

**2008 PROGRESS EXTENSION REPORT
STATE HORTICULTURAL ASSOCIATION OF PENNSYLVANIA, INC.**

Title: Organic Apple Demonstration Block

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Duration: Year 5 of 10

Current Status of Project: The organic demonstration orchard was established in May 2004 at the Fruit Research and Extension Center, Biglerville. An acre each of "Gold Rush" and "Enterprise" trees were planted over a two year period between 2004 and 2005. The trees are grafted on M26 rootstock with a between row spacing of 16 feet for "Gold Rush" trees and 12 feet for "Enterprise" trees in the row.

Justification:

Although history, production region, family farms and research and education programs favor fruit production in Pennsylvania, several outside factors have combined to make the business of fruit production more difficult and less profitable over the last 10 years. PA fruit growers have faced increased competition from other regions of the world that has lower input costs such as pest control, and labor. In addition, a world market and the cost of production can make the sale of PA fruit difficult outside the United States. Traditionally, the production of high quality fruit has been dependent on the continual development and marketing of new synthetic pesticides by commercial chemical companies. Fruit crops are at high risk for losses caused by insects and diseases. However, over the last few years the number of new pesticide products being developed and delivered for use in the fruit industry has steadily declined. As fewer pesticides are available for grower use, the risk of resistance development increases because of heavier reliance on fewer pesticide modes of action. In addition, several of the key pesticides used in fruit production are currently under review and are at risk to be eliminated through FQPA legislation. As the number of pesticides decrease, the cost of fruit production is increasing.

Consumer demand for reduced use of pesticides on foods and recent innovations in fruit pest management suggest that it might be possible to change the way pests are managed and fruit is grown in PA. Consumer demand for organic products is increasing at a rate of 20% a year but organic products demand a higher price in the market place. While consumers are seeking products with fewer or no synthetic pesticides the organic methods deliver products meeting such a demand. The researchers at the Penn State Fruit Research and Extension Center are currently testing alternative pest management strategies such as cultural management, biological controls, and alternative materials (soaps, fertilizers, oils etc) that appear to be effective in reducing pest levels on fruit crops. The combination of consumer demand for organic fruit and the development of new alternative pest management strategies has the potential of providing tools for PA fruit producers to continue profitable fruit production and marketing in the state.

The organic apple demonstration orchard was established at PSU Fruit Research Center to provide researchers and growers with the opportunity to observe/test best organic practices for local organic

apple production. Two apple varieties, “Enterprise” and “GoldRush” were selected for this block for two reasons. First, the varieties have resistance to diseases and second, they have the potential of being used either as a processing or fresh market variety. Both of these varieties are being utilized by local fruit processors for the processed products

Apple diseases, insects and other pest problems are being observed throughout the 10 year duration of the project. Economics for establishing and maintaining this block are also being calculated.

Results:

2008 Accomplishments

1. A pest/disease program consisting of NOP / OMRI / PCO (National Organic Program / Organic Material Review Institute / Pennsylvania Certified Organic) approved organic materials were utilized.

1.1 Disease Control Program. During the 2008 growing season, Copper, Sulfur, Lime Sulfur and JMS Stylet oil were mainly used to protect crop from diseases. There was no major occurrence of diseases except for a low occurrence of powdery mildew and cedar apple rust. To support the disease management component of the demo organic orchard, 2 sets of orchard trials were conducted ff:

