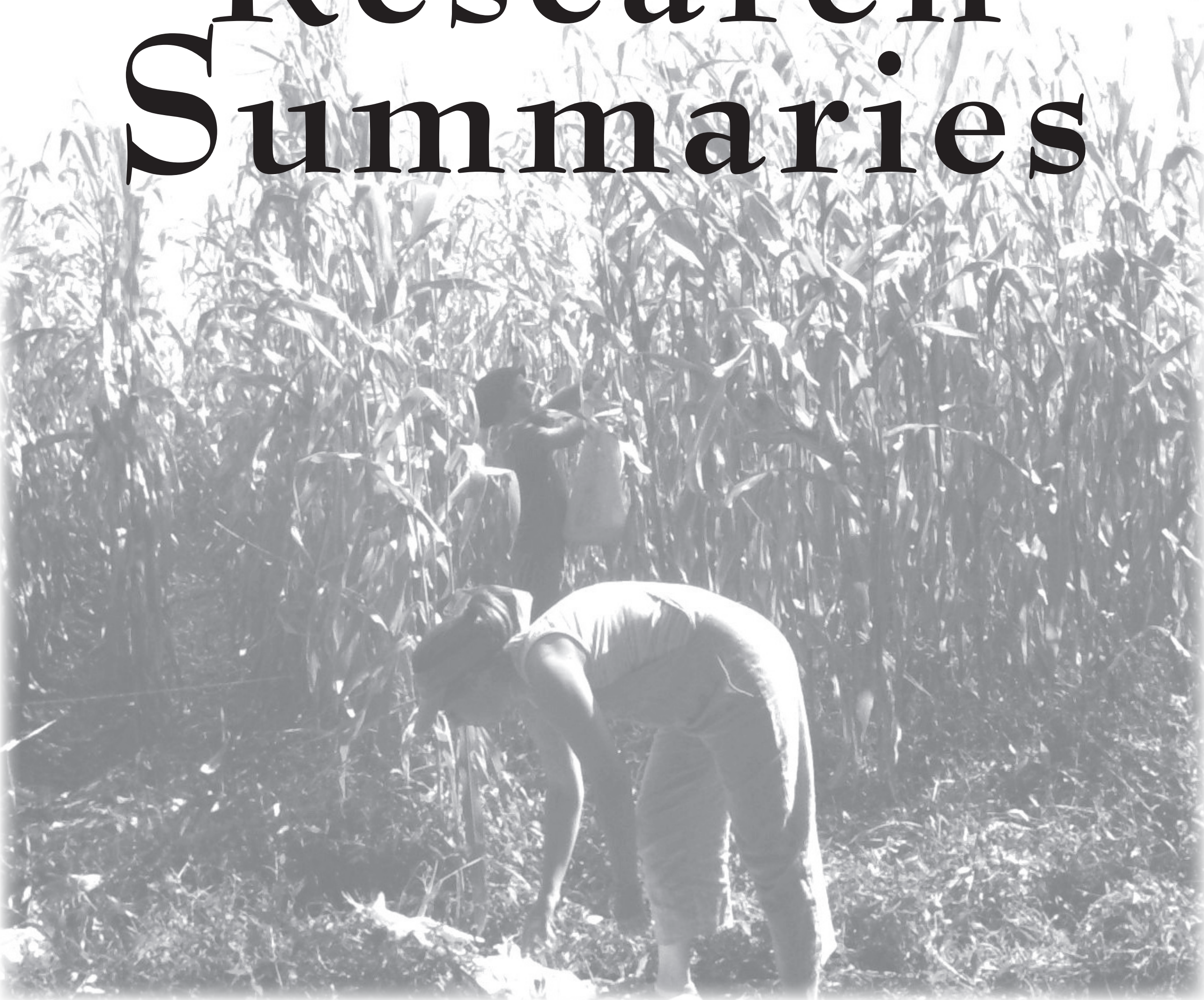
Midwest

Organic Research Symposium

Feb. 21-23, 2008

Held in conjunction with the 2008 Organic Farming Conference

Research Summaries



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Midwest Organic Research Symposium

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Front photo: Rodale Institute no-till corn research,
summer 2007. Photo by Jody Padgham

Organic Research Symposium

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No-Tillage Organic Soybean Production in Winter Rye for Improved Weed Management in South Central Wisconsin

Authors: Emily Bernstein[1], Josh Posner[2], Dave Stoltenberg[3], Janet Hedtcke[4]

Objectives

The goal of this research is to increase the understanding of the agronomic and economic risks associated with the use of fall-seeded rye (*Secale cereale L.*) as a mulch in no-tillage, organic soybean (*Glycine max L.*) production systems. Specific objectives are to determine the effects of plowdown rye versus roller-crimped rye on soil moisture availability, soybean stand establishment, weed suppression, and soybean yield. In addition, the risks associated with row versus drill seeding of soybean are being compared. The results presented in this report are from the first year of the experiment, and this research will be continued in 2008 and 2009 at the R&G Miller and Sons farm and at the University of Wisconsin Arlington Agricultural Research Station.

Treatments

Plowdown rye (planted 11/08/06):

1. Rye cover crop plowdown (5/17), secondary tillage, wide-row (30") soybeans (planted 5/22), mechanical weed management.
2. Rye cover crop plowdown (5/17), secondary tillage, false seedbed, wide-row soybeans (planted 6/1), mechanical weed management.
3. Rye cover crop plowdown (5/17), secondary tillage, false seedbed, narrow-row (7.5") soybeans (6/1), mechanical weed management.

Crimped rye (planted 11/08/06):

4. Rye crimping (6/1), wide row soybeans (6/1), no mechanical weed management.
5. Rye crimping (6/1), narrow row soybeans (6/1), no mechanical weed management.

Results

Plowdown rye (treatments 1-3):

• It was difficult to incorporate the rye in May due to its height (2 feet) and shoot biomass (1.2 tons DM/acre). It was chisel-disked and then required disking four times in order to prepare an adequate seedbed. The rye residue provided 36% ground cover.

• The soybean stands from the early (5/17) and late (6/1) soybean plantings were very poor (33-42% of the planting rate) due to seed corn maggot damage.

• Spring 2007 was dry; May rainfall was 1 inch, which is only 25% of the long-term average. Few weeds emerged after plowing the rye and prior to planting soybean in treatments 2 and 3 so no false seedbed weed management was done.

• Initial weed densities at the time of soybean planting were low (1 weed/ft^2) in all three treatments, but increased substantially at the time of soybean emergence (10-13 weeds/ft^2). Even with in-crop weed management (2 tine weedings and 1 or 2 cultivations), wide-row soybeans (treatments 1 and 2) did not compete well with heavy weed pressure associated with poor soybean stands, such that two replicates of treatment 2 were abandoned. In the narrow-row soybeans (treatment 3), where less mechanical weed management was possible (3 tine weedings only), all four replicates were abandoned due to heavy weed pressure.

• Early-planted soybeans (treatment 1) yielded 17 bu/acre, but hand-weeded checks within this treatment yielded twice as much, 34 bu/acre. The two remaining replicates of the late-planted wide row treatment (treatment 2) yielded 13 bu/acre.

Crimped rye:

• It was difficult to successfully flatten the rye on June 1 (4 feet tall, 2.1 tons DM/acre) with only one pass of the crimper, so the rye was crimped twice. The crimped rye provided excellent (98%) ground cover.

• Poor soybean stands were also a problem in the crimped rye; (85% of the planting rate in wide-row soybeans (treatment 4) and 56% of the planting rate in narrow-row soybeans (treatment 5).

Continued

Planting was difficult and seedling emergence was somewhat delayed due to the thickness of the mulch

• Weed density was low (< 0.3 weed/ft^2) in both the wide- and narrow-row soybeans until late summer, when the density increased (1 weed/ft^2). The rye mulch provided substantial suppression of weeds with weed biomass reaching only 25% in wide-row soybeans (treatment 4) and 10% in the narrow-row soybeans (treatment 5) of the weed biomass in treatment 1.

• However, the soybeans were less vigorous in the crimped rye. Although water availability in the upper 8 inches of the soil profile was similar between crimped rye and plowed rye treatments, the soybeans grew slower, and tissue nutrient analysis indicated that manganese was lower and possibly deficient.

• Yield of wide-row soybeans (treatment 4) was 23 bu/acre and narrow-row soybeans (treatment 5) was 30 bu/acre.

Preliminary Conclusions

Soybean stand: Seed corn maggots, which reduced the soybean stand, were most likely attracted to the recently plowed decomposing rye residue. If rye is used as a winter cover crop, it should be plowed as early as possible in the spring to avoid this outcome. If rye is crimped and left on the surface as a mulch, it can be difficult to plant through, so downpressure on the drill and seeding rate should be adjusted.

Plowing vs. crimping rye: The treatments with crimped rye mulch had greater ground cover, less weed pressure, and greater yields compared to the plowdown rye treatments.

Wide-row vs. narrow-row soybean spacing: When rye was plowed and mechanical weed management was used, wide-row soybeans yielded more and had fewer weeds than narrow-row soybeans. In contrast, when rye was crimped to provide a high-residue mulch, narrow-row soybeans had a greater yield and fewer weeds than wide-row soybeans.

Soybean vigor: Soybean vigor was a concern in the crimped rye treatments; experiments in 2008 will probe this phenomenon and address the affects of fall-applied dairy manure in this system.

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Cover Crop Management with Specialty Equipment for Organic No-Till

Jeff W. Moyer[1] and Dave Wilson[2]

The Rodale Institute has designed a unique farming system that makes it possible to incorporate the benefits of no-till technology into an organic farming strategy. This system, based on sound biological principles, uses intensive cover crop management and a specially designed piece of equipment, i.e. a roller/crimper. Using this system, organic no-till field operations for corn production are reduced from previous nine under plow-till to two with the roller/crimper. Data compiled in 2007 based on field operations during the 2006 growing season have shown strong results in both corn and soybean crops. The organic no-till corn yield of 10.1 t ha^{-1} was greater than the yield of 8.9 t ha^{-1} from the standard plow-till organic corn and 7.1 t ha^{-1} from non-organic chisel-plow systems. The goal is to crimp the stems and lay them flat. Timing is the key for termination of cover crops and termination at full flowering gave the best results. If the cover crop was rolled too early while the plant is still in a vegetative growth stage it will bounce back green and vigorous. Although challenges have been encountered with cover crop timing, moisture dynamics and planter engineering, the best results have shown corn and soybean yields outperforming organic-plow-till and conventional controls.

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The Effect of an Organic No–Till System on Organic Corn, Soybean and Tomato Weed Management and Production

Kathleen Delate[1], Andrea Mckern[2], Mark Rosmann[3]

Introduction

The Rodale Institute began experimenting with an organic no–till plus system in 2004, where commercial crops (corn, soybean, pumpkin) were no-till drilled or planted into cover crops that were rolled with a roller/crimper. The roller consists of a large steel cylinder (10.5 ft wide x 16 in. diameter) filled with water to provide 2,000 lb. of weight. The Rodale Institute supplied Iowa State University with a roller in 2005 for this experiment. Cover crops were planted on September 12, 2005, and on October 31, 2006, and consisted of three treatments: a control (no cover crop/tillage used after planting); a cover crop combination of winter wheat (56.25 lb/acre) and Austrian winter pea (18.75 lb/acre), and a cover crop combination of rye (64 lb/acre) and hairy vetch (32 lb/acre). The cover crops were rolled with a roller/crimper rear–mounted on a tractor on May 25, 2006, and on a custom front-mounted tractor on May 22, 2007. Plots planted to the wheat and pea mix were rolled two times, while those in the rye and hairy vetch mix were rolled 2 to 3 times. The corn and soybeans for the experiment were drilled on the same day as rolling, the soybeans (BR 3F43) at 160,000 seeds/acre and the corn (BR 67M07) at 32,000 seeds/acre. Nine six–inch 'Roma' tomato seedlings were planted in three replications of each treatment on June 15, 2006, and on June 4, 2007. Transplants were side-dressed with 0.5 lb/plant of hoop-house compost when transplanted.

Weed populations were enumerated in tomato plots in a one–square–meter quadrat at three randomly selected areas within each plot on four occasions each year. Fruit number data were taken on four dates throughout the season by counting the number of fruit on each plant. Plant populations were taken in soybean and corn plots three weeks after planting. Corn and soybean plant height data were taken by measuring the height of 10 randomly selected plants in each plot on August 29, 2006. Tomatoes were irrigated throughout the season compared to no irrigation in corn and soybean plots. Tomato disease samples were taken and confirmed at the Iowa State University Plant Disease Clinic, Ames, Iowa.

Tomatoes were harvested on five occasions in 2006 and 2007 by selecting all red fruit measuring ≥3 inches on nine plants per plot. Fruit was graded on a scale of 1 to 3, with 1 the highest grade (according to grading for organic tomatoes received at local markets). Soybeans were harvested on October 31, 2006, and corn was harvested on November 1, 2006, with a combine.

Results and Relevance for Organic Systems

Germination of cover crops was excellent in 2005 and in 2006. In 2006, the rolling was conducted when small grains in the cover crops were in the dough stage–headed out but not fully developed. This was in contrast to 2007, where the cover crops were crushed at an earlier stage–at anthesis (pollen shedding in the small grains). The cover crop crushed down well enough in 2006, but then proceeded to come back up into place, thus negating a "crushed" cover where the corn and soybeans would be planted. Improved crushing was observed in 2007. Much of the cover crop, however, returned to the original upright position. The most unfortunate event that followed planting in both years was the extremely limited rains through June and July. The cover crop continued to grow but the corn and soybeans suffered from drought and competition for moisture with the cover crop. In 2007, more moisture in July helped the soybean crop, but not the corn.

The tomato performance, however, was excellent, because of irrigation. Tomatoes in both cover crop treatments grew well but the tilled treatment and the rye/hairy vetch tomato plants were taller than those in the winter pea/wheat treatment. Although there were no differences in flower number, fruit number tended to be greater in the tilled treatment in July and August, when fruit numbers averaged 43 tomatoes per plant. Disease symptoms appeared in July and were diagnosed as Septoria leaf spot. Despite an overall low rate of disease (less than 8% of plants affected), and no significant differences among treatments, the tilled treatment tended to show less affected leaves than the cover crop treatments.

Continued

Both cover crop treatments were excellent in providing weed suppression (Table 1). The main difference in weed populations between the tilled (control) and rolled cover crop treatments occurred early in the season, when weed management was most critical. The winter pea/wheat treatment provided greater management of grass weeds early in the season (July 20) but because of high weed variability, differences among treatments were not significant (Table 1). This effect was reversed at the second sampling date (August 14) when there were higher levels of grass weeds in this treatment. Although there was no significant difference in yield between cover crop and tilled treatments (Table 2), there was a trend toward greater fruit harvested in the rye/hairy vetch versus winter pea/wheat treatment. Yields ranged from 355,579 fruit/acre in the winter pea/wheat treatment to 497,875 fruits/acre in the tilled treatment. Over the six harvest dates, fruit number was greatest in the tilled treatment on September 5, but harvests were greater in the cover crop treatments at the end of the season (September 26). This result corresponds with other reports where cover crop treatments permit a longer harvest period than a conventional crop. Tomato quality was high in all treatments, with an average of 84% in the highest grade (Table 2). There was no difference among treatments in No. 1 tomatoes, but a greater number of No. 2 tomatoes in the tilled treatment.

Corn and soybean yields in the rolled cover-cropped treatments were not successful in 2006 (averaging 90 bu/acre and 15 bu/acre, respectively) because of the drought. Plant height was 15 in. shorter in the cover crop treatments. The 2007 crops will be harvested on October 18; at this stage, the control crops appear to be the highest yielding but the soybeans following hairy vetch/rye look promising too. The organic No-Till system needs greater refinement before recommending as a broad-scale approach for all regions.

Table 1. Tomato weed populations in cover crop treatment trial, Neely-Kinyon, 2006.

Treatment	Weed Populations (weeds/ m^2)					
	July 20, 2006		Aug 14, 2006		Sept 13, 2006	
	Broad-leaves	Grasses	Broad-leaves	Grasses	Broad-leaves	Grasses
No Cover	16.00b	18.44	0.11	0.85a	0.56	1.22
Rye and Hairy Vetch Cover	1.22a	10.78	0.11	0.82a	0.22	0.67
Wheat and Winter Pea Cover	0.89a	7.89	0.11	17.52b	0.11	0.78

Table 2. Yield and tomato quality in cover crop treatment trial, Neely-Kinyon, 2006.

Treatment	Yield(fruit/acre)	Tomato quality (%)		
		No. 1	No. 2	No. 3
No Cover	497,875	79.53	9.13b	11.34
Rye and Hairy Vetch Cover	441,731	87.74	5.26a	6.99
Wheat and Winter Pea Cover	355,579	85.34	7.14ab	7.52
LSD 0.05	NS	NS	2.74	NS

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Weed Control Using a Propane Burner

Erin C. Taylor, Karen A. Renner, and Dale R. Mutch

Controlling weeds by use of a propane burner (or flamer) has been an option that some have considered, few have tried, and even fewer have succeeded in doing well. Those that do try using a flamer often go about it by trial and error due to a lack of information regarding the implement. The following areas were studied to begin to better understand how to best use a propane flamer for organic weed control.

Flaming vs. Rotary Hoeing

There has been some debate as to whether using a flamer can improve weed control. Over the past two years we have cooperated with a grower in Michigan to compare flaming, rotary hoeing, and a combination of the two for weed management in soybean.

Table 1. Field calendar.

Year	Planting	Flaming	Rotary Hoeing	Cultivation	Hand Weeding
2006	5/28	6/2	6/2, 6/3, 6/5, 6/8, 6/9	6/13, 6/20, 6/28, 7/8	7/18
2007	5/18	5/24	5/30, 5/31, 6/6	6/7, 6/12, 6/21, 6/30	7/21

In 2006, we observed that flaming (either alone or in combination with the rotary hoe) reduced giant foxtail populations. When hand labor was included, the flaming only treatment was the most cost effective (Table 2). Hand weeding took longer in the rotary hoe only treatment due to increased weed populations.

In 2007, flaming did not significantly reduce any one weed species compared to rotary hoeing and over all was not as effective as in 2006. There are a number of reasons that could explain this observation, including the lack of a soil crust at flaming, and less that half the rainfall of 2006. The most cost effective treatment for 2007 was the rotary hoe only.

Over both years it appears that the most stable option is to both flame and rotary hoe.

Table 2. Price of weed control per acre (i.e. diesel fuel, propane, and hand labor costs).

Year	Rotary Hoe Only	Burner Only	Burner + Rotary Hoe
2006	$54.45	$45.79	$47.75
2007	$34.93	$53.56	$42.42

Tractor Speed for Flaming

Tractor speed directly affects the effectiveness and the cost per acre of flaming. Slow speeds will increase weed exposure to the flame, but will increase fuel costs and can cause excess heat to build up on the equipment, especially the tires. High speeds are less costly but potentially less effective.

This 2007 trial was designed to determine the optimum speed to flame for weed control in soybean. Plots were flamed once at speeds ranging from 3.5 to 5.5 mph and were then uniformly rotary hoed three times (see Table 1 for planting, flaming, and rotary hoeing dates). Flaming at 4 mph treatment contained the least number of weeds, though there was no overall difference (Figure 1, next page). This trial will be repeated during the 2008 growing season.

Flaming and Humidity

The presence of dew can reduce the heat levels reaching the surface of the weed during flaming and reduce the level of weed control. We measured the effectiveness of flaming at four different times throughout the day, for weed control in corn. In the morning the air temperature was lower and the humidity higher than later in the day. We repeated the study at a second site two days later.

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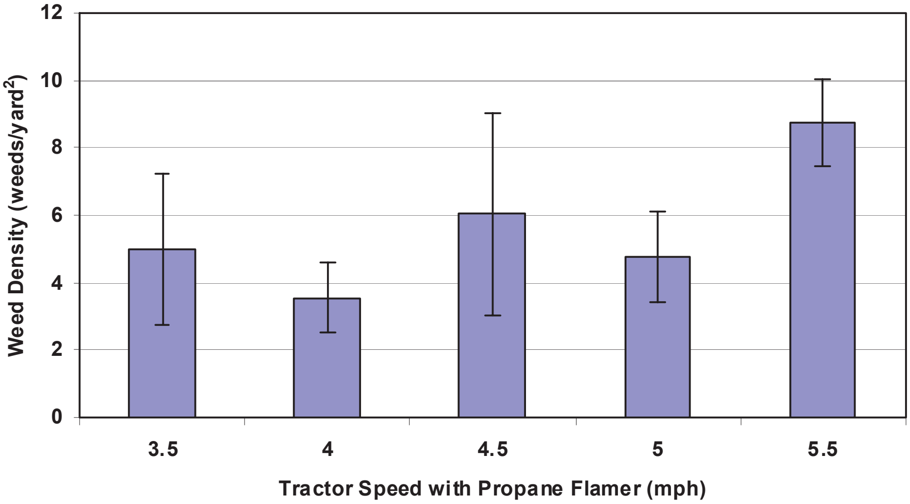

Figure 1. Weed density after early season weed control and one cultivation pass for the five propane flamer speed treatments.

