West Virginia University
Organic Research Farm

Field Day

Saturday, Sept. 16, 2006

Our mission is to conduct scientifically sound research designed to provide best-practice recommendations for organic farmers and home gardeners. This Field Day is part of our education and grower outreach efforts.

We truly hope you enjoy yourselves during your visit to the farm. Feel free to ask questions, walk around, or take pictures. Thank you for joining us and welcome to the West Virginia University Plant and Soil Science Organic Research Farm!

Be sure to sign on to our mailing list, and visit us on the web at: www.caf.wvu.edu/plsc/organic

Field Day Schedule of Events

1:00 Gates Open, Registration
1:10 **Workshops**
BioFuels and Energy Independence – Dr. Sven Verlinden
Insect Pests: Identification and Biology – Dr. Yong-Lak Park

1:40 **Break**

1:50 **Workshops**
Season extension-Making a longer growing season! – Natalie Baumgarner
Pasture Poultry Production – Dr. Joe Moritz
Making Money the Organic Way. - Dr. Gerard D'Souza

2:20 **Break**

2:30 **Workshops**
Sheep rotational grazing, and stuff. – Dr. William Bryan & Dr. James Gekara
AgrAbility- Tools to Help You Keep Farming! – Stacy Miller
Get More from Soil Test Results! Compost & Soil Fertility – Dr. Louis McDonald

3:00 **Break. Registration Continues**

3:20 **Welcome**: Dr. Barton Baker

3:30 **Wagon tours**:

<u>Tour A. Market Garden/Vegetable Production</u>

1. Season Extension. Natalie Baumgarner
2. Seed Emergence Trials. Hannah Schrum
3. Market Garden Systems. Dr. Sven Verlinden
4. Pumpkin Powdery Mildew and Pest Management Trials. Sheila Westfall

<u>Tour B. Field Crops, Sheep, Poultry, Weed Management</u>

1. Field Crop/Livestock Transition Systems. Dr. Bill Bryan, Dr. James Gekara
2. Poultry. Dr. Joe Moritz

4:00-6:00 Wagon Tours Repeat at approximately 30-minute intervals.
Plus, More Demonstrations, Free-Time & Self-guided Tours.

1. <u>Making Healthy Choices – The Organic Way.</u> Betty Forbes, RD, LD.
2. <u>Soil Microbiology</u>. Sherie Edenborn
3. <u>Organic treatments to improve seed emergence.</u> Dr. Jim Kotcon
4. <u>Creep Gates and Portable Fencing.</u> Dr. William Bryan

4:00 Exhibition by WVU Woodsmen Team

6:00 Dinner-Prepared by WVU Plant and Soil Sciences Club, and Dr. Joe Moritz.

7:00 Adjourn

Tour A. Market Garden/Vegetable Production

Market Garden Systems

Dr. Sven Verlinden, Assistant Professor of Horticulture;
Natalie Baumgarner – Graduate student;
Evan Anderson & Brittany Brevard – Undergraduate student interns

Transition systems for vegetable production are compared in this large market garden (0.5 acres). A low-input system uses on-farm resources, mainly green manure crops, to develop soil quality and sustain vegetable production. A high-input system depends on a combination of off-farm (10 tons per acre dairy manure/leaf litter compost) and on-farm resources (green manure crops) to build soil quality and maintain a sustainable level of crop production. The market garden consists of 32 plots measuring 16 by 50 feet. The low- and high-input treatments consist of 16 plots each, with 4 replications of a four-year crop rotation. Plots in the market garden are rotated among four plant families including legumes (peas and beans), leafy vegetables (spinach and lettuce), solanaceous crops (peppers and tomatoes), and curcurbits (zucchini and pumpkins).

The market garden project was started in 1999. In the first year the low input plots were not used for vegetable production but were cover-cropped with various green manure crops. High input plots were put into vegetable production from year one. Subsequent years both low and high input plots were used for vegetable production.