a) In a nearby apple research orchard, various spray programs including four organic (one full, three reduced copper treatments), five reduced risk treatments, and three conventional programs were evaluated for scab, sooty blotch, flyspecks, bitter rot, and Bot rot. Treatment applications were made on 6-15 day intervals, from 15 Apr (1/2” green) to 15 Sep (7C). Environmental conditions were favorable for apple scab due to adequate wetting periods from the beginning of the growing season. Overall, apple scab pressure declined and summer disease pressure was light in the test orchard due to dry weather towards the end of the season. Disease incidence was determined on 50 ‘Golden Delicious’ fruits on 20 Oct. Data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was determined by the Fisher's Protected LSD Test ($P \leq 0.05$). Scab incidence on nontreated fruits at harvest was 73.0%. Incidence of sooty blotch, flyspeck, bitter rot, and Bot rot on nontreated ‘Golden Delicious’ fruits three weeks after harvest was 5.5%, 3.0%, 5.0%, and 4.5%, respectively. Two of the organic (full program Trt. 7), reduced organic Cuprofix Trt. 10) spray programs, all conventional and reduced risk significantly reduced the incidence of scab on fruit. Only the two reduced organic Champion and Cueva treatments did not provide an acceptable level of scab control. All treatments provided significant control on flyspeck and sooty blotch compared with the nontreated control treatment. Also, all conventional and reduced risk programs, full organic Trt. 7 and reduced organic Champion Trt. 8 showed significant control on Bot rot compared to the nontreated fruits. All conventional, four reduced risk, full organic and two reduced organic Champion and Cuprofix programs controlled bitter rot. Of the five reduced risk programs, Trt. 6 with Kocide + MicroSulf at 6C-7C did not significantly suppress bitter rot compared to the other treatments. The reduced risk Trt. 7 with Kocide + Lime Sulfur from 5C-7C provided better bitter rot control than Trt 6. There were no significant differences in fruit russet severity (1.3%–1.9%) on most of the treatments excluding the two reduced organic Champion and Cuprofix programs which resulted in the highest fruit russet severity at 2.3% and 2.6%, respectively (Fig. 1A, 1B, 1C). No phytotoxicity was observed.

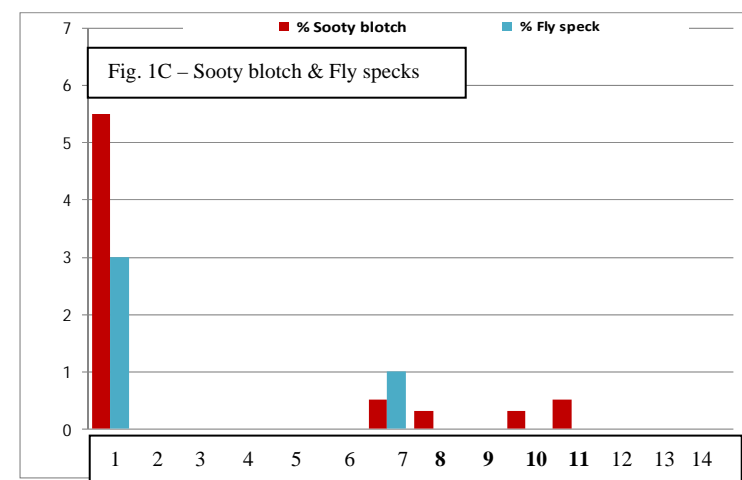
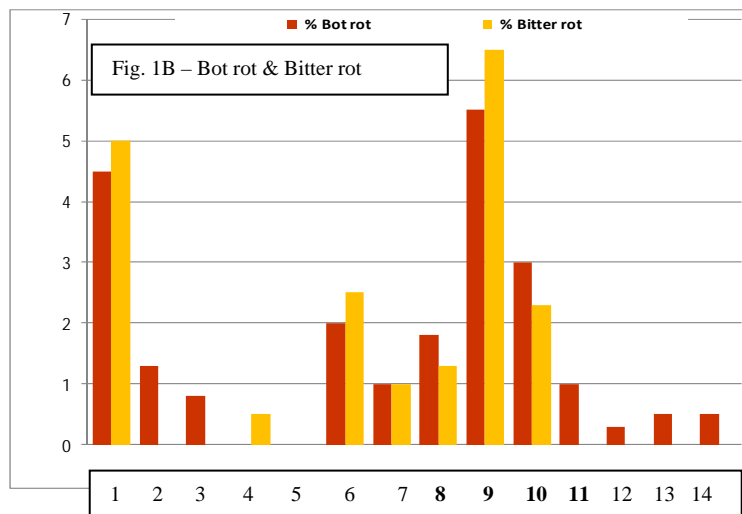
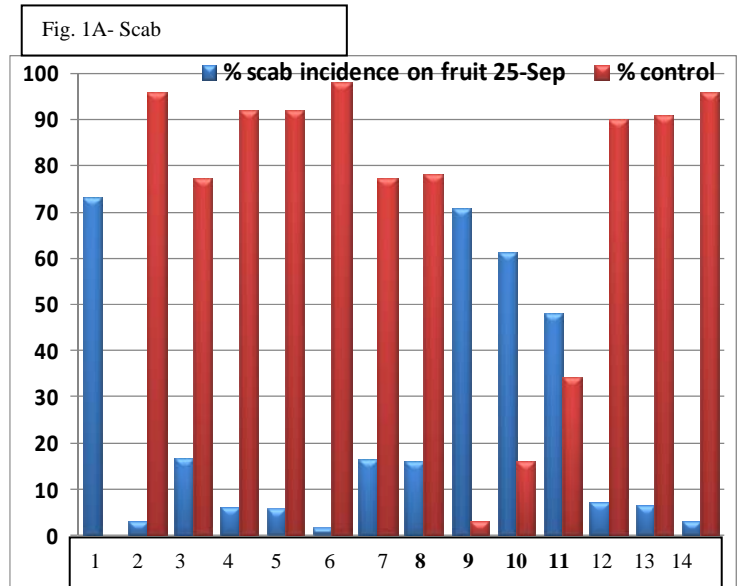
b) In an adjacent high density organic apple orchard, organic programs with sulfur and lime sulfur as early season sprays, two formulations of copper/biological control agents and oxidate were evaluated for control of powdery mildew and cedar apple rust. The high density research orchard consisted of two year old scab resistant “GoldRush” and ‘Crimson Crisp’ apple cultivars on Bud 9 rootstocks spaced at 4 x 12 ft. Treatments were arranged in a randomized complete block design with four replications. Treatments were applied dilute to both sides of the trees with a boom sprayer at 200 psi which delivered 100 gal/A. Spray programs were applied on 6-17 day intervals from 18 Apr (1/2 in. green) to 23 Aug (7C). An organic maintenance program for insects was applied with an airblast sprayer at 100 gal/A at 400 psi. Weather monitoring was recorded with a Field Monitor Weather System. Overall, apple cedar rust pressure was high and powdery mildew pressure was moderate in the test orchard. Disease incidence and severity on leaf spur and shoots were evaluated on 30 spur leaf cluster and shoots on 23 May and 8 Aug. Data obtained were analyzed by analysis of variance using appropriate transformations and significance between means was determined using the Fisher’s protected LSD ($P \leq 0.05$). Programs with early season sulfur and lime sulfur provided the best control on the incidence and severity of powdery mildew on GoldRush and only early season sulfur treatment provided sufficient powdery mildew control on Crimson Crisp. None of the fungicide programs showed good control on cedar apple rust. Gold Rush (23% incidence on shoots) appeared to be more resistant to powdery mildew compared to Crimson Crisp (42% incidence on shoots), while Crimson Crisp (85% highest incidence on shoots) was more resistant to apple cedar rust compared to GoldRush (98 % incidence on shoots). (Data not shown).