All plots had reduced weed populations after flaming at both sites. At site 1, there was no statistical difference in weed control due to the time of flaming (data not shown). Flaming at noon reduced weed densities at this site by 46%. At Site 2, the noon and 4 p.m. treatments reduced weed densities compared with the 8 p.m. treatment (Figure 2, below). The differences in flaming effectiveness at Site 2 do not appear to be explained by humidity since the greatest changes in relative humidity did not produce distinguishable results. All of the flaming treatments had more weeds (an average of 15 per ft^2) than the rotary hoe treatment (2.5 per ft^2). Flaming was more effective in controlling velvetleaf, pigweed, and common lambsquarters than the grasses (large crabgrass and giant foxtail).

One month after the flaming and rotary hoeing treatments were completed, there was no difference in weed densities among timing treatments (averaging 6 weeds/ft^2) or between flaming and rotary hoeing treatments (1.5 weeds/ft^2).

Overall we found that flaming mid-day when temperatures are highest and relative humidity is lowest resulted in the best weed control with a propane flamer. This experiment will be repeated in 2008.

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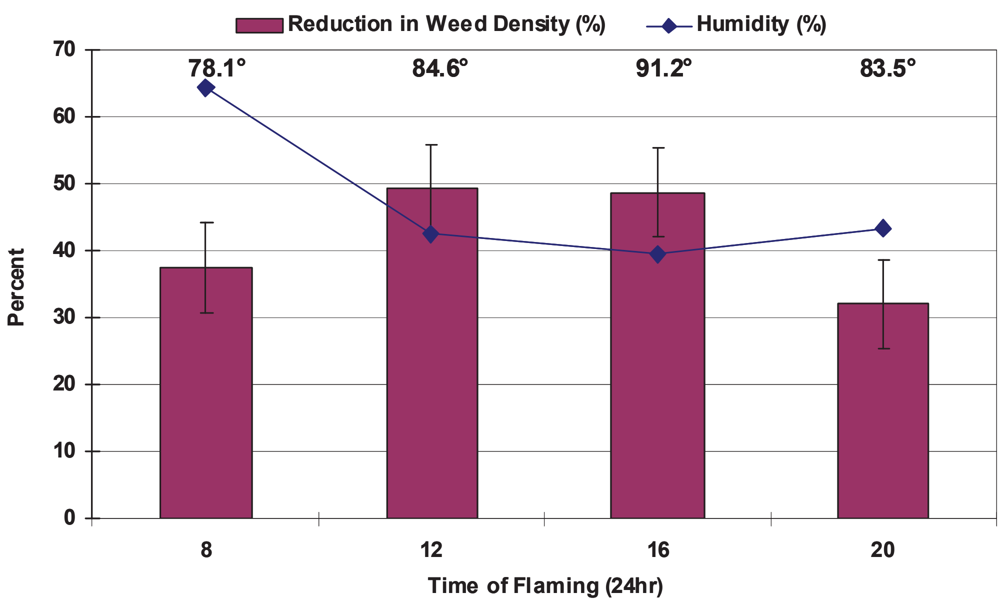

Figure 2. Reduction in weed density, relative humidity, and temperature as a function of flaming time for site 2.

Management of Canada Thistle with Summer Annual Cover Crops and Mowing

Abram Bicksler[1] and John Masiunas[2]

Canada thistle (*Cirsium arvense*) is a vigorous, creeping perennial weed that forms dense patches. There are few options to manage Canada thistle in organic cropping systems. Tillage creates propagules from the deep, fibrous root system, further spreading the problem and causing larger patches. It can take many years of intensive mowing to suppress thistle. Fall-seeded, winter annual cover crops are ineffective against Canada thistle. Warm season annual cover crops grow when Canada thistle root reserves and ability to regenerate are low and when seedlings first emerge. Competitive summer annual cover crops may prevent thistle growth, flowering and seedling establishment. In preliminary research, Sudangrass reduced Canada thistle while cowpeas alone did not. Combining Sudangrass and cowpea may reduce thistle populations while supplying legume-derived nitrogen for subsequent crops.

In preliminary research, Sudangrass reduced Canada thistle while cowpeas alone did not.

In 2006, field studies were conducted on organic farms and the University of Illinois Cruse Research Farm using established patches of Canada thistle. Prior to planting cover crops, we tilled to kill emerged thistle, slice the upper roots into small pieces, and prepare a good seedbed. The cover crop treatments were no cover crop (weedy fallow), buckwheat, Sudangrass, and Sudangrass + cowpea. The cover crop treatments were mowed either none, one or two times. Cowpea could not compete with Sudangrass and most cover crop plants in the mix were Sudangrass.

Even without treatment, the number of Canada thistle shoots decline over the growing season. This decline in number of shoots in a patch of Canada thistle is natural and is likely due to failed establishment, competition between thistle plants, and pest attack. Cover crops and mowing acted independently to reduce thistle patches. At 3 months after planting cover crops, thistle was 21 and 3% of initial numbers in the buckwheat and Sudangrass (alone or with cowpea), respectively. At 3 months, mowing once reduced thistle more than mowing twice. Two mowings further damaged growing points of thistle but made other weeds and cover crops less competitive and triggered emergence of new thistle shoots.

In 2007, at the Cruse Research Farm we determined if previous year treatments affected Canada thistle patches. The field was intensely tilled and we planted organic food-grade soybeans. In soybeans, the areas formerly with Sudangrass or Sudangrass + cowpea had Canada thistle populations approximately 2% of those the previous spring. Canada thistle shoots emerging in these areas were stunted and not competitive with the soybeans. Areas mown once had fewer thistle shoots than areas mown twice. Mowing and buckwheat only suppressed thistle for a single growing season. Sudangrass rapidly grows, tilling extensively, forms a tall dense canopy, tolerates mowing, quickly regrows, and forms thick mulch. Sudangrass combined with mowing controls Canada thistle due to competition for light and leaching of allelopathic compounds (sorgoleone) from roots. Mowing also defoliates thistle (mow at 7-10 leaf stage) and causes Sudangrass re-growth and tillering resulting in more competition for light. The thick mulch can smother thistles, modify the soil environment (cooler temps, increased moisture), and release allelochemicals (cyanogenic glucosides).

We are continuing research on Sudangrass suppression of Canada thistle. The mechanisms of Sudangrass control of Canada thistle are being studied. Sudangrass and sorghum germplasm is being surveyed for rapid grown and competitiveness. We recommend that Sudangrass be combined in an integrated approach to manage Canada thistle.

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Weed Management Practices in Organic Processing Sweet Corn and Snap Beans

*Heidi Kraiss, Jed Colquhoun, A.J. Bussan and Rich Rittmeyer **

The upper Midwest produces over 50% of the processed sweet corn and snap beans in the U.S. Recent organic market growth has stimulated interest in expanding this industry to include organic processing vegetables. Development of an organic management system that is feasible for the grower while keeping quality, consistency, and quantity of product will enable the development of an organic processing vegetable industry. A significant hurdle is the ability to grow organic vegetables on a larger scale where existing weed control methods, such as hand-weeding, are not practical. This study focused on the feasibility of managing weeds in organic sweet corn and snap beans, utilizing methods that are practical and economical in large acreage.

Organic weed management treatments consisted of either a single management tactic or combinations of tactics. One, two and three cultivations and utilization of a stale seedbed were single tactic treatments. Combinations of tactics consisted of a stale seedbed with two cultivations, a stale seedbed with two cultivations and hand-weeding, a rotary hoe with cultivation, and two cultivations with hand-weeding. Hand-weeding was added as a management tactic for comparison while it is understood that this tactic is not feasible on large acreage. An herbicide-based treatment was also included for comparison given that the vast majority of processing crops are currently grown conventionally.

Organic weed management was feasible in a short season crop, such as snap beans. In 2006, there were significant differences among treatments. Yield was similar when two and three cultivations and two cultivations with hand-weeding were compared with conventional management. Snap bean yield was reduced in all other treatments, particularly those containing a stale seedbed. In 2007, there was no difference among treatments. Yields were comparable among organic and conventional management. Furthermore, there were no differences in yield among organic management practices. The snap bean crop was harvested prior to viable weed seed production, thus minimizing the impact on future production of weeds that escaped control. Management decisions could therefore be based on criterion such as weather, weed control cost, and cleanliness of harvested material.

Organic weed management was more difficult in a long season crop, such as sweet corn. In 2006, yield was similar to conventional management with treatments consisting of three cultivations and two cultivations with hand-weeding. Yield was less than that in conventional management in all other treatments. In 2007, yield was similar to conventional management with three cultivations and a rotary hoe with cultivation. Sweet corn yield was reduced in all other treatments, particularly those using a stale seedbed. Reduced sweet corn yield was attributed to the ability of weeds to compete more effectively for nutrients and water and for a longer period of time with the crop than in a short season crop such as snap beans. Current research is investigating the interaction of weed pressure and fertilizer quantity and source in organic sweet corn.

Results are discussed in the context of the economics of organic production methods and premium prices received for organically produced vegetables. In the long-term, the potential for market saturation and price moderation must be considered if large-scale processing vegetable production were to expand. With this potential price moderation in mind, the cost of inputs and production should be considered relative to crop yield and quality to estimate the long-term feasibility of this investment.

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Insect and Disease Management in Organic Fruit Crops

Kathleen Delate[1], Maury Wills[2], Mark Whalon[3] and George Bird[3], Deirdre Birmingham[4]

In the U.S. in 2005 there were 97,277 acres of organic fruits, with the majority in the drier climates of Colorado and eastern Washington. Significant production of organic fruits occurs in the Midwest, however, because of our long history of producing these crops. Increases in organic fruit production have been associated with improved pest management methods, the use of disease–resistant cultivars, and organic–focused marketing schemes. At the Fourth International Organic Tree Fruit Symposium held at Michigan State University on March 6-8, 2007, growers, researchers and industry representatives identified the following most critical insect and disease issues and potential strategies in organic fruit tree management. This research, along with grower questions and answers, is compiled in the Upper Midwest Organic Fruit Tree Network at http://www.mosesorganic.org/treefruit/news3-2.pdf.

1. Systems approach for insect pest management

• Understanding interactions between biotic and abiotic environment, ecosystem, and social environment of organic tree fruit systems

Organic management of plum curculio (PC)

• Effect of parasitoids (braconid; eulophid on eggs)–PC has few natural enemies
• Effects of control measures
• Biopesticides: *Beauvaria/Metarrhizium/* nematodes
• Roto-tilling soil for PC in August; banding floor of orchard with control measure
• Ground trapping over-wintering PCs
• Mowing; mowing at night when beetles active
• Bird predation: guinea fowl wander too far; chickens better
• Botanicals and natural products (terpenes, etc.) as deterrents (planted/sprayed)
• Resistant cultivar development

Codling moth

• Hedgerows' effect on maintaining mating disruption semio-chemicals within orchard
• Better Codling Moth Granulosis Virus (CMGV): better UV resistance
• Bats: prey on Oriental fruit moth and codling moth

Japanese beetle

• Trapping outside orchard; use milky spore on orchard floor (every few trees) for larvae
• Tulip poplar blooms as attractants of typhiid wasps/natural enemies
• Surround™ as repellent; feeding deterrent

Peach tree borer

• Protection with aluminum and Tanglefoot™
• Painting lime/whitewash
• Lesser peach tree borer–mating disruption
• Borers in graft union; cover with uncompacted, mounded soil when borers are flying

Other pests: Blossom beetle on cherry; black cherry and cherry fruit fly; rose chafer; cherry aphid; apple maggot

Managing for organic pesticide non-target effects

• Entrust™ management (and natural enemy effects)
• Sulfur on beneficial insects.

2. Systems approach for disease management

• Scab: Resistant cultivars that consumers want; have improved storability
• Effective, reduced sulfur/copper programs (if intensive sulfur program, should have beneficial phytoseiid mites with tolerance to sulfur)
• Calcium effects on disease
• Genomics to identify genes with resistance to insects/diseases
• Other diseases: Fire blight; Brown rot-peach/cherry; Cherry leaf spot and mildew; Peach leaf curl (Resistant varieties: 'Curlfree'), Copper at bud break, but copper is under increased scrutiny
• Botanicals as fungicides: English ivy, Artemesia (active ingredients from these)
• Compost tea: standardization, effectiveness

3. Cultural management of organic fruit trees

• Exploring the "healthy trees = pest-resistant trees" concept
• Measuring stress responses and attractiveness to pests through biochemical content of leaves; Auditory disruption/attraction
• Postharvest treatments, i.e. for mold on cherries

Continued

- Management of crop load: Post-bloom thinning strategies
- Fertilization and nutrient cycling
- Appropriate ground covers that do not increase pest load
- Guidelines/standards for manure from animals in orchard
- Rootstocks for organic systems

Research programs in Iowa, Michigan and Wisconsin have identified the beneficial use of scab-resistant cultivars for disease management and codling moth Granulosis virus (CMGV) and Entrust™ for codling moth management. Cedar apple rust continues to require sulfur applications for management especially for 'Gold Rush'. Killing frosts in Iowa destroyed up to 80% of certain cultivars in 2007. In this year's research, we identified codling moth and plum curculio resurgence under a no-spray program, emphasizing the need to manage pests even in low crop years. The organic tree fruit blocks at the Michigan State University Clarksville Station have experimented with different strategies, tactics and tools for organic pest management. The system is now fairly stable with plum curculio and codling moth injury averaging less than 5-7%, aphid damage averaging about 2% and leafrollers between 1-7% annually. Plum curculio is managed with a combination of kaolin clay and Whalon PC traps lured with plum essence and benzaldehyde lures (available from Great Lakes IPM, Vestaburg, MI). Up to 12 sprays of kaolin (25 to 30 lbs/A: depending on tree size) are needed annually and we paint the trees "white" in the early spring to "push" curculios to the margins of the orchard where we trap them out of the system with the Whalon PC traps. We trap out with a density of one trap (Whalon Pyramid or PC screen trap) per 3 trees on the unsprayed border rows. Kaolin also helps manage other pests, especially apple maggot. Therefore, two sprays are timed using yellow sticky traps to monitor for early emergence of maggots as a means to synchronize spraying with emergence. Only 2 or 3 applications of kaolin at intervals of 9-14 days (depending on rain events) are necessary to control apple maggot. Companion plantings are also used to bolster natural enemies and pollination in our system. We have planted 32 Michigan native species ranging from a dwarf willow to comfrey to provide pollen and or nectar sequentially through the growing season such that natural enemies and pollinators would always have a food and liquid reward to augment their population in and around the orchard. Our ground cover management systems compared a Swiss Sandwich (18 inches of cultivation under the drip line with a modified weed badger and mulch around the trunk), straw mulch alone (18 inches per season under the drip line) to no weed management. In over 6 years of studying these systems, we determined that the Swiss Sandwich system suppressed weeds and amplified yields. The Clarksville system is also fitted with hawk perches, bat houses and bumble bee motels to enhance predation and native pollinators. We do not believe that the bat houses have been successful; however, several species of hawks do use our perches and to date we have not had extensive winter rodent injury. We do hand-rake or machine sweep the deep mulch into the drive row if it is more than 6-8 inches deep before snow fall and visually inspect for rodent activity in early March through snow-off.

The University of Wisconsin-Madison's Peninsular Agriculture Research Station in Sturgeon Bay, Wisconsin, is establishing organic apple and tart cherry research plots. The station has done research of use to organic tree fruit producers, but never before on plots dedicated to organic production. The plots were started in 2005 using dwarf rootstocks with apple and cherry varieties of commercial importance. The apple trees are starting to bear. Major challenges in the apple plots, for which several strategies are being tested, are orchard floor management, powdery mildew control, establishing wildflowers for beneficial insect habitat, and managing potato leafhoppers. Sulfur is being used effectively to control scab, which was not an issue during the 2007 drought. Soil quality is being studied in apples and cherries, particularly the role of organic vs. plastic mulch and foliar fish emulsion applications. Challenges for tart cherries are cherry leafspot, copper toxicity while controlling cherry leafspot, powdery mildew, and plant available soil nitrogen for the heavy N requirements of cherry.

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Understanding the Impact of Biodiversity on Transition Agriculture for Organic Cucumber and Tomato Production

Ajay Nair[1], Mathieu Ngouajio[1], John Biernbaum[1], Sieglinde Snapp[2], M. Brewer[3], George Bird[3], and Dale Mutch[4]

With rising concerns on the impact of current agriculture practices on our environment, organic agriculture has emerged as a more environment-friendly farming system. The core objective of this study was to better understand and document changes, with relevance to crop yield, fruit quality and cover crop management that occurs when transitioning from a conventional to an organic farming system. Using cover crops (cereal rye and hairy vetch mixture), compost and polyculture (growing alternate rows of tomato and cucumber), we intend to enhance soil management and biodiversity in an organic cucumber and tomato production system. Increased biodiversity promotes better soil quality, efficient nutrient cycling, reduced pest infestation and enhanced soil microbial activity. Our research aimed at addressing the following questions: (i) will a cover crop mixture of cereal rye (grass) and hairy vetch (legume) improve vegetable production when compared to cereal rye alone? (ii) does nutrient management through dairy compost work synergistically with cover crops? (iii) does crop variety play any role when transitioning to an organic cropping system?

It is thus recommended that farmers who have invested in vetch in order to maximize their returns should also use compost.

The study was conducted at the Horticulture Teaching and Research Center of the Michigan State University at East Lansing, Michigan. Cover crops were sown in the fall of 2006. They were plowed early spring and compost was added. Tomato and cucumber transplants were grown in the greenhouses starting mid April and transplanted into the field on 1st May 2007 on raised beds with plastic mulch. Two tomato cultivars 'Mountain Fresh' and 'Big Beef', and cucumber cultivars 'Cobra' and 'Dasher II' were used. Drip irrigation was set up at the time of bed formation. Altogether there were 3 treatments: (i) rye cover crop with cucumber or tomato monoculture, (ii) rye with polyculture, (iii) rye + vetch cover crop mixture with polyculture. Polyculture was achieved by alternating cucumber and tomato rows. Absence or presence of compost was added as a factor to all the treatments for a total of six systems. Plants were staked and all necessary cultural operations were undertaken when needed. Tobacco Horn Worm was the main insect pest on tomato and was controlled with a Bt formulation spray. Incidence of Septoria Leaf Spot on tomato was also observed but it did not warrant any control measures as it was late during the season. Same was the case with powdery mildew in cucumbers. It is important to mention that cucumber beetle infestation was one of the main limiting factors for cucumber production in our study

We obtained some interesting results from the study. Yield is the primary concern for most of the farmers as it directly translates into economic returns. There were significant differences in yield under different cropping systems. Cover cropping with rye, vetch and compost under a polyculture system gave the maximum yield in cucumber (8.92 t/A) followed by rye and compost under monoculture system. It was observed that the yield reduced by almost half to 4.94 t/A when no compost was added to the rye and vetch system. This difference in yield could be due to the fact that addition of compost to the rye vetch system stimulated the growth and activity of microorganisms which in turn accelerated the decomposition of rye and vetch and made nitrogen fixed by the vetch available to the plant. It is thus recommended that farmers who have invested in vetch in order to maximize their returns should also use compost. On the other hand using rye alone with compost gave equally good results (8.74 t/A) when compared to rye, vetch and compost. It seems that in this case the vetch did not produce enough biomass to contribute significant amount of nitrogen to the system in 2007. Even though rye and compost gave similar results as rye, vetch and compost, in the long run advantages of vetch cannot be discounted as it will fix nitrogen, enhance soil microbial population and improve

Continued

soil health. It seems that polyculture with tomato does not benefit cucumber yield. However, it could be used as a crop insurance tool against cucumber beetles that pose a phenomenal threat to organic cucumber production in our region.

Number of cucumber fruits from different treatments followed a similar pattern as yield. Rye + vetch + compost under polyculture system gave the maximum number of fruits followed by rye + compost under monoculture system. All other treatments were significantly less than the above mentioned systems. Variety influenced the yield and also the number of unmarketable fruits. Our results indicate that Dasher II could be a better variety to grow under organic systems as it gave significantly higher yield (7.7 t/A) when compared to 'Cobra' (4.8 t/A). Fruits were categorized marketable and unmarketable based on skin color, shape, size, and other physical defects. Variety 'Cobra' produced higher number of unmarketable fruits than 'Dasher II'. We would thus recommend growing 'Dasher II' at least for the initial few years while transitioning to organic cultivation.