Weed Management Research in Bell Pepper and Potato

Dr. Rakesh S. Chandran, Extension Weed Specialist and IPM Coordinator;
Dr. James Kotcon, Associate Professor of Plant and Soil Science
Sheila Westfall & Amanda Rack, Undergraduate student interns

Roller Application of Vinegar

Field experiments were conducted in 2006 to evaluate a novel application technique using vinegar to manage weeds in bell pepper and potato. Our previous research indicates that vinegar containing acetic acid at concentrations >15 % were effective for control of young (<3-inch-tall) actively grow8ng weeds. However spray drift to crop rows resulted in localized injury at varying levels. To reduce crop injury vinegar was applied using an 18-inch roller between pepper and potato rows. While weed control was achieved, this technique resulted in using high volumes of vinegar per unit area. Application was unwieldy after the hilling operations in potato. Repeat weekly or bi-weekly applications were necessary to keep weed populations at a satisfactory level. Weeds growing in close proximity (< 5 inches) to the crop plants were not controlled. A modified wiper in combination with hand cultivation may be required and will be tested in 2007. As in the past, weed control was best using black plastic mulch, resulting in highest yields.

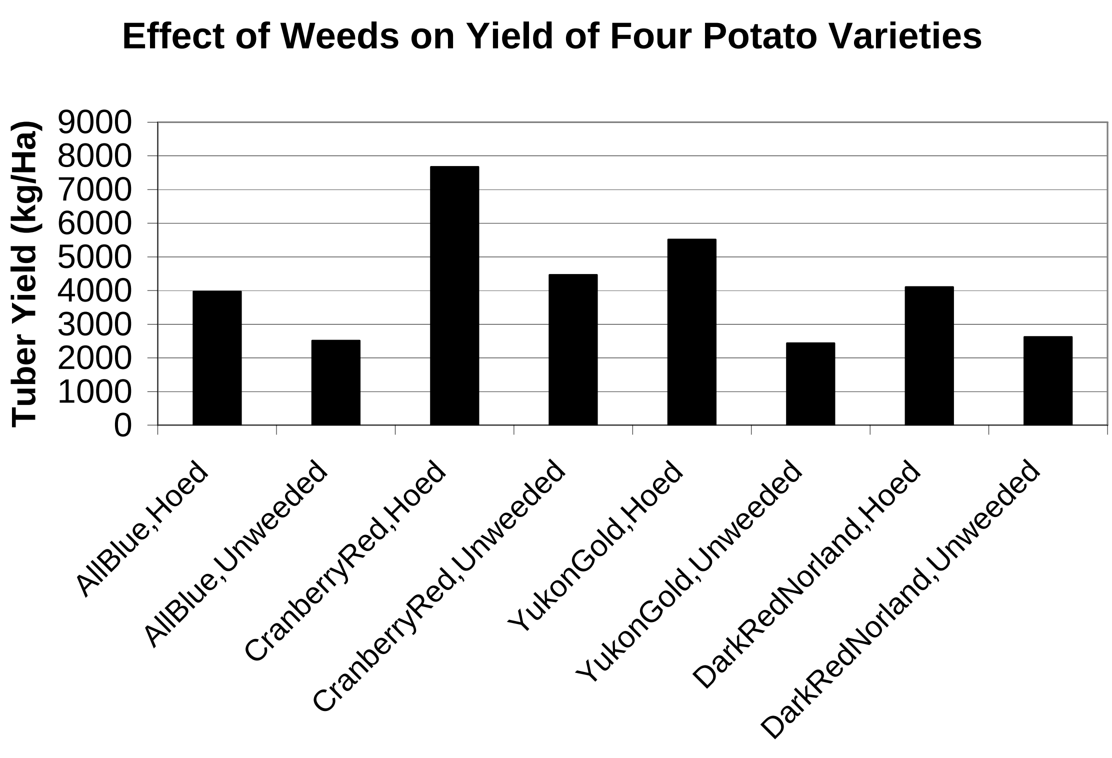
Weeder Geese

Use of geese for weed control was evaluated in potato. Geese were penned in plots for 48 hours at 4, 6 and 8 weeks after planting. Geese preferred grasses to broad leaved weeds, but grazing intensity was quite variable as geese preferred young seedlings to mature weed plants. Geese were not observed to graze on potato plants, but tended to trample potato plants during wet weather. Due to trampling, potato yields were lower than in un-weeded control plots.