1.2. Insect Management Program. The organic demonstration and transitional organic Gala orchards were used for the efficacy evaluations of certified organic products registered for insect pest control. The organic demo orchard was divided into four units about 0.5 acre each. Two units assigned east-west consisted of GoldRush cultivar (west part of organic block) while the other two units consisted of Enterprise cultivar (located in the east part of the block). Table 1 described the insecticide program applied on both cultivars during each treatment. During the 2008 season the main goals for the insect management program were to reduce the cost of insect control inputs while at the same time continue the production of fruit free from insect blemishes. Four different insecticide programs utilizing various combinations of compounds were compared within the orchard throughout the season. Efficacy of each program and potential effects on biological control agents were evaluated with the special emphasis on the predatory mites and aphid natural enemies. The lepidopteran pest complex in organic block was monitored using pheromone traps placed within the organic orchard and compared with the pest populations in adjacent blocks, managed with the standard insecticide program.

The monitored species included: codling moth (CM) *Cydia pomonella*, Oriental fruit moth (OFM) *Grapholita molesta*, lesser appleworm (LAW) *Grapholita prunivora*, tufted apple bud moth (TABM) *Platynota idaeusalis*, obliquebanded leafroller (OBLR) *Choristoneura rosaceana*, variegated leafroller (VLR) *Platynota flavedana*, fruit tree leafroller (FTLR) *Archips argyospila*, eyespotted bud moth (ESBM) *Spilonotta ocellana*, spotted tentiform leafminer (STLM) *Phylonycter blancardella*, dogwood borer (DWB) *Synanthedon scitula*, and San Jose scale (SJS) *Quadrastipidiotus periculus*. Additionally, traps for monitoring plum curculio *Conotrachelus nenuphar* (pyramidal PC traps), European apple sawfly *Hapllocampa testudinea* (white reflective sticky traps) and apple maggot *Rhagoletis pomonella* (red spheres bait with ammonium sulfate) were also placed within the organic blocks.