In the case of tomato, varietal selection will again help the farmers in reaping better profits while transitioning to organic production. Our study showed that variety 'Mountain Fresh' gave significantly higher yield (13.4 t/A) when compared to variety 'Big Beef' (11.5 t/A). We understand that selection of the cultivar depends largely on market demand, but transitional farmers should seriously consider varietal selection as it will directly reflect on the yield and the final output. In tomatoes too, fruits were categorized as marketable and non-marketable. Variety 'Big Beef' produced higher number of non-marketable fruits (4 fruits/plant) whereas 'Mountain Fresh' produced on an average 2.5 non-marketable fruits/plant. Out of the six management systems tested, best performances in terms of yield were obtained from polyculture treatments: rye + compost (14.4 t/A) and rye + vetch + compost (14.2 t/A). The results thus indicate that polyculture increases tomato yield. On the aspect of adding compost to the rye + vetch system, tomato yields followed a similar pattern like that of cucumber. Treatment with rye, vetch and no compost gave the lowest yield of all the treatments (9.1 t/A). We would thus again reiterate that addition of compost is indispensable when cover cropping with rye + vetch. Addition of compost also significantly reduced the number of non-marketable fruits under polyculture systems.

In most vegetable production systems, especially organic, addition of compost is a must as it adds to the nutrient pool in the soil and also improves soil health by stimulating microbial growth. Our study reinforces the above mentioned point and also advocates adopting polyculture as one of the tools when transitioning to organic production system as it improves yield (tomato in the present study) and could also serve as a factor of crop insurance against crop failure (mainly in cucumber due to cucumber beetle attack). In addition, farmers can obtain better nutrient cycling through polyculture. Because of their ability to survive winter, both cereal rye and hairy vetch could easily fit into most vegetable cropping systems. Cover cropping with a combination of cereal rye and hairy vetch is an effective way to improve soil health and other soil attributes. It is highly recommended to use compost when using the combination, otherwise the yield will be affected. To conclude, farmers should give added consideration to varietal selection as it could help mitigate yield decline which is the major deterrent for transitioning to an organic production system.

This study was supported by funding from USDA Organic Transition Program.

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Safe Planting Distances Between Bell Peppers and Field Corn to Minimize European Corn Borer Damage to Bell Peppers

Beth Kazmar

Bell peppers grown in the U.S. are often attacked by the insect pest European corn borer (ECB, *Ostrinia nubilalis*). ECB larvae bore into the peppers, creating entrance wounds that can lead to fruit rot. Presence of the borer larvae or entry holes make the fruit unmarketable. It is estimated that up to 64% of the peppers in a field can be damaged by ECB (Welty, 1995). The primary host for ECB is field corn. Due to the widespread planting of field corn in the Midwestern U.S., few vegetable farms in this region are isolated from corn. As a result, bell peppers are often planted near corn fields which can serve as a source of ECB.

The goal of this research project is to determine if the distance between peppers and field corn influences the extent of ECB damage to peppers. Field trials were conducted in 2001 on four vegetable farms in Wisconsin (three certified organic, one in transition to certified organic production). On each farm, a field of peppers was established adjacent to a planting of field corn. In all trials, the field corn on neighboring farms was not transgenic for the *Bacillus thuringiensis* (Bt) toxin and was not raised under organic conditions. During the second ECB flight, pepper plants at various distances away from the corn were examined for ECB egg masses or for ECB damage to the peppers. In three of four trials, bell peppers suffered significantly greater infestation when planted near field corn (regression analysis, $p=0.002$, $p=0.007$, $p=0.08$.) There was not a significant relationship in the fourth trial.

To answer the question "How far should bell peppers be planted from corn?" I calculated the distance from corn required to reduce the ECB damage or egg masses to 10% of the level in peppers adjacent to the corn. These interpolated values were 353, 506 and 638 feet, with a mean of 499 feet. In conclusion, I recommend that bell peppers be planted at least 500 feet away from field corn to minimize ECB damage to the peppers. Distances greater than 500 feet do not guarantee that peppers will be free of ECB, as light winds can carry the ECB moths for great distances. Rather, I conclude that peppers planted within 500 feet of corn have an increased likelihood of being damaged by this pest.

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The Clarksville Horticultural Experiment Station Organic Apple Project

Mark Whalon[1]

The Clarksville Horticultural Experiment Station Organic Apple Project was planted in 1997 as the first planted organic apple research plot. It serves as a demonstration and research plot for a wide array of agricultural disciplines, including horticulture, entomology, plant pathology, and physical and biological soil science. Some of the key features of the plot include a rootstock trial, border diversity plantings, variety trials and groundcover management trials. This paper will present some of the important findings from the past ten years of management.

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Are Perennial Grain Crops Feasible for Midwest Organic Crop-Livestock Production?

Sieglinde Snapp[1], Brook Wilke[2] and Lowell Gentry[3]

In 2006 a new phase of the long-term, certified organic trial 'Living Field Laboratory' was initiated at Kellogg Biological Station, southwest Michigan, designed with an organic advisory group of farmers, educators and extension. Novel perennial crops, a perennial wheat and Illinois Bundleflower (legume/livestock grain), are being evaluated, based on promising results from Kansas and Minnesota. Managed organically, the perennials are being compared to an organic corn-soybean-spelt-alfalfa rotation. We are testing how much grain is produced in perennial versus annual rotations, and the economic returns from organic livestock feed produced by perennials.

Perennial crops offer the opportunity to reduce tillage in organic production systems.

Preliminary results indicate that these new perennial grains can survive Michigan winters. We are testing 15 varieties of perennial wheat which were derived from crosses of perennial wheat grass, genus Thinopyrum-wheat amphiploids. Initial findings indicate that some varieties selected from the crosses made by plant breeders at Washington State University and The Land Institute in Kansas can produce grain that has excellent quality for livestock feed, and has 55 to 90% of yield potential compared to annual wheat varieties. We examined if the percentage of plant regrowth of different varieties was related to yield, as has been observed in Washington State. Our initial year results indicate 100% regrowth which is promising for the success of these novel crops in Michigan, once fully adapted varieties and agronomic management are developed.

We are also examining perennial sorghum and the perennial legume Illinois bundleflower (*Desmanthus illinoiensis*), which both show potential as novel livestock-feed producing crops. If they are successfully adapted to Michigan, they could then potentially be grown for 5 to 6 years at a time and harvested each year. The reduction in requirements for land preparation, planting and weed management could have substantial benefits for organic producers.

Over the long-term, we are studying soil quality, nitrogen and pest management in the perennial mixtures and in the 'best bet' four year annual cropping system that simulates a well managed organic production system for livestock feed. We are encouraged to find that perennials can grow in intercrop systems and appear to survive winter conditions at our Southwest Michigan site. However, longer term study is needed as climate variation is increasing, and we need to test these novel crops in a variety of environments. The perennial crops offer the opportunity to reduce tillage in organic production systems and support a crop phenology that mimics natural environments with minimal requirements to manage weeds, pests and apply nutrients.

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Use of an Oilseed Press to Make Edible Meal for Livestock

Seth Fore and Paul Porter

On–farm crushing and utilization of oilseed crops for oil and meal has become more attractive as the demand for agriculturally grown renewable energy has increased. Small oilseed presses located on individual farms can produce meals high in protein that can replace certain components of a ration for many different types of livestock. These small scale pressing operations can potentially help organic livestock producers by allowing them to press their own meal, as well as organic crop producers by creating new markets for their raw commodities. A project at the University of Minnesota is conducting a study to examine the potential economic feasibility of these small scale on-farm crushing facilities utilizing oilseeds commonly grown in the Midwest. The most prevalent oilseed crop grown in the Midwest is soybean; however, crops such as canola and sunflower have past cropping history in certain regions and could also be utilized for small scale oil and meal production. The meal generated from the crushing process can be used as a protein and energy supplement, while the oil can be used as straight vegetable oil for burning in modified diesel engines, as heating oil, or processed into biodiesel for use in diesel engines.

Livestock farmers may find that they can produce a portion of their protein more cheaply than they can purchase it.

The meal produced from small scale cold screw presses or expellers can be utilized both for its protein content as well as an energy source since there is a certain amount of fat remaining in the meal. Analyses on cold screw pressed soybean, canola and sunflower meal have indicated crude protein content in the range of 39, 37, and 24% and fat content of 15, 14, and 19%, respectively. While the crude protein content of these meals is lower than the standard benchmark of 48% found in soybean meal, utilization of these meals to satisfy a portion of the overall protein portion of the ration will ease producers' dependence and exposure to a volatile protein market. There has been a very observable trend of increasing soybean meal prices over the last year. Because of this increasing trend livestock farmers may find that they can produce a portion of their protein more cheaply than they can purchase it.

While meal produced from a cold screw expeller press can be used to replace other protein feedstocks such as soybean meal, it is not an identical substitute. Cold screw presses and extruders are generally 75 to 80% efficient, leaving a substantial amount of oil in the meal, in the range of 12 to 20%. This limits the amount of meal that can be included as a substitute in the overall protein ration. A typical rule of thumb for dairy cattle is that there should be no more than 1 lb of free fats in the diet, meaning one can safely feed up to 3 to 4 lb per cow per day of cold screw pressed meal without any adverse effects. The amount of free fats that can be allowed in a diet depends on species; hence the rate of inclusion of meal is determined by the species being fed.

There is a unique opportunity for organic livestock producers to utilize this system to decrease the costs of purchasing organically certified protein meal. This system may be especially advantageous to those producers that also have the ability to grow their own feedstocks. On-farm production and use of a product that would otherwise have to be purchased is a far more sustainable and efficient system that can be used to improve producer profitability. The market for both organic and conventionally produced protein has proved to be quite volatile, especially over the last year. On-farm production of meal can help limit livestock producers' exposure to this inherent volatility and allow them to supplement their protein demand through their own production of a high quality protein meal.

Just as there is an opportunity for an organic livestock producer to grow and process their own protein meal at a reduced price, there is an opportunity for organic crop producers to become crushers of organically grown crops to provide for a growing demand of organic protein meal. An organic crop farmer that is situated in moderate proximity to organic livestock producers has an excellent opportunity to investigate the feasibility

Continued

of an on-farm crushing facility utilizing crops produced on that farm to help meet the demand for organic protein meal of near by organic livestock producers. This system potentially makes economic sense for both organic farmers and livestock producers while utilizing sustainable and local solutions to enhance producer productivity.

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Organic Fertilizer Supported Grazing : Does it Work? An Intensive Grazing Research Grant: Fish Hydrolysate-based Foliar Spray Project

Reg Destree

The purpose of this project was to determine if foliar spray applications can provide significant cost effective pasture and animal product benefits for dairy and beef graziers. The project was funded by Grazing Lands Conservation Initiative and conducted by Glacierland Resource Conservation and Development Agency (Glacierland RC&D) in cooperation with Lakeshore Technical College, Dramm Corporation and AgriEnergy Resources.

The research sites included: Foster Organic Acres, Bill and Donna Foster, Suamico, WI and Grassway Farms, Kay and Wayne Craig, New Holstein, WI.

Organically allowed fertility inputs were applied to 50 percent of the grass/legume paddocks. Treated and untreated paddocks were then evaluated for plant nutrient density, plant health and yield.

The foliar spray package consisted of Drammatic ONE Liquid Plant Food, AER SP-1 Microbial Extract, AER Foundation (Trace mineral and nutrient pack), and Chilean nitrate (natural nitrogen). Two foliar applications were applied on May 10 and on July 25, 2007. The product cost of each application, not including application costs was under $30.00/acre. To address any concerns about the presence of mercury or PCDs in the fish hydrolysate, lab tests were done and showed no measureable levels.

Results showed benefits in pasture vigor and positive responses in weight gain in beef cattle. The key indicators included: yield per acre, feed palatability, feed quality analysis and economic results. Significant findings included some of the following results. The pasture plate test indicated yield increases of over 100% more grass from treated paddocks. The treated pastures were also more palatable as the cattle ate up to 20% more dry matter than those in the untreated pastures. Beef cattle gained 20% more grazing on treated paddocks.

Economically, using the University of Wisconsin 2006 Milk calculator, net returns were as high as a 12-1 return over foliar cost for dryland and over a 4.4-1 return for irrigated paddocks. Irrigated paddocks did also yield over $300 more milk per acre.

Recommendations are to continue these studies to build more data to support using organic inputs to improve grazing lands. A continued study is needed to understand and improve live plant health, improve calcium/potassium plant mineral ratios, and the influences of irrigating vs dryland grazing.

The Data Collection Oversite Committee includes Wayne and Kay Craig and Bill and Donna Foster, farm participants; Fred Depies, Glacierland RC&D; Greg Booher and Jason Fischer, Lakeshore Technical College; Reg Destree, Dramm Corp.; Ryan Albinger, Dramm/AgriEnergy representative and Gary Campbell, AgriEnergy Resources. The complete data for this project are available at www.glacierlandrcd.org

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The First Year's Experience of Integrating Berkshire Hogs into an Apple Orchard for Insect Control and also a Profitable Second Crop

Jim Koan

Almar Orchard in Flushing, Michigan consists of one hundred acres of certified organic apples and another one hundred acres of woods, meadows, and cropland. One of the biggest challenges of growing organic apples in the Midwest is the dreaded plum curculio beetle which, under the best management, ruins ten percent of the fruit crop and can do as much as one hundred percent damage, if left unmanaged, because it does not have any natural predators.

Grazing chickens in the orchards was attempted, but they were lazy and gave only marginal results, at best, as a predator of the plum curculio. I received a research grant to try reducing the plum curculio population by introducing guinea fowl into the orchards. That practice worked effectively, but hawks moved in and devoured my two hundred and fifty guinea fowl. For my third attempt at controlling the curculio, I have introduced a yet larger predator… pigs. With the help of the USDA and Michigan State University, I have finished my first year of grazing pigs in the orchard for plum curculio control, and have some exciting results; however, some challenges are yet to be overcome. I think that with more research and exploration of this sustainable approach to organic apple production, the possibility of increased profitability is very likely.

Three registered Berkshire sows and a boar produced twenty-seven piglets this spring (May 1). They were given a diet of almost exclusively apples and apple pomace from our cider mill. When the babies were weaned, we pastured them as well as the adults in a six acre orchard that was divided by electric fence into six different areas. We introduced them into the orchard at the beginning of June-Drop, where most of the fallen apples had Plum Curculio larvae inside of them.

The adults slumbered under the semi-dwarf apple trees and/or made undesirable big-rutted holes in the ground. The twenty-seven, twenty-pound piglets were like a little herd of Hoover vacuum cleaners and devoured all of the apples as they fell from the trees onto the ground. They also rooted up the sod in a desirable manner under the trees comparable to what I would do with my Rota-Tiller (called the "Swiss Sandwich System") which helps increase soil fertility. What is equally exciting is that they left the drive lanes undisturbed, because they didn't have the weight behind them to push away the sod. In August of 2007, Michigan State University did an analysis of the curculio damage of the apples that were to be harvested and found only three percent damage in the pig blocks and a whopping fifteen percent damage in the control blocks. After harvest, when the orchard floor was frozen, the piglets, then at approximately a hundred and fifty pounds, were run back into the orchard to pasture and to eat the apples that fell during the fall season.

The piglets will be slaughtered at two hundred and fifty pounds. Normally, pork will pick up the flavor of the food that they were fed on. Will our pigs taste like apples? They surely will not taste like pork that you would buy in the local store. We do not know yet, but we expect they will be different and should carry a higher than premium organic price tag.

This is only the first year of a proposed four-year research project, but we have already produced some exciting results. Future research will even more precisely define the impact of hogs on plum curculio populations, plus, we will be looking at their effect on apple disease control, soil fertility, weed management under the apple trees, and finally, taste comparisons of pasture/apple raised pork to free range grain fed pork and confined animal feeding operation pork.

The long-range goal will be to research all costs of raising and selling organic pork on a small scale at an apple orchard, and to write an extension bulletin on how to do this profitably and with sustainability.

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Assessment of Regional Organic Alternative Dairy Management Practices

Hubert J. Karreman, VMD

This study was an On Farm Research/Partnership Project funded by Northeast SARE (Project Number ONE05-042, 2005-2006). The principal investigators were Hubert J. Karreman, VMD, an organic dairy practitioner and Ken Griswold, PhD, the Extension Educator for Penn State Cooperative Extension in Lancaster County, PA.

The overall goal of the proposed project was to identify viable organic dairy management practices that sustain or enhance milk production per cow per year on organic dairies in southeastern Pennsylvania. The project achieved the goal by meeting the following three objectives: (1) using Dairy Herd Improvement Association (DHIA) records to determine the trend for milk production per cow per year for certified organic dairy farms in southeastern Pennsylvania (2) using DHIA records to determine monthly trends or changes in milk production, milk components, milk quality, and reproductive performance parameters for certified organic dairy farms in southeastern Pennsylvania (3) using DHIA records, on a monthly basis, to identify certified organic dairy farms that have significantly different trends or changes as compared to those determined in Objective 2, and determine what management practices were in place on those farms that may have caused those differences, positive or negative.

Additionally, we used GPS to locate conventional farms within one-mile from enrolled organic farms and compared DHIA production and reproduction data. By matching farms on a breed and herd size within one mile, factors such as different soils and weather patterns were minimized.

We asked the 34 organic farmers who voluntarily enrolled in the study to fill out a 6 page, 308 question survey about their farm demographic information, breeding and reproduction, herd health, milk quality, nutrition and feeding, and youngstock. After they filled out the questionnaire, DHIA data was remotely downloaded from DRMS in Raleigh, NC. Statistical tests were applied to all the information and due to the enormity of data, only select areas will be discussed. In general, those organic farmers using "conventional wisdom" regarding milking hygiene proved to yield better DHIA information. During the talk, differences between organic Holsteins and crossbred herds will be shown. Additionally, the matched pair comparisons will be discussed.

Association of Pre-Dip on… (statistically significant)	YES	NO
Actual SCC	295,000	419,000
Cows SCC 0-3	66%	59%
Linear SCC	3.02	3.35
Cows SCC 6	6%	9%
Cows SCC 7-9	7%	10%

Association of Wearing Gloves on… (statistically significant)	YES	NO
Cows SCC 7-9	3%	6%
1st Lact SCC 7-9	0%	3%
Cows SCC 4 (200,000)	19%	14%

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DHIA SARE Study 2006: 34 matched pairs of farms- Reproduction			
variable	conventional	organic	P Value
Average age at 1st calving (n=33)	25.0	26.0	0.041
Calving Interval (months)	14.2	14.0	0.307
Day to 1st Service (n=32)	90.6	88.4	0.668
Days open	152.5	146.8	0.318
Services per pregnancy	2.92	2.56	0.109
cull rate (n=33)	33.4	26.6	0.004

DHIA SARE Study 2006: 34 matched pairs of farms- Production			
variable	conventional	organic	P Value
Total Cows	40	39	0.497
Rolling Herd Average	21,745	16,251	0.0001
Fat %	3.61	3.67	0.163
Protein % (n=28)	2.91	3.03	0.089
Actual SCC	322,735	331,617	0.755
SCC < 40 DIM (n=33)	2.57	3.11	0.143
SCC 41-100 DIM (n=33)	2.21	2.49	0.314
SCC >305 DIM (n=32)	3.46	3.58	0.687
SCC 1st lactation (n=33)	2.35	2.46	0.584
SCC 2nd lactation	2.53	3.06	0.015
SCC 3+ lactations	3.27	3.47	0.218

ORGANIC SOYBEAN DATE OF PLANTING AND SEED POPULATION

Milton J. Haar[1], Craig C. Sheaffer[2], Donald L. Wyse[2], Matthew M. Harbur[3], Carmen M. Fernholz[1], Lee D. Klossner[1] and Joshua D. Larson[2]

Delayed planting is a common weed management practice used by growers of organic soybeans. At the expense of potential yield, a grower has the benefits of removing the first flush of weeds with pre-plant tillage and faster crop emergence due to warmer soil temperatures. The objective of this study was to measure the effects and evaluate the risk of delayed planting for organically grown soybeans. Soybeans were planted on three dates, May 15, June 1 and June 15 in 2006 and 2007 at four locations in Minnesota. Five soybean varieties, MN0901, MN1401, MN1503, MN1604, and IA1006, were planted at two populations, 160,000 and 220,000, seeds per acre. Crops were managed according to organic standards on certified land using common practices for the area. Analysis of results from 2006 indicates that soybean yield decreased when the growing season was shortened by delayed planting. The effects of delayed planting on the population of weeds varied among sites and years. Variation in the effects on weeds is attributed to differences in weather and weed pressure among the sites and years. Planting a higher seed population to compensate for potential yield loss was not a successful strategy in these experiments. The two planting populations did not result in differences in yield or number of weeds. Variety selection affected results. Varieties differed in yield, ability to compete with weeds and ability to tolerate delayed planting. The information generated in this study will help farmers make decisions regarding planting date, planting population and variety selection when soybeans are grown. Results will also be used to support the development of a model that will evaluate the risks and benefits associated with delayed planting and other organic farming practices. The goal for the model is to serve as a decision aide to organic farmers.

Soybean yield decreased when the growing season was shortened by delayed planting.