Treatment	Weed Biomass (kg/m^2)	Yield (kg/Ha)		Yield (Cwt/Acre)
Unweeded	21	2620	bc	23
Geese	22	996	c	9
Vinegar, 1 Spray	23	3088	ab	28
Vinegar 2 Sprays	20	3039	ab	27
Vinegar Wipe	19	1660	bc	15
Hand Weeded	9	4105	a	37

Tolerance of Potato Varieties to Weeds

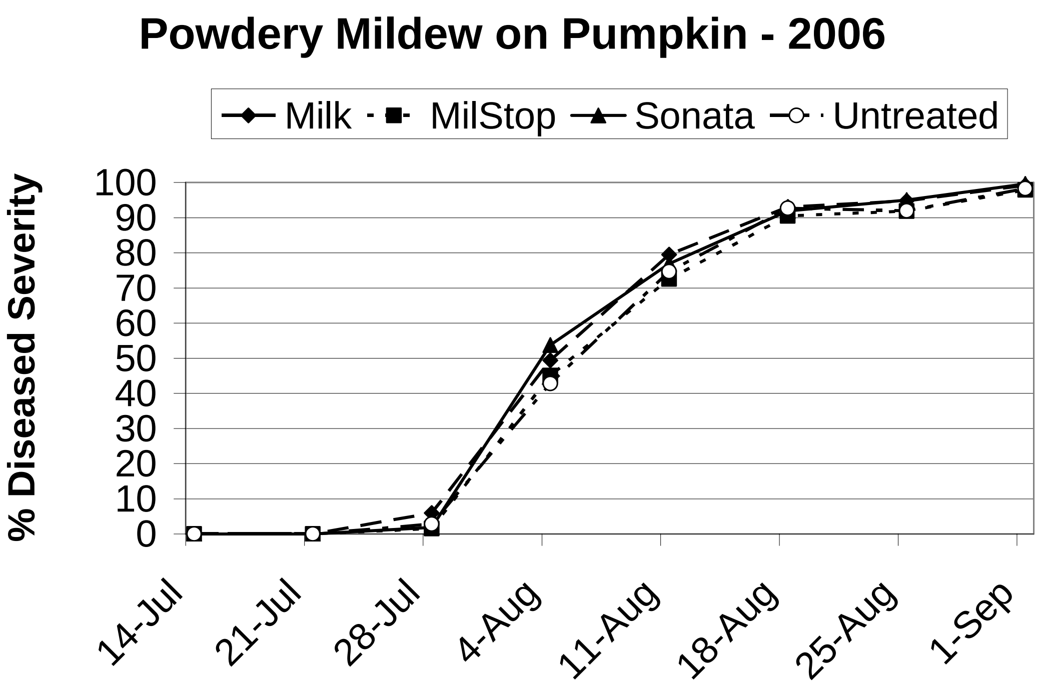
To evaluate whether potato varieties differed in their tolerance to weed pressure, four cultivars were grown in replicated plots that were either hoed regularly, or left unweeded all season. Yields of Cranberry Red were greater than all other varieties. Yields of Cranberry Red, Yukon Gold and Dark Red Norland were significantly greater in hoed plots than in unweeded plots, but differences for All Blue were not significant. The poorest yields occurred with Yukon Gold in unweeded plots and Yukon Gold also had the highest incidence of decayed tubers. If labor is limited, priority for hoeing should be given to varieties with the largest yield responses, i. e., Cranberry Red and Yukon Gold.



Disease Management

Powdery Mildew of Pumpkin

Powdery Mildew is a fungal disease of leaves that starts as a light mildew, but kills foliage prematurely. The disease also results in stem decay and breakage on fruits, decreasing the value of pumpkins for market as Jack-o-lanterns. Four plots each were treated with weekly sprays of Sonata (Bacillus pumilus), MilStop (potassium bicarbonate), 10 % whole milk, or tap water (untreated) beginning July 14. Disease was assessed weekly, and yield and fruit quality were determined at harvest, Sept. 7. Few significant differences were observed among treatments, although leaves treated with MilStop tended to have less disease than other treatments at the end of the season ($P<0.10$). No statistically significant differences in fruit yield were found. Plots treated with Sonata had the lowest number and weight of fruits, but also had the least stem decay or breakage. Plots treated with milk had the greatest amount of decayed fruits ($P<0.03$).



Treatment	Fruit Number[a]	Total Weight[b]	Stem Rating[c]	Powdery Mildew (AUDPC)[d]
Milk	4.5	12	1.2	422
MilStop	4.0	12	2.0	399
Sonata	3.0	10	2.2	419
Untreated	5.0	15	1.6	403

a Number of fruits per plot (6x9ft plots with 2 hills, 3 plants per hill).

b kg fresh weight at harvest.

c Stem Quality rated as 0 = missing, 1 = decayed, 2 = discolored from infection, 3 = healthy, green and solid.

d AUDPC = Area Under the Disease Progress Curve, cumulative percentage of the foliage with symptoms based on weekly ratings for 6 weeks.