Fig. 1. Scab and Summer Disease Incidence on 'Golden Delicious' Apple, 2008

	<u>Program</u>	<u>Rate/A</u>	<u>Timing</u>
1	Nontreated No Cu CK		
2	Captan 80W +	*3.0-5.0 lbs	
	Dithane 75DF	3.0 lbs	1/2" GT-1C
	Captan 80 WG	*3.0-5.0 lbs	2C-5C
3	Captan 80WG +	2.0 lbs	
	Topsin M 70 WP	1.0 lb	6C-7C
	MicroSulf WP	10.0 lbs	1/2" GT-1C
4	Captan 80WG +	*3.0-5.0 lbs	
	MicroSulf WP	*3.0-5.0 lbs	2C-5C
	Captan 80WG +	2.0 lbs	
5	Topsin M 70 WP	1.0 lb	6C-7C
	Dithane 75DF +	3.0 lbs	
	Captan 80WP +	3.0 lbs	1/2" GT-1C
6	MicroSulf WP	3.0 lbs	
	MicroSulf WP	6.0 lbs	2C-5C
	Captan 80WG +	2.0 lbs	
7	Topsin M 70 WP	1.0 lb	6C-7C
	MicroSulf WP	10.0 lbs	1/2" GT-TC
	Dithane 75DF +	3.0 lbs	
8	Captan 80WG +	3.0 lbs	B-1C
	MicroSulf WP	3.0 lbs	2C-4C
	MicroSulf WP	6.0 lbs	2C-4C
9	Kocide 3000	8.0 oz	5C-6C
	Lime Sulfur 1%	1 gal	7C
	Dithane 75DF +	3.0 lbs	1/2" GT-1C
10	MicroSulf WP	3.0 lbs	
	MicroSulf WP	6.0 lbs	2C-4C
	Kocide 3000 rot.w/	4.0 oz	
11	Lime Sulfur 1%	1.0 gal	5C-7C
	MicroSulf WP	10.0 lbs	1/2" GT-TC
	Dithane 75DF +	3.0 lbs	
12	MicroSulf WP	3.0 lbs	PF-1C
	MicroSulf WP	6.0 lbs	
	Kocide 3000 +	4.0 oz	2C-5C
13	MicroSulf WP	6.0 lbs	6C-7C
	MicroSulf WP	10.0 lbs	1/2" GT-TC
	Lime Sulfur 1.5 %	1.5 gals	PF
14	MicroSulf WP	6.0 lbs	1C-4C
	Cu Cueva rot. w/	1.5 gals	5C,7C
	Lime Sulfur 1.5%	1.5 gals	6C
15	Champion WP Cu	10.0 lbs	1/4"GT
	LS 2% rotate w/	2.0 gals	1C,3C,5C
	Kocide 3000	8.0 oz	2C,4C,6C
16	Cueva Cu	2.0 gals	1/4"GT
	LS 2% rotate w/	2.0 gals	1C,3C,5C
	Cueva Cu	1.0 gal	2C,4C,6C
17	Cuprofix Cu Ultra	7.0 lbs	1/4"GT
	LS 2% rotate w/	2.0 gals	1C,3C,5C
	Kocide 3000	8.0 oz	2C,4C,6C
18	Indar 2F +	8.0 fl oz	
	Nufilm 17 +	0.25 pt	
	Dithane 75DF	3.0 lbs	1/2" GT, TC, P-B, PF,1C
19	Captan 80WG	*3.0-5.0 lbs	2C-5C
	Captan 80WG +	2.5 lbs	
	Topsin M 70WP	1.0 lb	6C-7C
20	Nova /Rally 40W +	5.0 oz	
	Dithane 75DF	3.0 lbs	1/2" GT, TC, P-B, PF,1C
	Pristine only	14.5 oz	2C,3C,5C,7C.
21	Inspire Super +	12.0 oz	
	Dithane 75DF	3.0 lbs	GT, TC, P, B, PF, 1C
	Pristine rotate w/	14.5 oz	2C,4C,6C
22	Captan 80WG +	2.5 lbs	
	Topsin M 70WP	1.0 lb	3C,5C,7C