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Soybean and Corn Cultivars Vary in Weed Responses

Rita Seidel

For four consecutive years, we have conducted soybean and corn varietal trials at The Rodale Institute with the goal to determine if and how they vary in their abilities to tolerate and/or suppress weeds. Two subplots were established in every main plot: The "plus" plot was managed according to our standard organic weed management, the "minus" plot was hand weeded to produce a virtually weed-free environment. Weed biomass was determined in the plus plots by biomass sampling and minus and plus plots were compared for yield.

In these trials, statistically significant differences were found among years, crops and varieties. Between crop species, soybean was much more sensitive to weed interference than corn as measured by yield losses between the two subplots. In both crops, varieties were identified that showed little or no difference between hand weeded and standard management plots (i.e., they exhibited weed tolerance).

For both 2005 and 2006, soybean and corn varieties were identified that had significantly lower weed biomass, indicating an ability to suppress weed populations. Besides identifying both weed tolerance and suppression, we found weed interference was enhanced under the 2005 drought year. This appeared to override some of the cultivar tolerance, for instance in Iowa 3006 and NC+68F32. This information should be valuable for farmers looking for independence from a solely herbicide-based weed management approach and for organic farmers who want to capture premium organic prices while reducing their dependence on mechanical weed control applications.

Soybeans: Weed biomass levels and yield differences between plus and minus plots varied from year to year. In 2003, 2005 and 2006 the average weed biomass in soybeans was approximately 1,500 kg/ha, whereas in 2004 average weed biomass was only 300 kg/ha. Yield differences between plus and minus plots seemed to be affected by total weed biomass: In the three years with high weed biomass, yield differences in plus and minus plots were very variable, ranging from -12 to 54%, whereas in 2004 yields were basically not affected by weeds (yield differences ranged from -11 to 2 %).

Except for 2006, results indicate that there may be a weed threshold above which weeds have a greater effect on soybean yields, probably about 1,500 kg/ha.

Corn: Weed biomass levels in corn did not vary as much as in soybeans: Average weed biomass was close to 2,000 kg/ha every year. Although yield differences between plus and minus plots were highly variable every year, ranging from -4 to 60%, these differences did not seem to affect corn yields: Correlation between weed biomass and yields was always low.

As with soybeans we were able to identify several corn varieties with significantly lower weed biomass. Although corn seems to be less affected by weeds than soybean, the fact that some varieties might be actively suppressing weeds is a very important finding which will need to be verified and tested further. As with soybean, greater association of weed biomass and corn yield was found under the dry environment prevailing in 2005.

Summary of varieties tested every year

Corn variety NC+ 68F32 and soybean variety Iowa 3006 were the only varieties tested for four years in a row. Both had high yields and high weed tolerance in 2003, 2004 and 2006 but did not do as well in 2005. We attribute the major differences in these results to the different rain patterns during the growing season of those years: While 2003, 2004, and 2006 were fairly wet years, 2005 was a seasonal dry year with less than optimum rainfall early in the season and during the grain filling stage.

The two varieties showed great weed tolerance in years with adequate moisture but a significant yield loss under the dry environment of 2005. This suggests the importance of water as a key stimulator of weed competition. Some of the characteristics of weed tolerant varieties seem to include rapid and abundant vegetative development which may put the plants at a disadvantage under dry conditions due to increased evaporation and transpiration.

Averaged across the four years, NC+ 68F32 and Iowa 3006 still had very good results but more drought tolerant varieties should be investigated.

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Soil Health Improvement Under Organic Farming Practices at Prairie Birthday Farm

Robert J. Kremer[1] and Linda F. Hezel[2]

Organic agricultural systems seek to produce foods of optimal nutritional quality while conserving and improving soils, and protecting environmental quality by using organic or natural resources without application of synthetic chemicals. Prairie Birthday Farm (PBF) is a 'micro-eco farm' established in 1993 on the gently sloping soils of northwestern Missouri (Clay County) predominated by Sharpsburg silt loam (fine, montmorillonitic, mesic Typic Argiudolls). The deep loess soils at this site were eroded and depleted in soil organic matter (SOM) after many years of conventional cropping that included corn and soybean row-crop production. The transition to organic farming included strategies to restore SOM through a) "growing organic matter in place" via establishment of long-term native prairie ecosystems on landscapes with steepest slopes and in the alleys of an orchard system; b) integrating livestock in a managed pasture; and c) compost amendments to soil within the various annual and perennial horticultural crop production sites. We used a soil health assessment approach for monitoring the success of the organic management system in optimizing soil productivity and maintaining or improving soil properties. Measurement of biological, chemical, and physical indicators of soil health provides useful evaluation of the effectiveness of specific management practices involved in the transition to organic farming for improving soil characteristics, optimizing crop productivity, and maintaining or improving environmental quality.

Based on results collected from our five-year study, an evaluation of the effects of organic management on biochemical characteristics of soil ("soil quality or soil health indicators") as an assessment of soil health is presented.

Site Description, Basic Management Practices, and Soil Analyses

Prairie Birthday Farm (39°20'N, 94°24'W) is a sustainable land stewardship effort and is located on deep loess soils of Sharpsburg silt loam, on summits and 3-10% slopes, subject to erosion. A diverse organic system including native prairie plants, heirloom fruit trees, vegetables, herbs, pastured heritage chickens, and rotation paddock horse pastures is established at PBF. 'Corral Compost' is prepared from mixtures of horse manure, chicken manure + hydrated lime, hardwood sawdust; and is mixed/aerated in the barn lot by movement of the horses. Compost is applied at rates of 70 kg per 2.5 m^2 (150 1b per 30 ft^2) around fruit trees in the orchard and 35 kg per 1.25 m^2 (75 lb per 15 ft^2) soil-incorporated in vegetable plots. Our "check sites" consisted of adjacent unmanaged grass and hay fields and a conventionally managed field rotationally cropped to corn and soybean on similar landscapes.

Soils (10-cm depth) were collected annually according to transects across landscape features within restored prairie, pasture, and check sites; and randomly from vegetable, orchard and blueberry sites. Analyses of soils included various soil enzymes (dehydrogenase, glucosaminidase) for microbial activity; organic carbon and nitrogen, aggregate stability (>250 µm diam), and standard soil and tissue nutrient contents.

Results

Annual soil health assessments since 2003 demonstrate that SOM (organic C) has consistently increased under organic management compared with conventionally managed soils, leading to improved soil fertility and plant productivity. The prairie site is gradually increasing in SOM (the shoulder landscape position was severely eroded). The high SOM (≈ 6.0%) in pasture sites reflects the benefit of integrating livestock in this system. Very high SOM contents in orchard, vegetable, blueberry, and grape plots (6.5 – 10%) are the result of annual applications of high quality compost produced on the farm. Increased soil aggregate stability was associated with long-term organic management, reflecting improved soil aeration, water availability, and increased microbial activity. Highest aggregate stability was exhibited in the prairie site (50 – 60% stable aggregates), characteristic of soils supporting undisturbed root systems of established perennial grasslands. Aggregate stability

Continued

of pasture and orchard sites was intermediate (≈ 30%) demonstrating the contribution of the relatively high SOM as well as the recently established grasses. Unmanaged pasture and hay field sites were also high due to long-term cool-season grass stands and no recent cultivation.

...organic sites provided 5 to 6 times the N-mineralization potential compared with conventional sites...

High levels of soil enzymes at all organically-managed sites demonstrated the impact of systematic amendment of organic materials on overall improvement of soil health. Microbial dehydrogenase activity, representative of the viable soil microbial community, organic matter decomposition, and plant growth promotion (potential plant disease suppression), increased under organically managed crops and soils by 8 to 10 times compared with conventionally managed soils. Nitrogen-mineralizing enzyme activity indicates release of nitrogen (ammonium, nitrate) from organic substances during decomposition by soil microorganisms. Because PBF soils have been amended with organic materials, populations of N-mineralizing microorganisms were high and very active, thus few differences are seen among organic treatments. However, organic sites provided 5 to 6 times the N-mineralization potential compared with conventional sites; these extreme differences demonstrate the N-enhancing benefit to soil of organic management.

Summary and Implications

Since transition of the previous conventional farm to an organic system began 14 years ago, all organic management systems followed at PBF have improved the Sharpsburg silt loam in organic matter content, water-stable aggregation, and soil biological activity including critical increases in N mineralizing activity. Although water-stable aggregation is somewhat lower at sites receiving composts that are incorporated in soil, the activity and quality of the organic matter developed in place is considerably higher compared with conventional, unmanaged sites within the same landscape. Even though aggregation at conventional sites is relatively high under the unmanaged grasses, the lower microbial activity detected suggests considerably lower soil health resulting from continuous poor management.

The organic process practiced at PBF and sustained over a 14-year period clearly demonstrates how regular amendment with organic materials can improve several aspects of soil health including increased SOM, improved structure (aggregate stability), and increased microbial activity with higher release of available N for optimum plant growth and productivity. The management systems illustrate how resources internal to the farm (i.e., composts) can be used to restore soil health on organic matter-depleted and eroded soils. Further, perennial systems that include native prairie plants show how organic matter "grown in-place" can be supplied to improve properties of soils previously subject to severe erosion and to improve production in perennial horticultural systems (i.e., orchards). Organic growers might readily adapt some or all strategies described for the PBF system to improve soil health and crop productivity in other enterprises.

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Application of the Niche Concept to Organic Weed Management

Larry Phelan, Deb Stinner, Chris Nacci, and Dave McCartney

I. Principles

It has become increasingly clear that what might be termed the problem-solving or individual component approach of agriculture has resulted in the loss of many free beneficial biological services in agricultural systems and in the creation of unintended secondary problems, the cause of which often goes unrecognized. These problems are the result of short-sightedness of the individual component approach with regard to at least two areas of complex systems: 1) interdependency of components and 2) emergent properties of interacting components. In contrast, agroecology seeks to understand the linkages among system components and how they interact and impact one another. Synthetic herbicides are unacceptable to organic farming and "natural" analogs to herbicides for organic farming, even if effective, are likely to be of limited short-term benefit. On the other hand, tillage is labor- and energy-intensive and also has significant environmental consequences. An ecological approach to weed management should not rely solely on "curative" tools, but use principles of plant ecology and invasion biology to guide multiple cultural practices that prevent weeds, what Liebman and Gallandt (1997) describe as "many little hammers." Examples of concepts in plant ecology that can inform a systems approach to weed management include plant succession, the niche concept and niche differentiation, and plant competition. Our ecological understanding of weeds has lagged largely due to the commercial success of chemical control. As a result, many elementary questions elude our comprehension: What makes weeds such effective competitors? What determines which weed species dominate in a given location?

...it is apparent that many weed problems are created by current agricultural management practices.

Two components are considered in the ecology of invasive plants: the plant traits that favor invasiveness and the biotic and abiotic parameters that determine habitat invasibility. Traits associated with weediness include the ability to rapidly colonize after a disturbance, fast growth rates, and a crop of small but numerous seeds. Weeds are also widely considered as being generalists, which allows them to occupy a wide range of habitats (termed phenotypic plasticity). However, this is inconsistent with the common patchy distribution of weed species. A global survey of invasibility (Lonsdale 1999) found that temperate agricultural and urban habitats are the most invasible of all habitats, caused in large measure by two practices, disturbance by tillage and soil nutritional enrichment, providing another example of how an individual component-based problem solving that does not consider the entire system produces unintended negative consequences for other components of the system. Viewed in this way, it is apparent that many weed problems are created by current agricultural management practices. Our research has investigated the potential for two ecological concepts to improve weed management: niche differentiation and interspecific competition.

II. Experiments & Results

A. Increasing soil carbon to reduce weeds. Adding biologically active carbon to soil has many benefits, from physical to biological. In the context of weeds, carbon reduces the effect of soil eutrophication. By stimulating soil microbes with carbon, solution N is tied up, preferentially starving rapid-growing weed species. Since soybeans do not require soil N, this is also an example of manipulating the habitat to improve crop competitiveness. We conducted both greenhouse and field experiments to measure the effects of carbon on soybean-weed interactions. In both contexts, soybean yields were significantly enhanced, and at least in the greenhouse, weed growth was significantly reduced.

B. Nutrient balance and niche differentiation. We have hypothesized that weeds are not monolithic in their nutrient utilization and that manipulating soil mineral balance might be another avenue

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for reducing weed competitiveness. We are in the process of conducting experiments to compare how different weed species utilize mineral nutrients. In the first experiment, plants were grown in hydroponic solution with different proportions of N, S, and P. The experiment was designed to address the question of whether greater phenotypic plasticity in nutrient use is a characteristic trait of weedy species by pairing a weed species with a cultivated relative. A number of interesting conclusions were drawn from the results. First, consistent with the niche concept, weed species clearly varied in their growth responses to different N:S:P. Second, there was a pattern of similarity in nutrient utilization between weed and cultivated relatives, suggesting that nutrient utilization is a phylogenetically conserved trait. The third conclusion was that while plants varied in their response plasticity to nutrient blends, plasticity was not a trait associated with weediness.

C. Reducing weeds through competition. A weed census of a number of organic fields across Ohio suggested that planting density is a key determinant of weed pressures and soybean yields. We had a field experiment underway in the summer of 2007 to test the effects of soybean planting density in a more controlled and replicated design. Data have not been collected yet, but we expect to report on results for this meeting.

III. Conclusions and the Future

The future design of agriculture will include a more integrated systems foundation that derives greater benefit from biological services; organic farming has a lead in this regard, but work is still needed. An effective integrated system of weed management requires significant improvement in our understanding of weed ecology: what are the habitat conditions that favor invasion in general? what are the niches occupied by different weed species in particular? It will be some time before our understanding is deep enough to know how to manage the agroecosystem to maximize crop production while minimize the impact of weeds. However, we predict it will be worth the effort.

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Use of the Nematode Community Structure and Indicators of Biologically-based Fertility for the Assessment of Soils Under Organic Management

Carmen Ugarte and Michelle Wander[1]

The purpose of this work is to develop a soil testing approach for organic growers by focusing on measures sensitive to biologically based fertility. We found that organic management practices used during a three-year transition period were able to successfully maintain soil fertility status at the Windsor Organic Research Trail (WORT) in Champaign, IL. However, aggressive spring soil preparation and within season weed control reduced populations of nematodes that can act as biological control agents of insect pests and contribute to disease suppression. We measured particulate organic matter-carbon (POM-C) and potentially mineralizable-nitrogen (N) to assess the amount of resources that are available to feed and provide physical habitat for soil organisms and plant growth. We also measured nematode enrichment, which is an index of the response of fast reproducing families of bacterial and fungal feeding nematodes to conditions of high N-enrichment and the structure index which reflect the complexity of the soil food web. Our measures of resource availability were good indicators of soil building during transition whereas the nematode community indices reflected the status of the soil biological community during the season as a result of soil management practices.

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The goal for soil fertility management in organic farms is to provide nutrient availability for adequate productivity while minimizing damage to the environment and conserving resource integrity. This is achieved through the appropriate use of organic amendments and the enhancement of soil biology and its contributions to soil function. We looked at soil building practices in WORT, which consisted of three strategies to transition (vegetable, row crop and pasture systems) with three types of organic amendments (raw manure, composted manure and cover crops). We collected samples during the first year after we passed the three-year transition period. Results show that regardless of amendment type, all three transition strategies were able to build adequate POM-C concentrations (> 2.4 g/kg soil) and have produced concentrations of available N (> 35 ug of NH4-N/kg soil) that are high and possibly in excess. This is also suggested by high values of the enrichment index (~ 50), which indicate the presence of fungal and mainly bacterial feeding nematodes that are responsive to highly N-enriched conditions. This reflects a shift in the food web towards a bacterially dominated community. Maintenance of high N enrichment may not be a goal for optimized organic systems. Lower nematode enrichment index values are desirable at the end of the season as we seek to reduce nutrient losses to the environment. Similarly, high values of the structure index (> 90) were detected at the beginning of the season, suggesting the nematode community was diverse and complex. However, as we progressed into the growing season, tillage and weed control practices reduced the populations of predatory and omnivorous nematodes and, thus reduced the structure index (< 20) significantly. This signals a loss of function by reducing community members that help inhibit pressures caused by pests and disease causing organisms. Recovery of the structure index at the end of the season would be desirable in optimized systems and would reflect the ability of soil organisms to resist and recover from perturbation.

Maintenance of high N enrichment may not be a goal for optimized organic systems.

Ongoing work is focused on the development of indicators for the assessment of farming practices that can help balance the goals of resource improvement and production. These indicators would be used to optimize soil condition by adjusting management practices that enhance nutrient availability and provide habitat for soil organisms. Our resource indicators measured at WORT showed success from a soil building perspective. However, they also indicated maintenance of high N levels throughout the growing season which is not desirable from the environmental point of view. In an ideal organic system, N supply would be synchronized with plant demand and not reach levels high enough to shift biology unfavorably. Additionally, cultural practices like tillage or weeding operations, which reduce the complexity of the soil food web, should be minimized to enhance development of predatory and omnivorous nematodes that improve system performance. Our ability to integrate results generated from analysis of nematode communities that reflect the actual status of the soil food web with indicators of soil fertility will provide insight needed to optimize management practices for organic and sustainable systems.

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Organic Certified Seed Potato Production in the Midwest

Ruth Genger, Douglas Rouse and Amy Charkowski[1]

High quality, disease free seed is an important factor in safeguarding crop health. This is especially true for vegetatively propagated crops such as potato. Unlike most crops, potatoes are not grown from true seed. Instead, potatoes are vegetatively propagated from tubers. Vegetative propagation has important consequences for disease management. True seeds exclude many disease-causing organisms (pathogens) so that they are not passed on to the next generation. In contrast, potato tubers cannot exclude viral and bacterial pathogens, so infected parent plants produce infected tubers, and plants that grow from those tubers will also be infected.

Certified seed potatoes are inspected and tested to ensure that they have a low incidence of disease. Use of certified seed potatoes significantly reduces tuber-borne diseases in potato, improving crop health, yield and quality. Organic potato growers in the Midwest face a regional shortage of organically grown certified seed potatoes, since only one Wisconsin organic grower produces certified seed potatoes. In addition, certified seed potatoes for many specialty potato varieties are unavailable in the Midwest, whether as organic or conventional seed potatoes. Consequently, many Midwest organic growers import organic seed potatoes (certified or non-certified) from other regions of North America. This leads to several problems: shipping costs are high; farmers do not have an opportunity to verify seed quality in person before purchase; and unusual or quarantine pathogens can be imported into a region along with seed potatoes.

Our goal is to support the growth of an organic certified seed potato industry in Wisconsin. In 2007, we trialed production of certified seed potatoes on six Wisconsin organic farms located in different geographic regions of the state (south-east, south-west, and northern). We planted foundation class seed potatoes, which meet very stringent disease tolerances. Varieties included in the trial were: Adirondack Blue (6 farms); Adirondack Red (2 farms); Magic Molly (2 farms); Red Norland (3 farms); Dark Red Norland (4 farms); Yukon Gold (2 farms); Goldrush (1 farm).

Since Potato Virus Y (PVY), a virus spread by aphids, is the major disease problem for certified seed production in Wisconsin, we focused on strategies to control introduction and spread of PVY by aphids.

Strategy One: Surround crops with a border of winter wheat. Aphids prefer to land at the edges of fields, as the contrast between bare earth and crop foliage provides them with a target. PVY is carried on the aphid's mouthparts, and is cleaned from the mouthparts when the aphid probes for a feeding site. If aphids land in a border crop, rather than the potato crop, their mouthparts are more likely to be free of PVY before they reach the potato crop. We surrounded potato plots with spring-sown winter wheat borders, or maintained borders of bare earth as a control. Borders were 6 or 12 feet wide.

Strategy Two: Spray crops with mineral oil. Mineral oil reduces the ability of the PVY virus to move from the aphid to the potato plant. At one farm, potato plots were sprayed weekly with an OMRI approved mineral oil; unsprayed plots served as controls.

In-season crop health. Crops were inspected twice during the growing season for symptoms of viral infection. No evidence of viral disease was seen. Aphids, including green peach aphid and potato aphid, were seen in all plots during the season. Aphids were present earlier and in higher numbers at southern locations compared to more northerly locations.

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Health of harvested tubers. A sample of 10 tubers were inspected for surface signs of disease. For many lots, common scab and silver scurf were observed at levels that would threaten certification. In these trials, the greatest susceptibility to scab was seen for Adirondack Red, Yukon Gold and Adirondack Blue, while the greatest susceptibility to silver scurf was seen for Adirondack Blue and Red Norland.

Post-harvest testing for virus infection. A sample of 100 tubers was taken from each plot. Tubers were treated to break dormancy and grown for virus testing. Data are being collected and will be presented at the Midwest Organic Symposium.

Future plans. Since aphid and disease pressure varies from year to year, we need to repeat these trials in order to make reliable recommendations to organic farmers interested in seed potato production. As our initial trial data indicates that scab and silver scurf may present barriers to certified seed production, we plan to investigate the efficacy of green manures to manage these diseases. Additionally, we plan to trial live mulches as further means of controlling aphid movement into seed potato plots.