Tour B. Field Crops, Sheep, and Poultry

Field Crop/Livestock Systems

Dr. William Bryan, Professor of Agronomy; Dr. James Kotcon, Associate Professor of Plant Pathology; and Mark Satterfield, Research Assistant.

Organic systems of field crop production are compared in this study. A Low-input system uses on-farm resources, developing soil quality by growing green manure crops for 1 year, followed by field crop production. The High-input system produced crops the first year by using 10 tons/acre of dairy manure compost to build soil quality. Crops in the 4-year rotation include: potato, forage soybean, wheat, cowpeas, and forage rapeseed.

In addition, high- and low-input systems are compared with and without livestock as part of the farming system. 'Without-livestock' plots are cropped continuously in a 4-year rotation. 'With-livestock' plots include 3 years of red clover/orchard grass as hay or pasture as part of the 7-year rotation. Additional hay and pasture fields are maintained as part of these treatments (see below). Yield, soil quality, and pests are monitored to evaluate the farm management systems. Whole farm budgets are compared to assess economic returns. Sheep are used as the livestock with separate "herds" for low and high input farming systems.

Organic Lamb and Wool Production

Basweti, E, Graduate student; Gekara, J.O., Post-doctoral Fellow; and Bryan, W.B., Professor of Agronomy; Division of Plant and Soil Sciences, WVU.

Sheep for lamb and wool production are raised on organic grassland and managed according to the National Organic Program rules. Three grassland areas (blocks), dominated by tall fescue, orchard grass and red clover, were chosen based on the soil characteristics, slope and previous management. These blocks were then divided into two equal areas and two experimental treatments were implemented:

High input treatment: Dairy manure compost was applied at 13.5 tons/ac (122 lb total N/ac) in April 2000 and at 5 tons/ac (29 lb total N/ac) in April 2003. The stocking rate in 2006 is 3.4 ewes and 5.6 lambs per acre.
Low input treatment: No compost was applied to these plots. The stocking rate is 3.0 ewes and 4.7 lambs per acre.

The area assigned to each treatment is divided into three usages, namely, pasture, buffer and hayfields. These fields are further subdivided into paddocks. Pasture fields are grazed during the growing season (April to October); hayfields are used for first and second cut hay and aftermath grazing while buffers can be used as hay or pasture depending on need. The experiment includes cropped fields, some of which are in crops and some in temporary grassland, sheep also graze these.

During the 2006 grazing season, we introduced a creep gate to ensure access of lambs to high quality forage at all times. We also reduced the stocking rate on both high and low input treatments, compared to previous years (in 2005 stocking rate was 4.3 ewes and 6.9 lambs, and 3.4 ewes and 5.1 lambs per acre for high and low input treatments, respectively). Additional sheep on the farm graze non-experimental areas and along the perimeter fence to help control brush and weeds.

This project addresses two major challenges in raising organic sheep:

Internal parasites

Buildup of internal parasites is a major threat in organic sheep production because no synthetic drugs are allowed. The WVU Organic Research Farm has adopted a rotational grazing management, which entails, at most, three days occupancy on a paddock and at least 54 days pasture rest before the next grazing. This strategy is used to break the life cycle of common internal parasites.

Fertility of the soil

Harvesting and removal of forage takes nutrients from the soil. Composted manure supplied some nutrients to high input plots. Grazing sheep recycle nutrients through their excreta. The swards are also managed to encourage clover to fix biological N. In both treatments, soil nutrients are recycled through sheep excreta and N fixation by legumes in the sward.