1.2. Insect Management Program (Continued)

The internal fruit feeder complex (CM, OFM, LAW) was controlled in the organic block by applying mating disruption dispensers at a rate of 150 dispensers per acre (CheckMate CM/OFM Duel; Suterra, Bend, OR). To reduce the influx of mated female moths from surrounding blocks, the MD dispensers were also applied in neighboring orchard at the rate of one dispenser per tree. However, during the season due to continuous high CM pressure in surrounding apple blocks (as detected by pheromone traps), emergency applications of CM granulosis virus (CpGV) were applied in August and September to control CM larvae. The leafroller management options were evaluated by comparing the efficacy of spinosad (Entrust) and *Bacillus thuringiensis* (Dipel/Deliver) applied to different parts of the orchard. The early season pests (rosy apple aphids, apple aphids, sting bugs, tarnished plan bug etc.) were managed by multiple applications of azadirachtin (Neemix) and kaolin clay (Surround), with each of the product being applied in various combinations to a quarter of the orchard. To avoid excessive kaolin residue on fruit during the harvest, the Surround applications were limited to only early part of the season. Fortunately, the Japanese beetle, *Popilia japonica* adults were at a very low level during the 2008 season and did not require a special treatment. Except for the application of oil (Organic JMS Stylet Oil) during the dormant season, no special treatment was necessary to manage European red mite, *Panonychus ulmi* populations in organic orchard. Regular, in season mite and mite predator observations consistently revealed very low numbers of phytophagous and predatory mites.

Low numbers of insect related fruit injuries were observed during the in-season and harvest fruit evaluations. The injury from plant bug/sting bug complex and leafrollers continue to remain at low, almost not existent levels in all fruit collected from evaluated blocks.

Table 1. Seasonal insect control treatments in organic orchard during the 2008 season. All applications conducted using 100 gal of water per acre as complete applications. PSU FREC 2008.

<u>Date</u>	<u>Insecticide</u>	<u>Rate/acre</u>	<u>Comments</u>
May 02	Surround	50 lb	All treatments
	Neemix	7.0 oz	South Org. & East Gala
	AzaDirect	32 oz	North Org. & West Gala
May 05	Surround	50 lb	All treatments
May 09	Surround	50 lb	All treatments
	Neemix	7.0 oz	South Org. & East Gala
	AzaDirect	32 oz	North Org. & West Gala
May 19	Dipel	1.0 lb	All treatments (Gypsy moth)
May 23	Surround	50 lb	All treatments
	Neemix	7.0 oz	South Org. & East Gala
	Entrust	2.0 oz	South Org. & East Gala
	AzaDirect	32 oz	North Org. & West Gala
	Dipel	1.0 lb	North Org. & West Gala

June 12	Deliver	1.0 lb	South Org. & East Gala
	Dipel	1.0 lb	North Org. & West Gala
June 20	Deliver	1.0 lb	South Org. & East Gala
	Dipel	1.0 lb	North Org. & West Gala
July 24	Cyd-X	1.0 oz	All treatments (CM)
Aug 06	Cyd-X	1.0 oz	All treatments (CM)
Aug 15	Cyd-X	1.0 oz	All treatments
	Neemix	12 oz	North Org. & East Gala
	Deliver	1.0 lb	North Org. & East Gala
	AzaDirect	42 oz	South Org. & West Gala
	Dipel	1.0 lb	South Org. & West Gala
Aug 27	Cyd-X	4.0 oz	All treatments (CM)
Sep 05	Cyd-X	4.0 oz	All treatments (CM)

1.3. Thinning Program. Lime sulfur and JMS Stylet Oil program primarily intended for disease control was also used for thinning the trees, applied at petal fall followed by another spray 5 days after petal fall. This program was sufficient to thin the trees. More superimposed thinning research is being developed for the demonstration block.

1.4 Weed Control Program. Weed management alternatives were evaluated and demonstrated in the orchard including; hand hoeing, weed mowing and “mechanical hoeing”, i.e., Weed Badger™, weed cultivator, ground cloth cover, wood chips, and propane weed burner. The use of flame using propane weed burner was discontinued due to heat injury on the trunk of the trees. The weed cultivator was more efficient to use than the weed badger.

2. The organic demo orchard was a venue of grower discussions, grower education which included field days in September 9, 2008, and various group of visitors from India, Japan, local community people and youth Agricultural Explorers summer campers held on 4 June, 5 Aug, 14 Sep and 26 September, respectively at the PSU Fruit Research & Extension Center, Biglerville, PA with 350 growers, researchers, extension educators, administrators, students and crop consultants participating. The Sept 9 crop protection field day was a full day sessions on insect, disease and weed management, training and fruit thinning where organic production was highlighted in the program.

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