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Relationship of Organic Fertility Management, Plant Nutrition, and Insect Response

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Using experimental plots in organic transition since fall 2006 and working organic farms in southern Wisconsin, we are exploring the impact of crop plant mineral nutrition on insect pest and beneficial insect response under standard organic fertility and soil-balance fertility regimes. Growers subscribing to the soil-balance approach report that a high base saturation of the soil cation exchange capacity for plant available calcium (70-85%) in proportion to potassium (3-5%) and magnesium (12-18%) plays a significant role in crop plant nutrient uptake and improved resistance to insect pests. Grain crop and forage farmer partners provide on-farm research sites and project advice.

Because organic farmers have relatively few control options when insect pest populations reach problem levels, a preventive approach to pest management is essential in organic systems. Given farmer observations that a healthy soil makes for healthy plants capable of repelling (or at least tolerating) feeding by insects, this approach starts for many farmers with managing soil quality through the addition of livestock manure, green manures, compost, and/or approved mineral fertilizers.

The biological and chemical processes that happen in soil are complex, and plants respond both to what happens in the soil and to feeding by insects (not to mention weather and many other factors). Insects in turn are affected not only by the nutritional state of plants and by the defense mechanisms plants present to resist their feeding, but also by the actions of predators. A systems approach is necessary, along with good farming methods. Failure to manage weeds properly in an experiment, for example, can swamp any impact on yield that pests might have. To get meaningful results, good researchers must also work closely with good farmers!

Working in the greenhouse or the field (usually in small plots), most researchers exploring this subject have compared responses of individual insects or whole populations to the same crop under both

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organic and conventional management. In some of these studies, insects have been found either to be more variable and reach higher densities on conventionally grown crops than on organic crops or to prefer conventionally grown plants to organically grown ones when laying their eggs. In other studies, organic fertility programs have not been found to reliably diminish insect pest populations.

A modest but growing body of research supports the idea that the higher organic matter and microbial activity of organically farmed soils are at least partly responsible for helping to reduce the severity of insect pest problems on plants grown in those soils. Rather than compare organic and conventional systems, our goal is to develop research-based information on how different organic fertility management practices affect crop resistance to insect pests, and what (if any) particular soil management practices are most helpful.

One variation on the soil-balance concept proposes that raising soil calcium levels plays a significant role in crop plant nutrient uptake and improved resistance to insect pests. To test this hypothesis, we are comparing two different organic soil fertility systems for impact on a variety of insect pests. The Standard Organic Fertility (SOF) system relies on livestock manure, alfalfa hay in the rotation, and cover crop green manures for nitrogen and most other crop nutrients. Soil pH is adjusted with the addition of crushed dolomitic limestone, which is not considered an effective plant source of calcium. The second system, Soil Balance Organic Fertility (SBOF), incorporates SOF factors, but adds high-calcium lime or gypsum regardless of soil pH levels. Growers who subscribe to the soil-balance method report that a high base saturation of the soil cation exchange capacity for calcium (70-85%) in proportion to potassium (3-5%) and magnesium (12-18%) plays a significant role in crop plant nutrient uptake and improved resistance to insect pests.

We have partnered with seven certified organic growers throughout southern Wisconsin whose farms use the two systems mentioned above (four using the SOF system and three using the SBOF system). In addition to allowing us to work on their farms, these growers are also serving as an advisory board. Their assistance with the design and execution of the project has been invaluable and should make the results of the project more relevant to organic farmers.

At the same time, we are also conducting a controlled, replicated trial on approximately 30 acres under transition to organic certification at the University of Wisconsin's Arlington Research Station northeast of Madison. Both the organic farms and the transitional plots are being moved through a four-year small grain/alfalfa-alfalfa-corn-soybean rotation that is widely used in the upper Midwest by organic grain crop producers as well as organic dairy farmers. (Some of our farmer partners also include processing vegetable crops in their rotations).

In addition to collecting soil test laboratory analyses, qualitative soil assessments, and plant tissue data, we are studying three crop-pest associations (soybean aphid on soybeans, potato leafhopper on alfalfa, and European corn borer on corn). One possible long-term outcome of "balancing" nutrient and mineral availability might be that pest populations are regulated to levels that naturally occurring predators are better able to control. We are measuring both pest populations and the interactions between pests and their natural enemies.

As of fall 2007, we've completed the first year of organic transition in the controlled trial at Arlington Agricultural Research Station, and collected soil, plant tissue and insect data from corn, soybeans and alfalfa on participating established SOF and SBOF organic farms. We plan to continue the long-term Arlington study as part of this project initiative for 7 more years (that is, two complete cycles of the rotation). Since soils take some time to respond to even highly available calcium, we're not expecting to find much difference between the two systems in the first year at Arlington. In this presentation we summarize soil test results, crop plant nutrient profiles and pest and beneficial insect sampling results. We'll discuss our experimental design, year one observations, and plans for year two of the project.

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Pennsylvania Regional Organic Fruit Industry Transition (PROFIT) Update: Disease Management Strategies

J. W. Travis[1] and N. O. Halbrendt[2]

Apple production practices utilized over the last 40 years are being replaced by new organic and sustainable approaches to growing fruit. Disease management methods are being developed that are profitable for growers while being environmentally sound and focused on meeting consumers' expectations for food safety and quality. In 2004, an organic apple demonstration orchard was established at Pennsylvania State University (PSU) Fruit Research Center to provide the researchers and growers with the opportunity to observe best organic practices for local organic apple production (Fig. 1). Research trials have focused on the efficacy of sulfur and lime sulfur applied alone, in combination or in rotation with other organic or alternative fungicides to evaluate for effectiveness on apples (Table 1). Treatments were arranged in a randomized complete block design with four replications. Treatments were applied with a boom sprayer at 400 psi, which delivered 100 gal/A. Spray programs were applied on 7-10 day intervals, until primary scab ended, and then on 10-14 day intervals for the remainder of the season. An organic maintenance program for insects was applied to all the treatment plots. Weather conditions and primary scab infection periods were recorded with a Field Monitor Weather System using the Mills Modified apple scab infection model.

Disease incidence on 'Golden Delicious' shoots, spurs and fruits was recorded by observing all leaves on 25 shoots and fruit clusters per tree (4 replicates/treatment) on 21 Jun, 25 Jul, and at harvest (26 Sep). Data obtained were analyzed by analysis of variance using appropriate transformations, and significance between means was determined by the Fisher's Protected LSD Test ($P < 0.05$).

Apple scab incidence on untreated 'Golden Delicious' shoot leaves on 21 Jun were 61%. Fruit scab incidence on untreated trees from 21 Jun to harvest increased from 43 to 100%. Six of the treatment programs (Trts. 3-5, 7-9) reduced the incidence of scab on shoots and fruit compared to the untreated trees (Fig. 2, 3). Citrex (Trt. 2) and EF 400 (Trt. 6) did not control scab. Scab on shoots and fruit were significantly reduced when Citrex was tank mixed with Micro Sulf at a low rate (Trt. 3), or when EF 400 was rotated with Micro Sulf at a recommended rate (Trt. 7). Sulfur applied alone, Sulfur combined with Citrex, and Lime Sulfur plus Vigor Cal programs provided comparable control on scab incidence on shoots and scab incidence and severity on fruits. Slight phytotoxicity due to Sulfur was observed but was reduced when Sulfur was tank mixed or rotated with Citrex or Vigor Cal. All treatment programs with sulfur and lime sulfur reduced the incidence of scab on shoots and fruit as well as powdery mildew and cedar apple rust compared to the untreated trees. This project demonstrated that high quality organic apples can be grown in the eastern United States with existing and alternative fungicides currently approved for certified organic fruit.

All treatment programs with sulfur and lime sulfur reduced the incidence of scab on shoots and fruit as well as powdery mildew and cedar apple rust compared to the untreated trees.

Acknowledgements: The project was supported by the Pennsylvania State University, the Pennsylvania Dept. of Agriculture, the State Horticultural Association of PA, and the USDA SARE. We also thank the Penn State Fruit Research and Extension Center technical service for maintaining the organic apple demonstration orchard.

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Continued

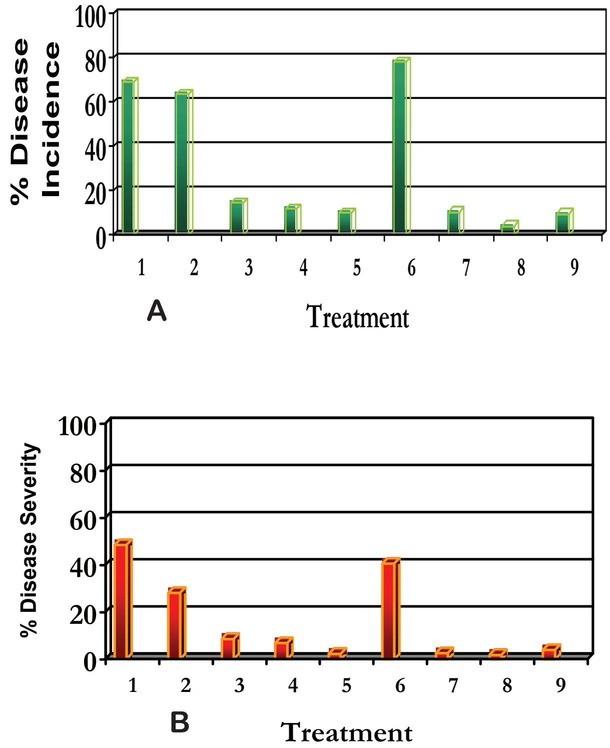
Table 1. 2006 Organic Fungicide Program.

Treatment & Rate/A	Timing
1. Nontreated CK	
2. Citrex 8 oz	P-H
3. Citrex 8 oz +	
Micro Sulf 15 lb	P-H
4. Micro Sulf 15 lb	
5. Micro Sulf 15 lb	P-B
Lime Sulfur 2% +	
JMS Oil 2%	PF
MicroSulf 15 lb	1C-H
6. EF-400 OM 32 oz	P-H
7. EF-400 OM 32 oz	
Rot. w/ Micro Sulf 15 lb	P-H
8. Lime Sulfur 1.5% +	P-B
Lime Sulfur 2.0 % +	
JMS Oil 2%	PF
Lime Sulfur 1.0% 14 da	1C-H
9. Micro Sulf 15 lb +	
Vigor Cal 1 gal	P-H

Table Key:

P-H pink to harvest
P-B pink to bloom
PF petal fall
1C-H 1st cover after bloom to harvest

Figure 2: Scab incidence on leaves (A) and severity on fruits (B) of Golden Delicious apples.



Suppressing Plum Curculio in Fruit Trees With OMRI-Certifiable Insect-Pathogenic Nematodes and Fungi

Mark Whalon

Michigan State University is pursuing four main approaches to Plum Curculio (PC) management in organic systems, including kaolin clay, push-pull strategy, integrating livestock and insect pathogens. We will highlight progress on organic management of PC with an emphasis on insect pathogens. PC are susceptible to disease caused by certain types of nematodes and fungi which are specifically pathogenic to insects. Insect pathogenic fungi can penetrate the bodies of some insects and cause death. Nematodes are microscopic, colorless, unsegmented roundworms which can be beneficial or pests depending on the species' feeding habits. Beneficial insect pathogenic nematodes release bacteria into, feed on and reproduce in the insect's body. Unlike the fungi, they are exempt from EPA registration, but they still have to be cleared through OMRI. Organic growers have the potential to augment natural populations of these biological control agents in their orchard systems in order to suppress plum curculio larvae in the soil as well as plum curculio adults. Strains of fungi or nematodes within species may have differing characteristics such as insect host range, virulence, tolerance to environmental conditions and soil persistence. Since 2004, the pesticide alternatives laboratory has been conducting research to determine the most effective strains of nematodes and fungi and the best application methods. PC adults were found to be susceptible to infection by two commercial fungus strains. The nematode *Steinernema riobrave* was found to be the most effective insect pathogen tested in trials against PC larvae with efficacy remaining high at least 5 days after application to soil.

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Suppression of Soilborne Diseases Through Organic Amendment and Cover Cropping

Alex Stone, Heather Darby, Bonnie Hoffman, Mikio Miyazoe[1]

Suppression of *Pythium* and *Phytophthora* root rots in compost-amended container systems has been documented by researchers and adopted by farmers. However, compost-, manure-, or cover crop-mediated suppression of soilborne diseases in field soils is poorly understood.

The first section of this presentation will discuss the relationships between organic residue amendment quantity and quality and suppression of soilborne diseases such as corn and bean root rots. In field trials in Oregon, high rate raw and composted manure amendments were applied to a field soil. Two months after amendment, all amendments (except the low rate of manure) reduced the severity of damping off 30 %, bean root rot 29%, and corn root rot 67 %. Twelve months after amendment, amended soils were no longer suppressive. All amendments were suppressive after re-amendment the following year and no longer suppressive six months later. Suppression was positively related to soil microbial activity (FDA activity) and to particulate organic matter quality and quantity.

...oat was the most consistently suppressive cover crop to root rot of sweet corn.

The second section of this presentation will address suppressiveness of cover crops to soilborne diseases. In container trials in Oregon, sudangrass treatments reduced disease severity 32 and 64% in each of two soils, while oats reduced severity 28 and 49%. Annual ryegrass and cereal rye had little effect on severity of the root rot complex. Root rot suppression was not related to the rate of fluorescein diacetate hydrolysis (FDA activity). In addition, annual ryegrass and cereal rye are alternate hosts to *Pythium arrhenomanes* and *Drechslera* sp., two pathogens involved in the sweet corn root rot disease complex. In field trials, suppressiveness of late summer and overwintered oat, sudangrass, and mustard cover crops was variable, and all cover crop species suppressed root rot in at least one greenhouse or field trial. However, across three years of field trials and greenhouse bioassays, oat was the most consistently suppressive cover crop to root rot of sweet corn. Overall, suppressiveness was not related to FDA activity. Oat immobilized soil nitrogen. In addition, oat is an alternate host to barley yellow dwarf virus, a pathogen of grass seed and other grass family crops grown in rotation with sweet corn.

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Transitional Dynamics in Converting Conventional Field Cropping Systems to Certified Organic

Andrew T. Corbin, Kurt D. Thelen, Richard H. Leep, Stephen K. Hamilton, G. Phillip Robertson

Certified organic crop production is the fastest growing segment of agriculture in the United States today, increasing at a rate of about 20 percent annually. The transition from conventional farming practices to organic is complicated, yet, growers interested in organic farming have extremely limited resources in the scientific literature to turn to for guidance in making the transition. This study focuses on the agronomic (weed management, yield, soil fertility, quality and sustainability) dynamics during the critical three-year transition phase from conventional farming to certified organic field crops. The research will result in the development of best management practices for growers to follow in transitioning to a certified organic system in corn, soybean, wheat and alfalfa. Two different organic cropping systems are compared here: A four-year organic rotation of corn, soybean, wheat and alfalfa which incorporates dairy manure and cover crops vs. one year of conventional corn followed by three years of continuous organic alfalfa without manure or cover crops. Michigan farmers have been taking notice of the increased profits and increased market share associated with certified organic products. However, many are reluctant to attempt the transition because they assume they will have to take a loss during the required 3-year transition period. This study will develop best management practices that position the grower's cropping system to be at optimal agronomic potential at the end of the 3-year transition period while still maximizing returns during the 3 transitional years. An economic analysis of treatment effects provides a quantitative estimate of potential impacts. Given the above stated growth potential of the organic industry, this work will significantly impact Michigan organic growers and those who will be transitioning over to organic production systems.

Objective 1). Develop a USDA Certified Organic Field Crop System Design for transitioning from conventionally farmed systems which employs basic agronomic techniques and produces high quality products while minimizing the effect on yield.

Objective 2). Test the two systems in Objective 1: a four-year rotation of Corn-Soybean-Wheat/Alfalfa-Corn, (TOR) produced with organic sources of nutrients (manure and crop residue), and no synthetic chemical inputs may increase soil organic matter quality and decrease the weed seed bank responses as compared to one year of conventionally grown corn followed by three years of continuous alfalfa (TCA) for the transition to a certified organic system.

Objective 3). Compare the functionality of the two systems by evaluating the performance of the same crop (corn) during the first certified organic season (2006) across treatments through analysis of yield, soil organic matter quality and weed seed bank contents and responses.

Results indicate yields exceeding local and regional averages with no significant difference in yield between the two treatments during the initial (corn) year. There was no significant difference in corn yield between the two harvest methods for the Corn-Alfalfa treatment. The yield between the two treatments in the hand harvest method differed slightly – albeit significantly.

This study is based on the assumption that a producer has decided to make the transition from conventional farming to organic. Rather than strictly compare conventional vs. organic management for three years (the required length of transition

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time for organic certification), we are contrasting two separate organic methods and their effects on yield and soil quality. Here we've focused on the agronomic methods and yield data from the first year (where corn is grown conventionally in one treatment) and soil organic quality at the start of the second season (year one of the transition period for both treatments). Bulk density did not differ significantly between treatments at either 0-7cm or 7-25cm depths. Water filled pore space was significantly greater in the TOR treatment at each depth. Aggregate size distribution was nearly identical between treatments at the start of the three-year rotation. There were no significant differences between treatments for any of the aggregate size classes at a depth of 0-7cm. Bulk density, water-filled pore space and aggregate size distribution are indicative of soil organic matter quality and the ability of the soil to sequester carbon. These baseline measurements will be compared to similar parameters at the end of the rotation. A weed bioassay has been conducted on this same baseline soil in order to determine the contribution of each treatment regime to the weed seed bank. We've also focused on weed management strategies for organic producers which are generally limited to crop rotations, cover or companion crops, and mechanical cultivation. To that end, we estimated weed seedling densities from buried seed reserves by means of a greenhouse germination assay followed by in-situ weed density observations throughout the growing season. The broadleaf weed seedling germination for TCA was not significantly different from the control, however the broadleaf weed seedling germination for TOR was significantly greater than that of TCA. Total germination was not significantly different between treatments for 2004, but differed significantly for 2005. Percent cover remained fairly constant for TCA, but varied significantly through time for TOR. The TCA treatment had a higher maximum percent weed cover in the field with lower total germination in the greenhouse. The opposite was true for the TOR treatment.

This research has resulted in quantifiable (bottom line) impacts for Michigan growers to attempt the transition. Both types of management strategies are economically plausible.

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Yield, Environmental and Economic Comparison of Three Organic Cropping Systems of the Upper Midwest (2004-2007)

J. Hedtcke, J. Posner, B. Stangel, G. Sanford, D. Mueller

In 1990, a large-scale, long-term study entitled the Wisconsin Integrated Cropping Systems Trial (WICST) was initiated at the Arlington Research Station, to compare the productivity, profitability, and environmental impact of a range of cash-grain and forage-based cropping systems. Two of these systems have been managed organically for 15 years or 5 cycles: System 1) a 3-yr cash-grain system: corn-soybeans-winter wheat (+ a clover cover crop), and System 2) a 3-yr dairy-forage system: corn-oats/alfalfa seeding-alfalfa hay (+ dairy manure). In 2003, another 12 acres of land at the Arlington Research Station was transitioned into a certified organic 4-yr rotation (3 yrs of grain + 1 yr of forage + dairy manure) (System 3). These three systems can be envisioned as a continuum from a short interval cover crop (System 1), to a full year of forage in the rotation (System 3), to two years of forage in the rotation (System 2). We hypothesized that integrating a single year of forage with manure inputs into the grain system would capture the benefits of improved weed control and improved nutrient availability while still being short enough to profit from the high organic premiums that grain crops have been receiving. However, soil fertility, particularly potassium, will likely be drawn down more quickly with more forage in the rotation. Yields, fall nitrates, fuel use and soil loss, as well as gross margins were evaluated under these three organic strategies. Gross

Continued

Table 1. Comparison among organic rotations with increasing length of green manure/forage phase (2004-2007)

	Corn	Soybean	Wheat	Production yr forage	Profile nitrates	System Gross Margins
	Bu/a			Tons DM/a	lbs NO^-_3-N/a	$/a
3-yr grain	115.4c	44.8b	58.9b	-	62b	299b
3- yr forage	139.4b	-	-	4.24	99a	303b
4-yr hybrid	169.2a	60.0a	71.7a	4.54	81ab	410a
p-value	*0.0001*	*0.0059*	*0.0056*	*0.3149*	*0.0002*	*0.1812*

margins (net returns) were calculated for each system and are calculated as crop income minus variable costs (seed, fuel, custom hire, etc). For this study, organic feed-grade, not food-grade premiums were used.

Grain Yields

• Corn yields (Table 1) have been excellent in the 4-yr integrated system (System 3) with its higher N input from manure and plowdown alfalfa (Fig. 1) and better control of annual weeds than in System 1 with only the cover crop, and less perennial weeds (especially quackgrass) than in System 2 with the longer forage rotation. The average corn yield was 22 to 47% higher in this rotation than the two 3-yr rotations (System 1 & 2, respectively).