Sheep inventory (2002-2006)

	2002			2003			2004			2005			2006		
	T[a]	D	S	T	D	S	T	D	S	T	D	S	T	D	S
Ewes	30	2	0	28	1	0	27	2	0	43	4	0	59	4	0
Ewe lambs	0	0	0	0	0	0	15	0	0	22	2	0	20	3	0
Lambs	39	0	39	38	0	21	42	3	15	62	25	17	75	17	2
Replacements	0	0	0	15	0	0	23	1	0	20	0	0	0	0	0
Rams/wethers	1	0	0	3	0	0	4	0	0	5	1	0	5	1	0
Total	70	2	39	84	1	21	111	6	15	152	32	17	159	25	2

[a]T = Total, D = Deaths, S = Sold/removed

Lamb data

	2002	2003	2004	2005	2006
Lambing %	130.0	135.7	155.6	152.5	131.6
Avg birth wt (lb)	10.0	11.1	9.0	10.1	10.4
Avg weaning wt (lb)[a]	70.1	66.2	53.2	67.2	53.5
Avg sale wt (lb)	81.0	78.0	73.5	68.5	

[a]From 2002 to 2005 lambs were weaned in August, in 2006 they were weaned in June

<u>Organic Poultry Research:</u> Synthetic methionine and feed restriction effects on performance and meat quality of organically reared broiler chickens.

N. P. Buchanan, A. S. Parsons, N. J. Baker, Graduate students, Dr. O. J. Gekara, Post-doctoal Research Associate; Dr. W. B. Bryan Professor of Agronomy; and Dr. J. S. Moritz, Assistant Professor of Animal Science.

Overview - The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil, plants, animals and people (Petaluma Poultry, 2003). Organically-reared poultry are fed certified organic feed without synthetic additives, grown at low bird density and have access to outdoor paddocks. Production of organically-reared poultry is a niche market that commands a premium price.

Research Problem - Organically-reared poultry offers an antibiotic/drug free alternative for consumers that address animal welfare concerns. Organically-reared poultry also have been reported to possess higher omega-3 fatty acid content and a more firm meat texture. Despite the aforementioned benefits of organically-reared poultry, increased cost may affect consumer acceptance. Little is known about the nutrient requirements of organically reared poultry that have access to forage. A better understanding of feeding requirements and strategies may lessen organic poultry production cost and/or retail price.

The use of synthetic methionine is controversial in organic poultry production. Methionine is an essential amino acid that can not be produced by the bird in adequate amounts to support growth, thus it must be supplied to poultry in the diet. Poultry have a high methionine requirement and corn-soybean based diets (typical poultry diet ingredients) are low in methionine, therefore poultry require an alternative source of methionine to maximize growth. Use of synthetic methionine in organic feed has been criticized because methionine is used to increase growth and not bird health. It also does not promote “sustainable agriculture” due to chemical extraction associated with synthetic methionine production. Poultry may be able to partially meet their methionine requirement through sources of forage. Research concerning the removal of synthetic methionine from corn-soybean based diets that are to be provided for organically-reared birds does not exist.

Results summary – Over the past two years, our research laboratory has found that birds fed diets without synthetic methionine can obtain acceptable performance if given pasture access. Environmental conditions have been demonstrated to influence feed intake thus nutritional status. The only negative effect associated with removal of synthetic methionine was a decrease in breast yield when birds were reared in summer months (72^{o}F mean temp and 83% humidity) likely due to a lower feed intake.

Data Table. Performance data of organically reared broilers and negative control broilers in summer months (21-56d).

	Bird LWG[G] (kg)	Per Bird FI[H](kg)	FE[I] (kg/kg)	mg Met/g gain[I]	g CP/g gain[J]	Mortality (%)
NO-MET 100[A]	2.590[ab]	5.495[a]	0.471	7.6[b]	0.398	0
NO-MET 50[B]	1.377[d]	2.885[c]	0.470	7.7[b]	0.399	1.67
MET 100[C]	2.647[a]	5.449[a]	0.486	8.2[a]	0.392	0
MET 50[D]	1.234[e]	2.632[d]	0.477	8.4[a]	0.400	0
NO-MET (non-pastured)	2.444[c]	5.191[b]	0.475	7.6[b]	0.402	2.50
MET (non-pastured)	2.517[bc]	4.991[b]	0.502	8.0[ab]	0.374	0
ANOVA P-value	0.0001	0.0001	0.2096	0.0064	0.1346	0.4449
LSD[F]	0.123	0.243	--	0.440	--	--

[A] No Methionine – ad libitum intake
[B] No Methionine – 50% intake of the ad libitum group
[C] Methionine – ad libitum intake
[D] Methionine – 50% intake of the ad libitum group
[E] Indoor birds were raised at similar indoor densities with a similar lighting program as birds that were reared organically; however, indoor birds did not have access to pasture.
[F] Fischer's Least Significant Difference value
[G] Live Weight Gain
[H] Feed Intake
[I] Feed Efficiency (gain:feed)
[I]mg of analyzed dietary methionine per g of weight
[J]g of analyzed dietary crude protein per g of weight

