigena	Non-Fumigated	48	33	2108
	Mustard/Metam	7	16	1176

Phosphorus Fertility

In a recent issue of the Spudvine, Dr. Bill Bohl of University of Idaho gives his recommendations on tracking and maintaining adequate phosphorus nutrition throughout the season. The article can be seen at: http://www.if.uidaho.edu/~bingham/June%202002.pdf, or feel free to contact the commission office for a copy.

Field Day Dates

The following field days are still upcoming this season. Please contact the commission office for further information, driving directions, etc.

Eltopia - Potato Pest Management Field Day & hosted lunch, August 7, 10:00 AM.
Mount Vernon - Mount Vernon Field Day, WSU Research Unit, August 20, 4:00 PM.
Paterson - Specialty Potato Field Day, USDA-ARS Research Site, Sept. 12, 9:00 AM.