• Organic soybean yields were 44.8 bu/a in the 3-year grain system compared to 60.0 bu/a in the 4-yr rotation, very comparable to conventional corn/soybean system (data not shown). Again excellent weed control in the longer rotation was the primary difference.

• Wheat yields in the 4-yr rotation were 15.2 bu/a higher than in the 3-year grain system most likely as a result of additional nutrients from manure and no companion-seeded cover crop competition.

The integrated 4-year system has an intermediate amount of N-input, good corn yields, and intermediate levels of fall N.

• Estimated soil loss: Multiple tillage operations are often necessary for weed control in annual crops but this is an important constraint on organic grain systems in terms of labor and fuel inputs. RUSLE2 will be used to model predicted soil loss estimates. We hypothesize that by adding a year of forage, less soil needs to be tilled over the rotation and there is a higher percentage of ground cover and therefore less is prone to erosion.

• Energy input: Fuel use was highest for the 3-yr dairy system using an average of 10 gal/a mostly from more frequent manure applications and primary tillage operations. The grain systems used slightly less diesel fuel and were similar to each other at 8 gal/a. All these systems use 2-3x the fuel as our no-till corn-soybean system (3.6 gal/a).

Economic evaluation

· In the 3-yr grain and dairy forage systems, all crops are sold with an organic premium. Feed-grade price premiums have held fairly constant over the past decade with corn, soybeans and

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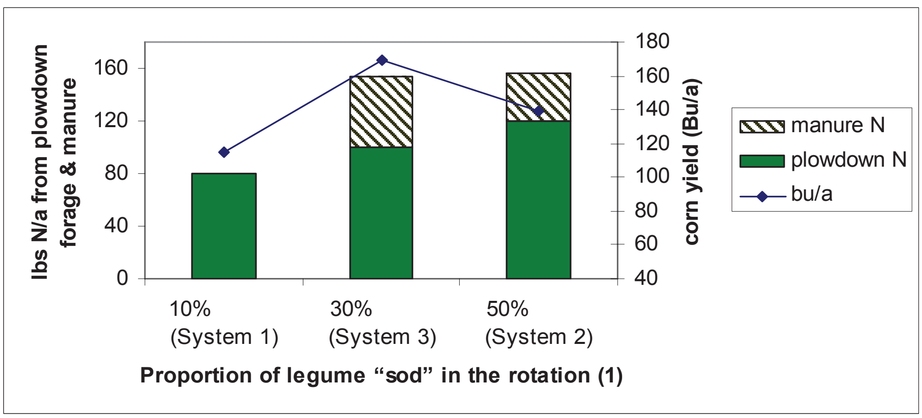
Environmental Variables

• Fall nitrates: As a proxy for the synchrony of N-availability and N-uptake and a measure of potentially leachable nitrogen, fall nitrates were monitored. With just a short interval green manure crop in System 1, nitrogen inputs to the corn phase are modest and fall nitrates the lowest. With a 2- year sod plowdown plus manure (10t/a), system two has the greatest N-input, but due to modest yields, it has the highest fall N levels.

Figure 1. Biological N additions (forage credits + Manure) and corn yields (2004-2007)



(1) System 1 (C-Sb/w-W/clov). Clover cover crop actively growing 4 months (4/36=10%). System 2 (C-O/a-A). Alfalfa forage in the rotation 18 months (18/36=50%), plus manure. System 3 (C-Sb/w-W/a-A). Alfalfa forage in the rotation for 14 months (14/48=30%), plus manure.

wheat selling around \$5, \$12 and \$5/bu, respectively, due to the demand from organic livestock farms. Although still an emerging market, organic hay has been receiving up to a \$25/ton premium, depending on quality. However, in the 4-yr system, since we are taking manure and selling back the forage to a neighboring dairy farm (not necessarily organic), we have put a conventional price on the forage phase of this system. Nonetheless, this system is most profitable (\$410/a/yr) due to the agronomic advantages from adding a forage to the system. During this same period gross margins with a conventional no-till corn/soybean rotation were only \$249/a/yr.

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Financial Performance of Organic, Grazing and Confinement Dairy Farms in Wisconsin

Tom Kriegl[1]

Potential organic dairy producers want to know three things about the economic impact of choosing that system:

1. What are the potential rewards once the goal is achieved?
2. How long will it take to attain the goal?
3. What will it cost to attain the goal?

To help answer those questions, 70 farm years of actual farm financial data from Wisconsin farms receiving organic milk prices from 1999 to 2005 were put into a seven-year summary and compared with similar data from Wisconsin grazing and confinement farms and with other data from organic dairy farms in North America.

The data were not collected randomly. Producers volunteered to provide the financial information. Actual farm financial data from organic dairy farms is scarce and the organic dairy farmers participating in the survey are an experienced group. A less experienced organic farmer may not have the level of financial performance shown by this group.

For this study, organic farms are defined as those certified organic and marketing milk organically for the whole year. To be considered a grazing farm, the operator must harvest over 30 percent of forage needs from grazing and must provide fresh pasture at least once every three days. Some of the organic dairy farms met the definition of grazing and some did not. Both grazing and non-grazing organic dairy farms were grouped together for this analysis. Confinement farms are defined as those that rely on stored feed throughout the year and include both smaller traditional dairy farms that use mainly family labor and larger dairy farms that use mainly hired labor.

Comparison Overview---Financial indicator NFIFO divided by total income

Net Farm Income from Operations (NFIFO) represents returns to unpaid labor and unpaid management, and equity (owned) capital invested in the business. NFIFO is the income (cash plus non-cash) that is left over after all costs except opportunity costs of unpaid labor, management, and equity have been accounted for. NFIFO divided by total farm income expressed as a percentage was used to compare the different farm types. Farms with a higher percentage are retaining more of their total income; those with lower percentages are using a larger portion of their income to cover expenses. This ratio was used to compare the farms because differences between some of the categories of income and expenses make comparisons of absolute values difficult. For example, confinement farms sold 30 to 40 percent more pounds of milk per cow than grazing and organic herds and organic farmers received a much higher price for their milk.

Using NFIFO as a percent of income, graziers retained the highest portion of the farm's total income, followed by organic dairy farmers. Since

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Data for three farm types, 1999 to 2005

	Organic farms	Non-organic grazing farms	Confinement farms
Range in number of farms participating	6-17	21-43	581-660
Average herd size range	48-64	61-68	96-133
Average pounds of milk sold per cow	14,465	15,966	20,929
Average price received per hundredweight of milk	$19.44	$14.83	$14.30
Average NFIFO/Total Income	21%	26%	14%
Range of NFIFO/Total Income	14%-26%	19%-32%	7%-18%

smaller farms may use more unpaid family labor and the cost of unpaid labor is not included in NFIFO, this measure could show an unfair advantage for the farms that have smaller herds—grazing and organic farms. However, an examination of the opportunity costs of unpaid labor, management and equity shows that the cost of unpaid labor accounts for some but not all of the advantage in NFIFO as a percent of income that graziers have over the organic farms and both grazing and organic farms have over confinement farms.

Other observations include:

1. The price premium is very important to the economic competitiveness of organic dairy farms.

2. Organic dairy producers receiving organic prices were more competitive with other dairy systems in years that the national average milk price was low.

3. It appears that grazing practices enhance profitability more than organic practices do.

4. For those farms (we've encountered a few of these) whose routine practices for the past three or more years just happen to meet organic requirements, about the only downside to becoming certified and obtaining organic prices is the cost of and record keeping effort to become certified.

5. The three to five year transition from a "conventional" system to organic is often challenging financially and other ways. We have been trying to measure the long-term financial impact of this transition.

6. In a comparison of 10 Quebec farms transitioning to organic with 22 similar sized non-organic Quebec farms, the transitioning farms did better financially in the first year, not as good in the third year and about the same in the fifth year.

7. The lbs of milk sold per cow from organic dairy farms were fairly similar from Wisconsin to New England to Quebec. This level was about 70% of the lbs of milk sold per cow by Wisconsin confinement herds. Wisconsin grazing herds sold about 75% of the lbs of milk sold per cow by Wisconsin confinement herds.

8. In 2004, 30 organic dairy farms from Maine and Vermont were not as competitive as
   a. non-organic New England dairy farms
   b. any Wisconsin dairy system

9. Feed costs were much higher for New England farms than in the Corn Belt – especially for those which were organic. Organic grain prices are typically twice the price of non-organic grain in the same location. Organic grain prices in New England can easily be double the price of organic grain in Wisconsin. Organic forage prices are typically about 30% more than the price of non-organic forage in the same location.

10. Be careful about comparing a dairy system from one state to a different dairy system in another state. The financial performance of Wisconsin organic dairy farms looks dramatically different from the 2004 and 2005 financial performance of New England organic dairy farms.

11. The jury is still out regarding many other economic questions about organic dairy farming. Economic data from organic dairy farms are slowly becoming more available.

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Organic Grain Price Data Analysis

Alexandra Fehring

Weekly wholesale organic and conventional agricultural prices for 8 major markets (Chicago, Omaha, Dallas, Fargo, Minneapolis, San Francisco, Detroit, Seattle) throughout the United States are provided from The Rodale Institute® Organic Price Index® (OPX). Specifically, we focused on the weekly prices of organic and conventional grain from the market regions from 2004 to 2007, which provides for over 3000 data points. The data points were used to analyze: i) the differences between organic and conventional grain prices, ii) the relative variability of conventional corn and organic corn prices, iii) the role of geography in determining corn market price, and iv) the role of ethanol use in rising corn prices. From 2004 to 2007, organic corn prices have increased nationally on average 131% from $4.02 to $9.25 per bushel, due to ethanol production and increased demand for the growth of corn.

Using linear regression and price correlation analysis of corn, soybeans, wheat, and oats, we see no future trend of any organic grain price disappearance. Corn is the biggest player in the organic premium market, showing a great upward slope and widening gap from the conventionally produced corn. Soybeans show deterioration in organic premium with a negative slope and r-squared value at 0.153. Even with this recent organic premium deterioration, soybeans still have the highest percentage organic premium aggregate over all other analyzed grains. Organic wheat premiums have remained stable over the past 4 years and organic oat premiums have a slightly rising slope.

The organic market is expected to grow and price premiums will hold for at least 10%-18% until 2025.

We also analyzed the beginning and ending stocks of grains (as a measure of supply and demand availability). The grain availability is a function of the beginning stock plus the amount in production (supply), subtracting off usage (demand). The corn availability has a ripple effect on other grain commodities; this is due to the increased demand and acreage used for corn in the production of ethanol. Soybeans, wheat, and oats all have increased prices, diminishing beginning stocks, and increasing proportion of ending stocks, which leads to scarce commodities.

So far, ethanol production has driven commodity corn and organic corn prices higher. The price of organic corn tends to increase in tandem with conventional corn increases. Even though organic corn is not used in ethanol production, they are the same commodity. This high demand will have an ever increasing effect on the price and availability of other grains as well. Currently the organic grain market is growing at 20% per year with organic premiums holding well above the conventional prices. The organic market is expected to grow and price premiums will hold for at least 10%-18% until 2025. Growth in domestic certified acreage in organic has averaged about 10% increase creating a supply environment favorable for continuing organic price premiums.

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Procurement and Contract Practices of U.S. Organic Handlers: An On-line Database for Farmers and Other Operations

Lydia Oberholtzer[1] and Carolyn Dimitri[2]

Retail sales of organic food in the United States have soared over the last decade, from $3.6 billion in 1997 to $15.7 billion in 2006. Growth in the organic sector has provided opportunities for all agents along the supply chain. Although nearly all organic commodities pass through the hands of at least one intermediary on the way from the farmer to the consumer, there is a dearth of literature examining organic food marketing, especially for the middle section of the supply chain. Organic handlers play a central role in the industry, packing and shipping, manufacturing and processing, and distributing, wholesaling, and brokering organic products. By virtue of their place in the middle of the supply chain, changes at either the farm or consumer level have implications for these intermediaries, and vice versa.

Contract relationships are of special importance because they are used more in the organic sector than the conventional sector.

To gain insight into organic supply chain dynamics, a nationwide survey of organic processors, manufacturers, and distributors (handlers) was undertaken by the USDA's Economic Research Service (ERS) to study 2004 practices. The survey was drafted with input from organic industry stakeholders, and consisted of 59 questions covering: (1) operational and business practices (e.g., facility function, products produced); (2) basic characteristics of handling facilities (e.g., gross sales, size, years certified organic); (3) relationships with customers (e.g., marketing outlets used, market distance); and (4) relationships with suppliers, including supplier types and purchase arrangements.

Procurement and contract practices are at the heart of the survey results, and of particular interest to farmers. Contract relationships are of special importance because they are used more in the organic sector than the conventional sector. A searchable database of procurement and contract information will be available on the ERS website in fall, 2007. The database will include procurement information reported by handlers on the survey, including information about: (1) where purchases are made; (2) the type of sales arrangements used (e.g., contract, spot); (3) the type of suppliers used (e.g., growers, cooperatives, manufacturers); (4) requirements made of suppliers; (5) assistance offered to suppliers; (6) important supplier attributes; and (7) size and type of firm. The procurement database also separates the information by handlers that manufacture/process and those with other handling (e.g., distributing) functions.

Database information related to contracts includes: (1) type of contract (written or verbal) used; (2) compensation methods; (3) price mechanisms; (4) quality measurements; (5) payment timing; (6) average length of contract; (7) standard contract terms; and (8) assistance provided to contract suppliers.

The tables on the next page summarize some of the data available at the website, grouped by national (n=1,393) and Upper Midwest (defined as MN, MI, WI, SD, ND, NE, IA, MO, OH, IL, IN) (n=321) results. More detail, including state level data and commodities when applicable, is available at the ERS website. The searchable database is available at: www.ers.usda.gov/briefing/organic/

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Continued

Nationwide Survey of Certified Organic Handlers: 2004 Procurement Practices

	Percent of handlers	Percent of handlers
Operational characteristics	National	Upper Midwest
Function: manufacturer/processor	55	64
Other functions (e.g., wholesaling, packing, distributing)	47	38
Small (self-identified)	59	62
Medium	31	32
Large	10	6
Purchasing characteristics	National	Upper Midwest
Buys locally (within an hours drive), more than half	22	24
Buys regionally (within State/surrounding states), more than half	30	34
Buys nationally, more than half	28	31
Buys internationally, more than half	23	12
Type of sales arrangement	National	Upper Midwest
Formal contract (written)	59	55
Informal contract (e.g., handshake or verbal)	37	40
Spot market	46	52
Assistance offered to suppliers	National	Upper Midwest
Recruits existing organic suppliers	41	41
Works with organic suppliers in business for less than 1 year	33	31
Provides technical advice on organic standards or production	31	30
Works with suppliers to increase production	32	30
Accepts shipments that are less than a full carload	33	42
Assists farmers with transitioning into organic	35	31

Supplier requirements	National				Upper Midwest			
	Always	Sometimes	Never	Don't Know	Always	Sometimes	Never	Don't Know
Organic certificates	97	2	1	1	96	3	1	0
Product specifications for packaging and merchandising	50	20	25	5	52	19	23	6
Testing to verify product claims (e.g., free of GMO)	21	28	44	7	36	24	35	5
Third party food safety certification	20	23	48	9	14	26	49	11
Uniform product standards (e.g., size)	35	20	38	8	32	24	38	6
Minimum quality standards	61	14	18	6	64	14	18	3
Minimum quantity for shipments	25	32	34	9	24	31	40	6
Certifications for other attributes (e.g., kosher, fair trade)	35	23	35	8	34	27	34	5
Ranking Supplier Attributes	High priority	Medium priority	Low Priority	No Difference	High priority	Medium priority	Low Priority	No Difference
Local (near my facility)	38	22	18	23	36	25	20	20
Knowledge of organic products	58	27	7	8	58	28	8	6
Length of relationship with facility	33	34	19	13	26	41	18	15
Length of time certified organic	15	33	33	19	11	35	34	21
Diversity of products available	20	25	28	27	15	29	30	26
Availability of year-round supply	50	18	15	17	47	23	16	15
Flexibility in meeting facility's needs	52	30	8	10	45	34	10	10
Reputation for quality	71	21	3	5	68	22	2	8
Price	45	39	7	8	44	43	7	6

Continued

Nationwide Survey of Certified Organic Handlers: 2004 Contract Practices

	Percent of handlers	Percent of handlers
Contract length	National	Upper Midwest
Seasonal	33	36
Yearly	39	39
Multi-year	9	4
Other	8	6
Time not specified	12	15
Compensation term used most often	National	Upper Midwest
Flat Price	38	47
Markup over conventional price	9	7
Negotiated price at time of transaction	33	28
Price based on performance relative to other suppliers	2	1
Price determination not in contract	4	4
Other method	10	10
Price mechanisms in standard contract	National	Upper Midwest
Quantity discount	27	24
Quality premium	24	32
Penalties for lower than contracted quality	26	27
Prices depend on supplier's past performance	9	14
When suppliers are paid	National	Upper Midwest
Upon delivery of product, organic certificate	57	70
At harvest	6	1
After downstream sale	13	5
Other	24	23
Standard contract clauses	National	Upper Midwest
Automatic renewal	14	9
Verification of organic certification	79	85
Minimum quality standards	74	74
Number of acres you will buy production of	21	27
Best management practices	24	18
Reject deliveries that don't meet specs	61	70
Other actions if contract specs not met	39	40
Place of delivery	62	69
Date of delivery	55	61
Exclusive supply	11	18

Organic Research Symposium

Student Research

Wholesale and Retail Market Opportunities and Barriers for Fresh Organic Produce in Michigan and the Midwest

Lourdes Martinez[1], James Bingen[2], David S. Conner[3], Emily Reardon[3]

Industry publications and academic research regularly acknowledge the growing demand for organic food. The Organic Trade Association (OTA) counted an increase of organic sales of approximately 16 percent between 2005 and 2006. More than 50 percent of consumers currently purchase at least one organic product. The main reasons consumers buy organic products is their perception that they are healthier than conventional food products. On the other hand, high prices of organic products remain the main barrier for many consumers to buy more organics. Although this upward trend in consumer's purchase of organic products is expected to create incentives to production, significant numbers of farmers in the Midwest have not responded by "going organic."

Certified organic fruit and vegetable farmers sell predominantly in local markets but rely on a mix of marketing strategies.

In order to assess the inter-related production, processing/packaging and marketing hurdles that might constrain many farmers from transitioning to organic, we conducted two different sets of interviews in Michigan. First, we interviewed 29 organic farmers about their marketing strategies. These conversations set the stage for discussing ways to match Midwest farmer and buyer interests and needs. For the next round of interviews, we focused on fresh fruit and vegetables, mainly because the fresh produce industry presents production and marketing characteristics differently than grains and other commodities. Using a publicly available directory of fresh produce wholesalers, brokers, retailers, processors and grower-shippers (produce traders), we contacted a total of 226 produce traders in Michigan. The main purpose of these interviews was to understand trader's perceptions of opportunities and barriers to increasing purchase of organic produce.

The 2006 Survey Report, "Organic Agriculture in Michigan" (Progressive Grocer Magazine, May 2007) found that certified organic fruit and vegetable farmers sell predominantly in local markets (defined as 150 miles or less from the farm), but rely on a mix of marketing strategies that include community supported agriculture (CSA), on-farm sales, farmers markets, restaurants and local grocery retail stores. Networking among farmers represents an important way to learn about new buyers and buyer practices. These networking relationships appear to be an important way for farmers to learn about and/or deal with problems such as late payments or other mis-understandings that arise between growers and traders.

For a variety of reasons, many certified organic fruit and vegetable farmers vary their marketing strategies from year to year. Until the 2007 season, the supply and packaging requirements kept most farmers from working with the larger retail grocery chains. But starting in the summer of 2007, many of these larger chains have invited some organic farmers to set up produce stands in the store parking lot, and in some cases guarantee purchase at market price of any produce left at the end of the day. For direct to retail sales, most certified organic fruit and vegetable farmers do not use written contracts, but sell on the basis of word-of-mouth. While this tends to be a satisfactory basis for marketing, frequent turnover among produce managers in some retail outlets makes it difficult to maintain reliable relationships.

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The responses of fresh produce traders reflected their growing interest in organic products. Out of the total number of participants (112), 37 percent is considering handling organic produce in the future and 32 percent is considering buying from Michigan. According to these respondents, one of the main opportunities for Michigan organic farmers is consumers increasing interest in local products. Also, produce traders agree that organic is perceived as healthier than conventional products. As one wholesaler pointed out, if consumers were given a choice between conventional and organic products "consumers would always prefer organics."

Respondents indicated that production problems remain one of the biggest barriers for Michigan farmers to sell to produce traders. Some of the most commonly issues addressed by traders were insufficient production volume, short season in Michigan, and lack of variety of fresh products. Other traders suggested that decreasing price premiums can be detrimental for farmers and traders in the future. With regards to pest and diseases, traders indicated that these issues can greatly damage the quality appearance of products.