Demonstrations

Organic Treatments to Improve Seed Emergence

Synthetic fungicides are prohibited on organically certified seeds, thus a variety of seed rots and seedling disease may reduce seedling emergence and result in poor stands, especially in wet soils. Four commercially available biological seed treatments, three organic soil amendments, and two cultural practices were compared to untreated controls to evaluate seed emergence in pea, spinach, green beans, and sweet corn. Actinovate ® (Streptomyces lydicus), MycoStop ® (Actinomyces sp. Strain K61), PlantShield ® (Trichoderma harzianum) and Kodiak ® (Bacillus subtillus) were applied at label rates (5 g, 2.3 g, 1.7g and 0.14 g per pound of seed, respectively. In spinach, PlantShield was applied as a 5 g/100 gallon spray. A mature dairy manure compost was applied in the furrow using approximately 1 gallon per foot of row to create a bed into which seeds were planted. Fish emulsion was applied in a band over the row 14 days before planting at 60 ml/foot of row. Compost tea from a dairy manure compost was brewed passively without aeration for 48 hours and applied as a soil drench at planting and at two and four days after planting at 100 ml per foot of row. Pre-sprouted seed was pre-germinated for 48 hours at room temperature in moist paper towels and planted without other amendments. Ridge planting was achieved by tilling a 15-cm high ridge and planting seeds at the top of the ridge. Dairy manure compost was broadcast over all plots except those receiving the in-furrow compost, fish emulsion, or compost tea, at 10 tons per acre and incorporated by rototilling. Plots consisted of a single row planted with 50 seeds spaced at 2 inches apart for peas, spinach and beans, and at 4 inches for sweet corn.

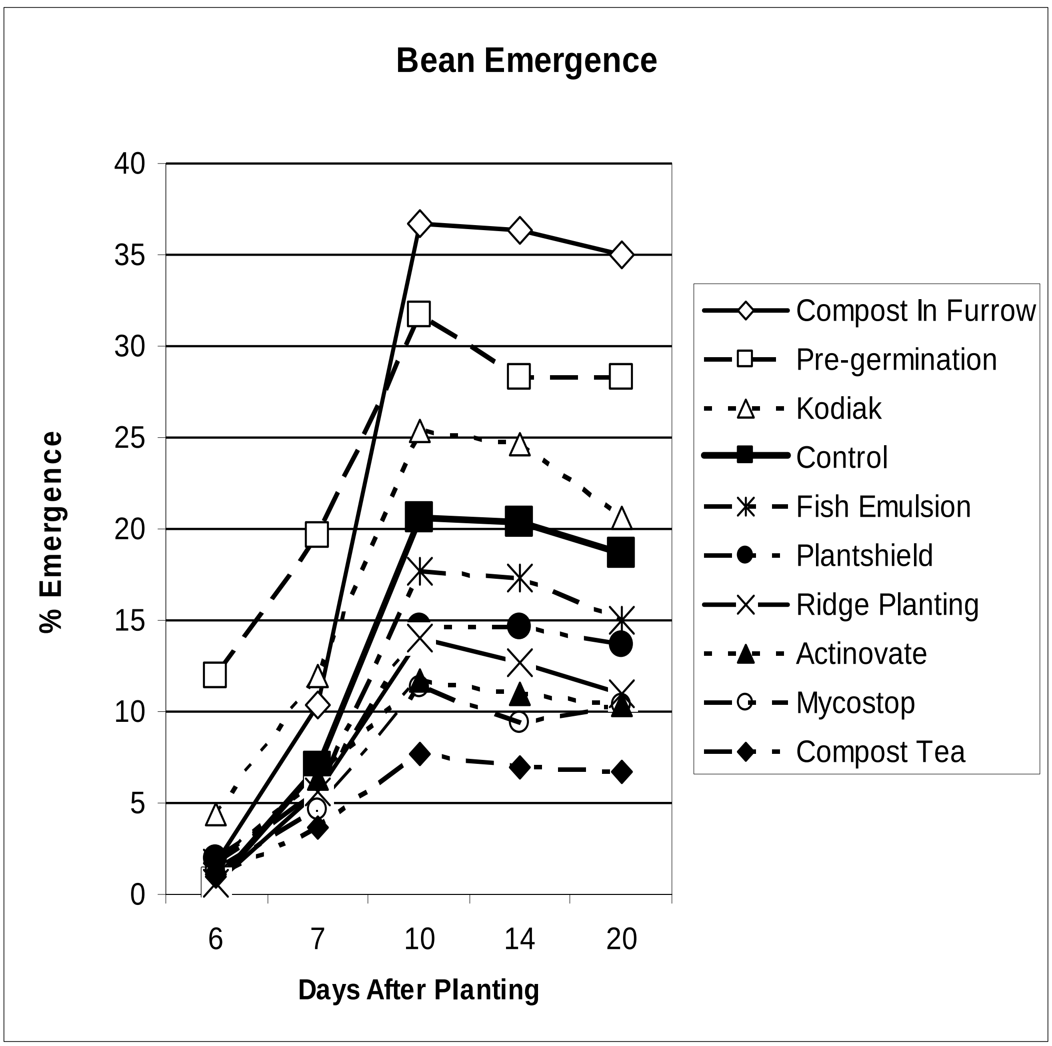
Irrigation was applied at planting and at two and four days to assure wet soils favorable for seedling diseases. Seed emergence was counted at regular intervals beginning when seeds emergence was first observed and continuing through 20 days after planting. Peas and spinach were planted May 23, beans and sweet corn on June 9. Yields of green beans and sweet corn were determined, however survival of peas and spinach was too low for meaningful yield data.