For the most part, traders develop long term relationships with their supplier. Hence, before they look for new suppliers, most traders would prefer to remain in business with their current suppliers. This issue can represent a barrier for farmers wishing to sell to this market segment in the future. Some traders responded that they were members of marketing cooperatives, which precludes them from buying from non-members of those cooperatives. Also, there is growing preference (particularly with retailers) to deal with 'consolidators' who are people able to gather production, deliver it to different stores and place the products in the produce department.

The scale of trader's operations represents a major constraint to work directly with some organic farmers. For example, one key element in the calculation of total costs is the transportation cost which is usually reduced by bringing products directly from one farm. Increasing the number of farms would likely represent an increase in transportation costs, even if all the farms were located in the same state. For this reason, some traders would prefer to bring directly from California where they can find the volume they need and year-round supply, helping traders maintain their operation costs down.

In summary, main barriers to establishing a relationship between farmers and fresh produce traders are production problems, long term relationships with current suppliers and trader's operation scale. Among factors that can create opportunities for farmers is the growing interest for local production which acts as an incentive to find new partnerships with local organic growers. Some wholesalers indicated that having fresh products during the season is important to better serve their customers. For farmers interested in accessing the wholesale produce market there is growing need to join forces and find alternatives to satisfy the demand for fresh organic produce in Michigan.

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Do We Need a Separate Breeding Program for Organic Soybeans?

Michelle Menken[1]

Organic farmers often express the need to have crop breeding programs which are designed to produce crops better adapted to organic farming situations. In most modern breeding programs new lines are grown using Best Management Practices (BMP) that include synthetic fertilizers and herbicides. In this way the lines selected can be guaranteed to produce at predictable levels across a range of environments that have been "equalized" by added inputs. In organic agriculture, crops will be grown under a wider range of growing conditions. Weeds are less predictably controlled so lines that are more weed-competitive or weed-tolerant become more important than they would be in a system where farmers use herbicides. Fertility will also vary more in organic systems where farmers use green manure or livestock manure instead of synthetic fertilizers. Crop rotations, cover cropping, and intercropping practices all vary more than in conventional systems. Organic soils may have a different range of organic matter and soil microorganisms that could influence crop performance. In this experiment we will be growing approximately 550 new breeding lines of food-grade soybeans in five organic and five conventional environments to see whether we make different best selections. We will be using yield, protein and oil content, seed quality, and agronomic traits such as canopy closure and lodging to make selections. Also important will be stability of performance across years and locations. If the same best selections are made in both systems, then breeding programs can be conducted under either system and the best lines will be selected. If different best lines are selected, then it would indicate that organic agriculture would benefit from separate breeding programs where lines are grown, tested and selected in organic conditions.

If different best lines are selected, then it would indicate that organic agriculture would benefit from separate breeding programs.

In 2005 1500 new breeding lines were grown out at the University of Minnesota's SW Research and Outreach Center (SWROC) at Lamberton, MN. These were crosses that had been made between good food-grade lines and high-yielding and Minnesota hardy lines. Using criteria developed through conversations with an organic soybean farmer and an organic soybean broker, the lines were scored for agronomic qualities (yield, early vigor, canopy closure, lodging, disease and maturity date) and seed qualities (oil and protein content, hilum color, uniform seed size, smooth seed coats, and disease). Included in the trial were small (<11 grams per 100 seeds), medium (11-20 grams) and large (>20 grams) seeded lines with maturities suited from southern to north central Minnesota. These lines were harvested, weighed, analyzed for protein and oil. From the 1500 lines, 554 were selected to be moved into the experiment where they will be grown in organic and conventional fields over three years. All lines that had poor quality seeds or plants, low yields, or low protein levels were discarded. The 554 lines included 48 small-seeded lines, 247 medium-seeded lines, and 259 large-seeded lines. They were divided into 12 tests according to maturity date. Each test (randomized and replicated), together with check varieties, will be grown in every environment.

In 2006 the first trials began in two organic and one conventional environment in southwestern Minnesota. One organic location was the university's SWROC and the other was a cooperating farmer's field located nearby. The two organic locations were both certified and the plots were grown under common organic management practices. In both cases the weed pressure was primarily from annual weeds (foxtail, red-root pigweed, and common lambsquarter) with some Canada thistle. The conventional location was also at the SWROC and the plots there were grown under standard University of Minnesota BMP's. Soybean aphids were present in both organic fields but were not treated. This was based on the presence of many lady-bug larvae in the fields (natural biocontrols) and the fact that most organic farmers in the area were not treating and we were trying to follow common practices. The conventional fields were sprayed with insecticides for soybean aphid.

Continued

In 2007 four trials were planted, one organic and one conventional at SWROC at Lamberton, MN again and one organic and one conventional at the University's South Central Research and Outreach Center (SCROC) in Waseca, Minnesota. Again both organic locations were certified and plots were planted and maintained using common organic practices of area organic farmers and the conventional plots were grown using University of MN BMP's. The weed pressure in the Waseca organic plots was mainly quackgrass this year and in the Lamberton plots foxtail, pigweed, and lambsquarter. Soybean aphids were quite heavy for a short period in the Waseca organic plots, but again were not treated. The Waseca organic plots were planted somewhat later than desired due to abundant rain early in the season and then both the conventional and organic plots were stressed due to a very hot, dry summer period. An early hard frost may have had some impact on the later maturing lines.

In 2008 three final trials will be grown, one conventional at Lamberton (SWROC) and one conventional and one organic at Waseca (SCROC.) This will give five organic and five conventional trials, three each in southwest and two each in south central Minnesota. The lines will be compared across years and locations (environments) within each of the maturity test groups.

As we expected after moving the 554 best lines into the experiment, in 2006 we had many high-yielding lines with good-quality beans. The earlier maturing plants did yield somewhat less, but many of the small-seeded lines (Natto-type beans) were also in these tests and they inherently yield less. Translating our test plot yields into bushels per acre (250 grams = 10 bushels), we had average yields at Lamberton ranging from 32 bushels to 50 bushels per acre in the conventional trial and 25 to 35 bushels per acre in the organic trial. The maximum yields in each test ranged from 54 bushels to 78 bushels per acre in the conventional trial and from 46 to 61 bushels per acre in the organic trial. Our test materials all had at least 30% protein levels (at 13% moisture) and in 2006 we found the protein levels to be stable with average protein levels ranging from 36.7% to 40.2% (minimum 32.4%; maximum 46.8%) in the conventional trial and averages ranging from 37.2% to 41.8% (minimum 32.3%; maximum 48.3%) in the organic trial. The next step in the analysis will be to see if the highest yielding lines are the same in the two trials.

Though I could have looked at my research question by selecting a smaller number of lines and grown them in more locations, I preferred to design the experiment to be more like a real breeding program. In this way I will be able to answer my research question of whether we need a separate breeding program for organic soybeans and also be at a point where we may have some good quality food-grade soybeans suitable for organic farmers in the central and southern half of Minnesota. The best lines that come out of this experiment should be available for further agronomic and processing tests and perhaps eventually available as University releases.

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Assessment of Organic Farming Systems across Nebraska Agroecoregions - Development of a Healthy Farm Index

John Quinn

The United Nation's Millennium Development Goals (MDGs) challenge the world's nations to improve food security and reduce biodiversity loss by the year 2015. This poses a major challenge for farmers and scientists to produce food while maintaining biodiversity and a healthy environment. Recognizing and rewarding farm systems for the ecosystem services they provide, including conservation of biodiversity, will be essential to achieving the MDGs.

Organic certification is one means of recognizing and rewarding farmers for the beneficial ecosystem services farms can provide. Organic practices and values include whole system farming, environmental stewardship, and a connection to the land and to the community. Farms using organic practices host generally higher levels of biodiversity than do conventional farms; organic producers maintain sustainable yields with reduced inputs; and feel a stronger connection to the community.

Current measures of farm success focus on short-term yield, resulting in production that outpaces human population growth. These increases have come at a cost to natural capital, estimated between $5.7 and $16.9 billion annually in the United States. Consequently, there have been numerous calls for a paradigm shift in agriculture and measures of farm success.

Yield increases have come at a cost to natural capital, estimated between $5.7 and $16.9 billion annually in the United States.

A healthy farm optimizes production of food and ecosystem services. Services provided by healthy agricultural systems benefit both human and natural systems. Ultimately, sustainable agroecosystems must sustain the people and preserve the land.

A healthy farm does not replace working fields with native habitat but rather restores natural qualities to farm-systems, envisioning the farm as a natural habitat rather than as a factory. Understanding the agroecology of organic and sustainable farms will enable concerned farmers to produce enough food to feed the world's growing population, conserve biodiversity, and contribute to the conservation agriculture's environmental legacy.

Communicating these benefits could facilitate the adoption of organic practices by conventional producers, enhancing the sustainability of all farm systems. Communicating positive effects of good farming will improve public opinions about farmers and stimulate a new view of stewardship in the agricultural community. A Healthy Farm Index would be a valuable tool to policy makers, farmers, and citizens. Such a tool should represent the overall condition, resiliency, and resistance of the farm as well as elements that have important value to the community. Ecological, economic, and social data will be used to develop an initial Healthy Farm Index. The first step in development of the index is a survey of the avian diversity on organic farms in the Nebraska and associated habitat variables at field, farm, and landscape scales. Birds stand as an ideal bioindicator because of their ease of detection, broad presence in the environment, and well understood ecology.

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Effects of Organic Management on Weed-Crop Competition

Matthew R. Ryan[1], David A. Mortensen[2], and Paul R. Hepperly[3]

Organic cropping systems have demonstrated potential in producing corn yields equal to conventional systems, despite significantly higher weed levels. Experiments were conducted within a long-term cropping systems trial in 2005 and 2006 to test the effects of organic management on corn tolerance to weed competition. The Rodale Institute Farming Systems Trial was initiated in 1981 to rigorously compare two organically managed cropping systems that differed primarily by their fertility source and rotation complexity, to a conventionally managed system that relied heavily on external inputs. In addition to measuring standard agronomic parameters, a more detailed set of measurements was made to evaluate the relationship between weeds and corn yield. The densities of mixed weed species were experimentally manipulated within subplots to achieve a broad range of weed infestation levels. Weed communities were measured by counting individuals of each weed species in quadrats. Weeds were then harvested, dried, and weighed. Corn was hand harvested and shelled, and then weighed.

All cropping systems produced equivalent corn and soybean yields under standard management conditions. Yield of organically grown corn averaged 24% higher than conventionally grown corn in plots that were maintained free of weeds. Within the two organic systems, corn grown in the absence of weeds yielded significantly higher than corn grown under standard management conditions, indicating significant yield loss from weed competition with standard organic weed management. Yield loss in response to total weed density was also significantly lower in organic systems, indicating that weeds in the organic systems were less competitive. For example, in 2005 corn yield in the organic systems was 36.5% higher when there were 100 weeds / m^2. Weed-crop competition relationships were further explored by evaluating relationships of the most dominant weed species in mixed communities. In both years, foxtail (*Setaria* spp.) and common ragweed (*Ambrosia artemisiifolia L.*) were the dominant weed species across all systems, accounting for more than 65% of the total weed biomass. Common ragweed was found to be more than twice as competitive in the conventionally managed system than in the two organically managed systems. There was no difference in giant foxtail competitiveness across cropping systems.

We believe multiple factors contributed to the increased corn tolerance to weed competition in the organic systems including: 1) soil mediated increase in crop production capacity through increased resource availability from larger pools of soil C and N; 2) a fertility source with nutrient release that is more synchronized with corn requirements; 3) a shift in weed community composition to less competitive species; and 4) increased corn vigor. Enhanced corn tolerance to weed competition may play an important role in buffering crop fitness during years of less than ideal weed control. While we don't advocate growing crops with excessively high weed populations, the fact that organic corn is tolerant of relatively high levels of weed biomass enables organic growers to accept less than perfect weed control in years when weather variability compromises timely weed management. In this way, organic weed management is more forgiving. On the other hand, the organic systems produced higher yields in the absence of weeds, demonstrating that future work should focus on improving organic weed management strategies so that farmers can achieve greater yields.

...multiple factors contributed to the increased corn tolerance to weed competition in the organic systems.

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Amish Dairy Farm Stewardship in Wisconsin: A Case Study of Two Settlements

Caroline Brock

This presentation will explore how economic, social, spiritual and ecological factors shape farm management choices and viability evaluations using both survey and interview data. The Amish in the Kickapoo Valley provide an ideal case to study the influence of networks on farm decision making related to stewardship. The Kickapoo Valley is home to about a quarter of the state's Amish dairies and is an especially ecologically fragile region. Other pasture-based dairy farm sectors, organic and graziers, which are also prevalent in the area will be included for descriptive and comparative purposes. Although the Amish farms are often portrayed as models of sustainability, some Amish face challenges between balancing external pressures against their basic desire to follow a Biblical call for stewardship. Further, some agricultural educators have tried to influence Amish farming practices in ways that may run counter to Amish spiritual values. The Cashton district Amish and Hillsboro district Amish are the largest Amish groups in the region and both have similar core faith values but differing farming practices. This comparative study may be beneficial in facilitating information exchange between the two groups. This exchange may further enable the adoption of sustainable practices.

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Directions for Grazing Research: Agronomic Recipes or Ecological Principles?

Alexandra Lyon[1]

Many agree that there is a need for more research that graziers can use. We (a group of UW-Madison researchers from the disciplines of Grassland Ecology, Entomology, and Rural Sociology) undertook to produce such research. In collaboration with a group of farmers from eight farms in Southern Wisconsin, we studied nutrient flows and soil organisms in pastures under four different management regimes. Our experiences working with graziers on this project led us to examine what type of research-based knowledge is most appropriate for grazing. Some of the graziers expressed frustration with conventional agricultural research that they felt promotes a formulaic approach to farming—a "recipe" of inputs and practices to ensure the same outcome in every place, at every time. Grazing, as they described it, relied not on enforcing such uniformity, but on embracing the unique variations of their individual farms. If this is so, how can scientific research—which is often more interested in broad, general findings than the specifics of one place—produce knowledge that is useful to graziers? We offer the idea of ecological principles, rather than recipes, as a way forward for grazing research.

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Reducing Off-farm Grain Inputs on Northeast Organic Dairy Farms: An Evaluation of Alternative Forage Cropping and Concentrate Feeding Systems: Jersey Herd

S.P. Marston, P.S. Erickson, C.G. Schwab, N.L. Whitehouse and K.L. Brussell

Intensively managed pastures may reduce the reliance on grain during grazing periods, but due to short growing seasons in northern areas, mechanically harvested and stored forages and costly purchased concentrates (grains and protein supplements) are required for confinement periods. The objective of this study was to evaluate four different forage and concentrate combinations, while maintaining similar production levels. This study is part of a three-year farmer-driven experiment. Thirty-two primiparous Jersey cows from the University of New Hampshire (UNH) Organic Dairy herd were randomly assigned to one of four treatment diets testing the main effects of corn silage or grass silage as the forage source and homegrown grains versus a commercially available pellet. There were no differences among treatments in milk yield. Cows fed the grass silage diet containing homegrown grains had higher ($P < 0.05$) milk fat concentrations and body weights. Cows fed the grass silage diets had higher true protein ($P < 0.01$), milk urea nitrogen (MUN) ($P < 0.01$) and crude protein ($P < 0.05$) concentrations than those fed diets containing corn silage. Cows fed the commercial pellet had higher true protein and crude protein concentrations, while cows fed the homegrown grains had higher MUN ($P < 0.01$) and body condition score ($P < 0.05$). Treatment diets ranged from $4.11/cow/d (corn silage with pellet) to $5.19/cow/d (grass silage with homegrown grains). Income over feed costs for the treatments were $5.92 (corn silage with pellets), $5.77 (corn silage with homegrown grains), $5.38 (grass silage with pellets) and $5.73 (grass silage with homegrown grains). The results from year one of this study indicate that feeding a corn silage based diet with a commercially available pellet may have the greatest economic benefit to New England organic milk producers. This was a cooperative project with the University of Maine.

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The Effect of Fish Hydrolyzate on Short-term Nutrient Loss by Leaching

Marilyn R. Johnson[1], Bud Markhart[2] and Sarah Schumann[3]

The objective of this research was to test the hypothesis that the natural complexed forms of the nutrients in Drammatic Liquid Fish Fertilizer increase retention of nutrients in the soil and decrease leaching, compared to an inorganic fertilizer. To test this hypothesis, equivalent amounts of two fertilizers were added to soil columns containing field soil. At four subsequent dates the pots were flushed with 0.01 M $CaCl_2$, and leachate was collected and analyzed. After the 10-day experiment, soil from each column was analyzed for extractable nutrients. Leachate and soil were analyzed for NO3, NH4, PO4 and K. Total nutrient mass balance (input minus leaching losses) was calculated for each column and used to determine the degree of leaching of these nutrients.

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Reducing Off-farm Grain Inputs on Northeast Organic Dairy Farms: An Evaluation of Alternative Forage Cropping and Concentrate Feeding Systems: Holstein Herd

G.W.C. Clark, D. Marcinkowski, M. Stokes, G. Anderson and R. Kersbergen

In the Northern U.S., winter-feed costs are the largest expense on organic dairy farms. This experiment evaluated the effects of forage and concentrate combinations on the nutrition, production and economics of winter-supplemented organic dairy cows in New England. The first of three annual feeding trials was conducted using two different organic forage systems (all grass diet vs. grass/corn silage based diet) and two concentrate supplementation strategies (commercial 20% protein pellet vs. mix of commodities consisting of ground corn, roasted soybeans, soybean meal) analyzed in a 2-by-2 factorial system. Each ration was balanced using CPM-Dairy to equalize milk production and fed as a total mixed ration (TMR) to separate groups of Holstein cows in early to mid lactation. The cost/cow/day of the rations ranged from $5.84 (for corn/pellet) to $6.89 (for corn/commodity). Milk production and milk fat percentage were higher for the two rations balanced using commodities ($P< 0.05$), but milk protein was unchanged. Based on the current value of organic milk in New England ($26.00/cwt base price), the grass/commodity ration resulted in the highest daily milk income ($17.71) and the corn/pellet was the lowest ($16.16). With regard to daily milk income over feed costs it was found that the grass/commodity diet was the most profitable ($11.24), followed respectively by corn/commodity ($10.78), corn/pellet ($10.32) and grass/pellet ($10.20) diets. Based on the results of this first year, there appears to be an advantage to commodity based concentrate supplementation. This was a cooperative project with the University of New Hampshire.

Acknowledgement: This research is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture Integrated Organic Program, "Reducing Off-Farm Grain Inputs on Northeast Organic Dairy Farms." Project partners include the University of Maine, USDA/ARS New England Plant Soil and Water Lab, University of New Hampshire and The Maine Organic Milk Producers

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Risk Management Tools for Corn and Soybean Production

Kris Moncada

Organic producers need decision-making tools to reduce risk in soybean and corn production. We are developing a web-based Risk Management tool to assist organic producers in Minnesota and surrounding states. Users will answer questions about their management practices including crop rotation, soil fertility, compost and manure management, mechanical weed control and planting dates and rates. The tool will determine their risk and effects on crop yields and provide recommendations to decrease risk. This project integrates data from our research and other organic research along with input from our learning groups composed of educators and organic farmers. As a companion to the interactive risk management tool, we will be producing a PDF document that will be available for download on this website. This research is being funded by the USDA's Risk Management Agency.

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Transition Approaches and Soil Amendments Influence Weed Communities

Isabel Rosa[1] and John Masiunas[2]

Farmers transitioning to organic production are concerned about the potential increase in weeds due to difficulties in management and poor soils. Prior to starting transition, many growers have relied on herbicides and have not developed the expertise to use tillage, cover crops, and rotations to suppress weeds. Increases in weed populations during transition can discourage new organic farmers, reduce income, and increase seed banks resulting in future weed management problems. Our research studied the emerged and seed bank weed populations during a four-year transition to certified organic production. Expert organic growers identified our treatments and provided ongoing advice on weed management strategies.

A managed ley system may be a method for land-rich farmers to transition to organic production without increases in weed populations.

We evaluated three management intensity systems combined with three soil improvement treatments as transition strategies. The high management system had a vegetable crop rotation (tomatoes, cabbage and broccoli, and winter squash). This represented a situation where the farmer had limited land and required a large income during transition. The medium management intensity system had an agronomic rotation (soybeans, wheat, and corn). This management system was a common system used by midwestern farmers transitioning to organic production. In the low intensity system we established a perennial ley (clovers, timothy, orchard grass, vetch) and manage it similar to CRP land. The goal of the soil improvement strategies was to improve the soil characteristics, add organic matter, and supply nitrogen needed for crop growth. The soil improvement treatments were cover crops alone, cover crops and compost, and cover crops and manure.

In 2003, the dominant weed species were grasses in the ley system; common lambsquarters and velvetleaf in the agronomic system; and lambsquarters, grasses, and foxtails in the vegetable system. In 2003, the ley system had the most weeds; in subsequent years it had fewer weeds than other management intensities. The low weed populations were due to establishment of a vigorous mixture of perennial plants and lack of disturbance in the ley system. In the vegetable system, during the first year we used plastic mulch and straw to control weeds. The straw had seed, so volunteer wheat was a problem. In 2004 and 2005, the grain system had more weeds than the vegetable system. The higher returns for vegetable production allowed hand-weeding which likely reduced weed populations compared to the agronomic system. The effect of soil amendment varied depending on year. In 2004, there were more weeds in the manure amendment and in 2005 there were more weeds in the cover crop only amendment. Weed species composition changed depending on management intensity and year. Common lambsquarters became less frequent, mainly due to later plantings. *Amaranthus* species (primarily redroot pigweed) became more frequent. Common purslane, a problem weed of vegetables, first was found in Brassica vegetables in 2005. Weed species diversity in the seed bank increased between 2003 and 2005. Species composition of the seed bank was similar to the composition of the emerged weed community with the exception that seed from *Amaranthus* species were the most common. A managed ley system may be a method for land-rich farmers to transition to organic production without increases in weed populations.

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Perennial Crop Mixtures for Organic Grain Production

Brook J. Wilke[1], Emma Flemmig[2], Valentin Picasso[2] and Sieglinde S. Snapp[1]

In the absence of chemical inputs, perennial grain cropping systems require careful design to maintain yields for multiple years. Intermediate wheatgrass (IW) is a perennial grain crop that produces substantial amounts of seed for several years without the need for tilling or replanting. When grown organically in monoculture, IW exhibits decreased seed yields over time. A five year collaborative study between graduate students examined multiple intercrops for IW at Iowa State University and has shown that intercropping white clover with IW initially increased grain yields, but alfalfa was the best intercrop for maximizing IW grain yields after five years. Alfalfa also reduced weed pressure compared to other intercrops and IW monoculture after five years. This research, combined with farmer guidance, is being applied at the Kellogg Biological Station in SW Michigan, where perennial wheat (a hybrid between IW and annual wheat) is being evaluated for organic grain production.

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Rye as a Cover Crop for Organic Food Production

Michael Kantar[1]

An increasingly important cover crop is rye (*Secale cereale* L.). While rye has been grown as a grain crop it possesses useful characteristics such as excellent winter tolerance that make it an excellent cover crop in northern temperate regions. However, rye germplasm is poorly characterized as it relates to traits that make it useful as a cover crop such as earliness to anthesis. Rye can ameliorate some of the negative environmental effects associated with the corn-soybean rotation without jeopardizing the livelihood of farmers. While rye has been investigated in many locations, it is most intriguing in northern temperate regions because of its excellent winter hardiness coupled with its broad adaptability. Several management techniques including mowing the rye at anthesis followed by no-till drilling soybeans into the rye residue can be used to help maximize the benefits of the cover and not adversely impact yield of the subsequent soybean crop.

There is still work to be done in terms of maximizing the efficiency of the cover and breeding varieties that are specifically designed to be cover crops. Three studies evaluating rye germplasm and adaptability to Minnesota growing conditions are being undertaken to develop a greater understanding of variability in rye germplasm to provide quick fall biomass, larger amounts of early-season spring biomass, and an earliness to anthesis while still maintaining appropriate winter hardiness for northern tier states in the U.S. The first study initiated in 2006-2007 looks at the effect of five different date of planting in the fall on rye biomass accumulation and growth stage at three locations across MN. The second initiated in 2006-2007 looked at 44 accessions and named varieties to evaluate the amount of variability in rye anthesis date. The third study initiated 2007-2008 chose five of the accessions to grow out in larger quantities to evaluate for biomass and earliness to anthesis at three locations and two planting dates across Minnesota. Rye's potential as a cover crop is only beginning to be appreciated.

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Assessing Organic Seed Treatments for Enhanced Corn Establishment

N. Goeser, J. Hedtcke, E. Luschei, E. Silva

The first line of defense in weed management is having a good stand and vigorous crop. Delayed corn planting, when soil temperatures warm > 50° F, is a common strategy for organic farmers but this can reduce yield potential if weather further delays planting. Even with delayed planting, it is common to observe poor crop seed germination, emergence, and early seedling vigor due to pathogens, insects or variability in soil moisture availability. Field-scale studies were conducted to compare several organically approved corn seed treatments with an untreated check: Agricoat LLC's "Natural II," Bioworks' "T-22 Planter Box Treatment," and Agrienergy Resources' "Myco Seed Treat" (2007 only). Studies were conducted near Arlington and East Troy, WI in 2006 and near Arlington and Columbus, WI in 2007. In both years, crops were planted at an early (cooler soils) and late (warmer soils) date in May. In the early planted corn in 2006 at both locations, Natural II had significantly higher populations and yields than the other treatments. As expected, there were no significant yield differences between treatments in the late planting at Arlington. In preliminary analysis of 2007 data, due to a warm and dry May there were no significant differences in plant populations between planting dates or seed treatments. Final populations at Arlington were 34,500 plants/a and 30,100 plant/a on-farm. However, corn seed treated with Natural II had the greatest average plant height at the V3 stage at both planting dates, followed by T-22 and Myco Seed Treat, respectively. At the V5 stage, Myco Seed Treat was still significantly lower in height than the other 3 treatments. Yield, the most important integrator, will be measured this fall.

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A Summary of the Boundary Waters Veterinary Conference: Food Animal Production without Antibiotics

David Bane, DVM, Ph.D.

This poster summarizes the Boundary Waters Veterinary Conference: Food Animal Production without Antibiotics held August 22-25, 2007, in Ely, MN. The conference focus was alternatives to antibiotics in livestock production. The goal was to bring scientific information to veterinarians and veterinary students on products and methods that control health problems in organic and natural livestock production systems. The conference program included 15 scientists from academia, industry and veterinary practice.

Topics included:
Opportunities for marketing organic food animal products
Veterinary services needed by organic dairy, beef, swine, sheep, and goat producers
Review of antibiotic alternatives
Diet and health
Tools to assess efficacy
Biosecurity
Parasite control without anthelmintics
Research priorities for organic producers

Plans are being made for the 2nd Boundary Waters Veterinary Conference, August 14-16, 2008, in Ely, MN. Veterinarians, veterinary students, graduate students, food animal producers and any other interested individuals or groups are invited to attend. The conference website (www.bwcawvetconf) will include the scientific program, conference updates, and registration information.

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Tumult, Tenacity, Toil, and Tile: The Arduous Journey of a Michigan Organic Farm Family from the City to the Soil

Taylor Reid and Jim Bingen[1]

Establishing a new farm business is extremely difficult, particularly for those who lack a family background in the profession. First-generation farmers confront a host of unique and daunting challenges with regard to production, marketing, and capitalization. Those who manage to overcome these initial hurdles inevitably face inherent uncertainties related to weather, pests, price fluctuations, and labor supply, to name but a few. Often resource poor at the start, and without access to family land, equipment, knowledge, public support, and private loans, many first-generation farmers face extremely long odds in a profession which seldom produces significant monetary rewards.

Here we present the story of one first-generation Michigan farm family in an attempt to dramatize the motivations, challenges, innovations, and experiences of their fascinating and unpredictable journey. Their story like that of all farmers is uniquely personal. At the same time, we believe that fundamental issues such as the difficulties of obtaining credit, frustrations with the modern certification process, dealing with unforeseen crop losses, the challenges of marketing, and the importance of principles, values and resilience will be revealed through this presentation in a personal and tangible way. By exploring the experiences of one family we hope to explore the specific issues that first generation farmers face, while maintaining the realism, richness, and depth which abstract survey evaluations tend to lack.

Part of a larger research project involving ethnographic studies of several first-generation Michigan farm families, this poster presentation is based on a series of participant observations, interviews, and informal discussions which took place between the spring of 2006 and the fall of 2007.

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Making Organic Farming Research Sustainable: A North Dakota Experience

Jeffrey J. Gunderson and Patrick M. Carr

North Dakota leads the country in organic oilseed and specialty grain production, and is a major domestic producer of organic wheat, barley, oat, and rye. Only California had more certified organic acreage than North Dakota in 2005. Limited research on organic farming has occurred in North Dakota since 1960, despite the state's relative importance in organic crop production. A sustained effort by a collaborative team of farmers, researchers, and others overcame obstacles and established the first thorough and long-term organic farming research program in the state in 2007. A 10-acre tract of land at the Dickinson Research Extension Center, a facility operated by the Agricultural Experiment Station at North Dakota State University, received organic certification that same year, and field studies were established. The goal of this research is to: (1) devise strategies for transitioning from crop and crop/livestock enterprises using conventional practices to organic production methods that are profitable and maintain or enhance soil resources and ecological integrity; (2) develop methods for providing adequate amounts of nitrogen, phosphorus, and potassium to maintain economical yields of forage, grain, horticultural, and seed crops using organic production practices; (3) formulate weed control approaches in field and horticultural crops that do not rely on intensive tillage, are effective and economical, and are permitted under certified organic guidelines; and (4) identify morphological and phenotypical growth traits along with genotypes of horticultural, oilseed, pulse, and small-grain crops that are adapted to organic production systems.

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Establishing an On-Farm Research and Learning Network for Illinois Organic and Sustainable Farmers

Dan Anderson[1] and John Masiunas[2]

Perennial weeds, such as Canada thistle (*Cirsium arvense*) or field bindweed (*Convolvulus arvensis*), threaten the sustainability of farms. Perennial weeds can establish from seed or extensive, deep creeping roots. They are vigorous and very competitive against annual crops. Based on farmer and other input, we are initiating a study to develop and disseminate information on Canada thistle management as a case study in perennial weed control. The objectives of our project are: 1) expand a farmer-based research and co-learning network; 2) develop effective and sustainable systems for perennial weed management; and 3) disseminate information and foster farmer adoption of site-specific sustainable best management practices. Research will use an integrative, sustainable approach to weed management, integrating tillage, mowing, cover crops, decision-making tools, and biocontrol. The research builds on prior research – station and on-farm research. It expands the context of practices used for managing annual weeds to enhance activity against problem perennial weeds. The project will be conducted on sustainable and organic farms. Information from our project will be disseminated through web-based decision-aids, a website, fact sheets, research reports, workshops on perennial weed management, field days, and mini-grants to farmers to evaluate these practices, and co-learning networks. We invite discussion and input on our project and are recruiting additional farmers interested in participating in the perennial weed management network.

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Co-learning to Develop Innovative Extension for Organic Farmers. A case example in Michigan

Vicki Morrone[1] Jeffery Grabill[2] and Jane Bush[3]

The objective of this research, conducted by Vicki Morrone and Jeffery Grabill, was to gain a better understanding of organic growers' perceptions and demands for Michigan State University Extension agricultural production resources. Likewise research was conducted to expand our understanding of MSUE educators' insights on organic production for Michigan. This awareness was gained by conducting two focus group sessions with Michigan State University Extension Educators (15 and 6 participants) and two focus groups with Michigan organic farmers (8 and 10 participants). From these several discussion sessions, further understanding of attitude and perception between the groups was formed. This information helped to initiate discussion during the sessions about how the extension system can improve and develop better services for organic farmers and prospective organic farmers in Michigan. Discussions and impressions of a participant in the focus groups will be presented to demonstrate the positions of each groups and ideas that were offered by the participants to improve relationships and services offered by MSU Extension. Presenting these observations and findings among the participatory audiences (extension educators and farmers) is creating a bridge of understanding and respect, permitting the university's extension system to move forward to enhance services for organic farmers in Michigan and beyond.

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Minnesota Grocer Demand for Organic and Locally Sourced Farm Products: Results from a 2007 State-Wide Survey

Gigi DiGiacomo

A retail telephone survey was developed through the University of Minnesota's Endowed Chair Program in 2007 to gather information from grocers about retail demand for locally-produced, organic farm products. Survey targets included approximately 75 independent and chain stores located in 18 rural and urban Minnesota zip codes. Store managers and individual category buyers for produce, meat and dairy products were contacted at each store. All survey respondents were asked questions about current and expected purchases of organic farm products, sourcing practices and challenges, as well as their interest in buying locally from within the state and Midwest region. Results are presented by product category and by zip code. Survey data can be used by farmers in Minnesota and throughout the Upper Midwest to develop well-informed retail marketing strategies.

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Biological Control of Insects and Mites: A Newly Updated Publication Emphasizing the Upper Midwest

Paul Whitaker

Initially published in 1994, "Biological Control of Insects and Mites" (North Central Regional Publication 481) was a brief (90 pp.) overview of biological control for growers, consultants, extension agents, and others. Since then, much has changed in the science and application of biological control. Organic agriculture has undergone enormous growth.

New pests and natural enemies have arrived in North America. Research in biological control has taken some new directions, some of it guided by growers interested in providing on-farm habitat for natural enemies. Many new organic and conventional pest control products are available, and these may contribute to and/or interfere with biological control in different ways than older products. Funding from USDA SARE has allowed us to substantially update and revise this publication, incorporating feedback and ideas from nearly a dozen farmer and university researchers from around the Midwest. The revised publication (University of Wisconsin-Extension Publication A3842) includes the following major additions: a key to natural enemies, a crop-by-crop list of major natural enemies, detailed methods for assessing biological control, expanded coverage of habitat provision for natural enemies, and references to many new web-based and print resources. In 2008 and 2009, this revised publication will be the centerpiece of biological control conferences throughout the upper Midwest. To download a free PDF of the publication or to purchase a hard copy, visit http://learningstore.uwex.edu.

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Resources for Organic Farming Research

Reports on Funded Research

• **Integrated Organic Program (IOP)**—where the majority of federal organic research dollars have been invested since 2001. Go to http://www.csrees.usda.gov/fo/integratedorganicprogramicgp.cfm and click on "abstracts of funded projects" to pull up list of projects with links to project reports.

• **Sustainable Agriculture Research and Education (SARE)**—Federally funded program that has been making grants in "sustainable agriculture" since 1988. Searchable database of project reports is online at http://www.sare.org/projects/index.htm

• **Organic Farming Research Foundation (OFRF)**—non-profit foundation that has funded organic research and education since 1990. Project reports may be found at http://ofrf.org/funded/funded.html

• **Current Research Information System (CRIS)**—database of all federally funded research. Can customize searches to find specific topics in organic research. http://cris.csrees.usda.gov/

Websites Compiling Links to Research

• **OrganicAgInfo.org**—links to hundreds of research reports on organic-related topics. Can be searched by region, commodity, and other parameters. http://www.organicaginfo.org/

• **Organic Eprints**—international open access archive for papers related to research in organic agriculture. http://www.orgprints.org/

• **Upper Midwest Organic Tree Fruit Growers Network**. Features organic fruit tree research links, including links to proceedings from the 3rd and 4th Organic Tree Fruit Research Symposia (2005 and 2007, respectively). http://www.mosesorganic.org/treefruit/research.htm

• **Organic-research.com**—commercial organic research abstracting and indexing database. International in scope. Very up-to-date yet expensive (starts at $755/year). http://www.organic-research.com/

• **New Agriculture Network**-- Offers seasonal advice to field crop and vegetable growers interested in organic agriculture from farmer contributors and researchers at three universities: Michigan State University, Purdue University, and the University of Illinois. http://www.new-ag.msu.edu/

• **University of Minnesota's Organic Ecology website** has page with links to research reports: http://organicecology.umn.edu/research/

• **National Agricultural Library's Alternative Farming Systems Information Center (AFSIC)**. Has list of organic resources. http://afsic.nal.usda.gov/nal_display/index.php?info_center=2&num_to_skip=0&tax_level=1&tax_subject=296&want_id=0&target=0&topic_id=0&level3_id=0&level4_id=0&level5_id=0

Other Research-Related Resources

• **Organic Farming Research Foundation's 2007 National Organic Research Agenda** —a compendium of organic research priorities with scientific and farm-level context. http://ofrf.org/publications/publications.html

• **New Farm**—Rodale's online farm magazine. Regularly covers organic production research and education. http://www.newfarm.org/

• **Organic Center**—primarily focuses on organic food quality and safety research. http://www.organic-center.org/

• **ATTRA**—provides information and other technical assistance to those involved in sustainable agriculture in the United States. http://www.attra.org/organic.html

• **USDA Economic Research Service (ERS)**—conducts economic and market analyses of the organic industry. http://www.ers.usda.gov/Briefing/Organic/

• **Organic Trade Association website** on how to go organic. An online collection of existing resources for anyone exploring how to transition to organic. http://www.howtogoorganic.com/

• **International Society of Organic Agricultural Research (ISOFAR)**—recently formed international organic research scientific society. http://www.isofar.org/adelaide2005/index.html

Compiled by Jane Sooby, OFRF

Symposium Schedule

Each Symposium session will begin at the stated time in the **South Hall Ballroom**. Please join us there to start each session. After a 20 minute overview, individual breakout discussions will move to the rooms listed below.

Weed Management in Organic Systems **8:30-10:00 am Friday, Feb. 22**		**Room** **South Hall Ballroom**
No-tillage organic soybean production in winter rye for improved weed management in South Central Wisconsin	Emily Bernstein, Univ. of WI	Red
The effect of organic no-till system on organic corn, soybean and tomato weed management and production	Kathleen Delate, IA State Univ.	Yellow
Weed control using a propane burner	Erin Taylor, MI State Univ.	BallRm 1
Management of Canada thistle with summer annual cover crops and mowing	John Masiunas, Univ. of Illinois	BallRm 3
Cover crop management with specialty equipment or organic no-till	Jeff Moyer, Rodale Institute	Blue
Issues in Organic Vegetable and Fruit Production **2:00-3:30 pm Friday, Feb. 22**		**South Hall Ballroom**
Weed management practices in organic processing sweet corn and snap beans	Heidi Kraiss, Univ. of WI	Blue
Safe planting distances between bell peppers and field corn to minimize European corn borer damage to bell peppers	Beth Kazmar, TiPi Produce, WI	Yellow
Insect and disease management in organic fruit crops	Kathleen Delate, IA State Univ.	BallRm 1
Understanding the impact of biodiversity on transition agriculture for organic cucumber and tomato production	Ajay Nair, MI State Univ.	Red
The Clarksville Hort Expt. Station organic apple project	Mark Whalon, MI State Univ.	BallRm 3
Issues in Organic Livestock Systems **4:00-5:30 pm Friday, Feb. 22**		**South Hall Ballroom**
Are perennial grain crops feasible for Midwest organic crop-livestock production?	Sieglinde Snapp, MI State Univ.	Blue
Use of an oilseed press to make edible meal for livestock	Paul Porter, Univ. of MN	Red
Rotational grazing of cattle	Reg Destree, DRAMM Corp.	Yellow
Organic and conventional dairy farms in SE Pennsylvania: are there differences in production and reproduction?	Hubert J. Karreman, DVM	BallRm 1
A pilot study on integrating organic pork and apple production	Jim Koan, Al-Mar Orchard	BallRm 3
Pest and Disease Management in Organic Systems **2:00-3:30 pm Saturday, Feb. 23**		**South Hall Ballroom**
Use of the nematode community structure for the assessment of soils under organic management	Carmen Ugarte, Univ. of IL	BallRm 1
Application of the niche concept to organic weed management	Larry Phelan, Ohio State Univ.	BallRm 3
Soil health improvement under organic farming practices at Prairie Birthday Farm	Robert J. Kremer, USDA-ARS	Yellow
Organic soybean date of planting and seed population	Milton J. Haar, Univ. of MN	Red
Selecting corn and soybean varieties that tolerate and suppress weeds	Rita Seidel, Rodale Institute	Blue
Soil, Seeds and Systems **8:30-10:00 am Saturday, Feb. 23**		**South Hall Ballroom**
Relationship of organic fertility management, plant nutrition, and insect response	Robin Mittenthal, Univ. of WI	Red
Suppressing plum curculio in fruit trees with OMRI-certifiable insect-pathogenic nematodes and fungi	Mark Whalon, MI State Univ.	BallRm 1
Organic certified seed potato production in the Midwest	Ruth Genger, Univ. of WI	Yellow
PA Regional Organic Fruit Industry Transition (PROFIT) 2007 Update: disease management strategies	James Travis, Penn State Univ.	BallRm 3
Suppression of soilborne diseases through organic amendment and cover cropping,	Alex Stone, Oregon State Univ.	Blue
Economics of Organic Systems **4:00-5:30 pm Saturday, Feb. 23**		**South Hall Ballroom**
Is the organic corn price right?	Alexandria Fehring, Rodale	Red
Economic and environmental comparison of three organic systems common to the Upper Midwest	Janet Hedtcke, Univ. of WI	Yellow
The economics of organic dairy farms	Tom Kriegl, Univ. of WI	BallRm 1
Transitional dynamics in converting conventional cropping systems to certified organic	Andrew T. Corbin, MI State Univ.	Blue
Procurement and contract practices of U.S. organic handlers: an online database for farmers and other operators	Lydia Oberholtzer, Univ. of GA, ERS	BallRm 3