Seed rots were primarily associated with infection by fungi such as Pythium and Fusarium. None of the plots treated with commercially available biological seed treatments had emergence that was significantly different from untreated controls. Pre-sprouting seed tended to result in the earliest emergence. Seeds planted in the in-furrow compost treatments consistently had the highest emergence in all four crops, and the emergence was significantly greater than controls in peas and beans. Plots receiving the compost tea drench consistently had the lowest emergence, and this was significantly lower than the controls in some crops. Yields followed the same trends, and significant differences among treatments were observed for both beans and sweet corn.

While pre-sprouted seeds tend to emerge earliest, post-emergence damping off frequently reduced plant populations to levels not different from controls, especially in peas and spinach. It is not clear whether the compost tea drench was directly toxic, or merely resulted in excessively wet soils that were more conducive to disease. The improved emergence in seeds planted in the compost in-furrow treatment may have been due to disease-suppressive microbial activity from compost, improved nutrition, or improved water drainage and aeration for seeds in this medium.

Treatment	Sweet Corn Emergence[a]	Sweet Corn # Ears[b]	Peas Emergence[a]	Spinach Emergence[a]	Bean Yield[c]
Actinovate	14	14	8.7	0	2238
MycoStop	17	22	8.3	0.7	2668
PlantShield	20	28	10.7	1.3	3572
Kodiak	19	21	10.0	1.3	3733
Compost In Furrow	20	30	16.7	0.7	6252
Fish Emulsion	21	28	7.7	0	5218
Pre-Sprout Seed	21	22	15.3	1.0	4863
Compost Tea Drench	17	8	2.3	0.3	1291
Ridge Planting	17	12	6.0	0.7	3239
Control	13	18	10.0	1.0	3798
LSD[d]	9	17	7	n.s.	2500

a % of seeds emerged at 20 days after planting.
b Number of ears per 100 feet of row
c Kg per hectare, total of four harvests.
d LSD = Least Significant Difference



Soil Microbiology.
Sherie Edenborn

A tremendous array of bacteria are important in breaking down organic matter, degrading toxic chemicals, building soil structure, and recycling nutrients in soil. Many of these organisms have never been identified, but nevertheless continue their quiet work improving soil quality.

Making Healthy Coices – The Organic Way
Betty Forbes RD, LD, Dietetics Internship Program Director; Jason Nguyen, Nettie Puglisi, and Melissa Weber, Graduate students and Dietetics interns, Division of Family and Consumer Sciences.

Discover how to read organic and natural food labels. Sample organic and conventional foods to determine if you can tell the difference. Take our fun quiz and register for a prize.

Creep Gates and Portable Fencing.
Dr. William Bryan

Organic Farm Day Dinner Menu 2004

Organic Roasted Chicken
Potato salad
Roasted Zucchini
Zucchini bread
Cheese slices
Apples
Water, Lemonade

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