Great Lakes Fruit, Vegetable & Farm Market EXPO
December 4-6, 2007
DeVo Place Convention Center, Grand Rapids, MI

Asparagus

Tuesday morning 9:00 am

Where: Grand Gallery (lower level) Room C
Recertification credits: 1 (1B, PRIV CORE)
CCA Credits: PM(1.5) CM(0.5)
Moderator: Norm Myers, Oceana Co. MSU Extension, Hart, MI

9:00 a.m. Applying Pesticides On-Target: Common Sense and Technology

- Andrew Landers, Pesticide Application Technology Specialist, Cornell Univ.

9:45 a.m. Asparagus Disease Update

- Mary Hausbeck, Plant Pathology Dept., MSU

10:20 a.m. Horticultural Strategies for Improving Asparagus Production in a Replant Situation

- Mathieu Ngouajio, Horticulture Dept., MSU
- Buck Counts, Plant Pathology and Horticulture Dept., MSU

10:45 a.m. Is There a Future for Me in the Asparagus Business?

- John Bakker, Michigan Asparagus Advisory Board, Dewitt, MI

Applying Pesticides On-Target: Commonsense and Technology

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Introduction

There are many news developments in spray technology that will help reduce the costs involved in applying pesticides. The main costs associated with pesticide application are the costs of the pesticides, which continue to rise in many cases. Any technology that reduces the amount of product necessary to control a weed, insect or disease, or improves its effectiveness, is welcome. Commonsense and technology is required to improve spray deposition onto sweet corn plants.

Droplets

Poor spray coverage is a major factor contributing to poor insect control. Better coverage leads to better control, and a thorough application of an effective material is required. The results of uneven coverage frequently increases the number of sprays required and therefore increases the amount of pesticide that must be applied.

Whilst canopy size will affect application volume, there are equal dangers in not applying enough spray and also in applying too much. There is an optimum quantity required for a thorough coverage of the target. The old adage that you should spray until the leaves drip is misplaced; likewise lowering spray rates to below the minimum which offers control is also misguided advice.

A number of growers have reduced application volumes to extremely low levels and are observing poor insect control due to inadequate coverage. Interestingly, research around the world confirms similar results and also indicates that there is an optimum volume to provide thorough coverage and pest control.

Droplet size

Physics is a wonderful subject! A droplet with twice the diameter of another has four times the area and eight times the volume. Eight smaller droplets having the same total volume as the larger droplet will provide twice the coverage of the larger droplet.

Conversely, for the same volume of liquid, when you halve the diameter of a droplet you increase the number of droplets eight-fold. For instance, when a single 200 micron droplet is halved to 100 microns, you disperse its liquid into eight of these smaller droplets. Halve them again to 50 microns and you now get 64 droplets etc.

Similarly the area covered increases as the size of droplets decreases, assuming the volume stays the same. As described above, a 200 micron droplet has 64 times the volume of a 50 micron droplet. Assuming the target area covered by a droplet is equal to its cross sectional area, 64 droplets of 50 microns will cover four times the area of a single 200 micron droplet, even though both scenarios involve the same amount of spray.

A combination of the optimum volume and droplets that adhere to the leaves will provide good insect and disease control. It must be stressed that too fine a droplet will result in off-target drift and equally important, especially in hot weather, lead to evapouration of droplets.

Even modest winds, (v>7 mph) can result in high levels of drift. Conversely, the total absence of wind (v<1 mph) can be a significant risk factor, especially in temperature inversion conditions that typically occur on very hot days. A spray cloud may remain airborne under such conditions and when air currents appear, spray may be deposited some distance from the intended target.

A nozzle’s droplet size spectrum determines deposition and drift. Conventional flat fan nozzles fitted to a crop sprayer produce droplets in the range of 10 – 450 microns. There are 25,000 microns in one inch. Drift is a major problem with droplets less than 100 microns.

Increasing the Volume Median Diameter (VMD) will certainly reduce drift, but too large a droplet will bounce off the leaves to the ground, thus causing pollution, wasting money and resulting in less product on the target. Drift has been a major concern for some years, off target application wastes money, reduces deposition on the target plant, pollutes water courses and may cause nausea to other people.

New nozzle selection technique

A number of pesticide manufacturers are adopting the ASABE/BCPC nozzle selection system and stating on the pesticide label the spray classification needed for their product. Reference nozzles, tested in a laboratory using a laser analyser, are then classified according to the characteristics of the spray produced. Very fine, fine, medium, coarse and very coarse are the categories of spray. The label recommendation makes nozzle selection far easier for the sprayer operator. A general guideline is:

Fine classification for fungicides and insecticides
Medium classification for herbicides
Coarse classification for pre-emergent sprays

However, weather conditions, particularly wind and its effect upon drift, must be taken into consideration. If the label or supplier makes no recommendation concerning nozzles or spray quality, then a reasoned choice of spray quality must be made, based upon the target, the product and the risk of drift

Small droplets, less than 100 microns, drift in the air, whereas larger droplets, over 300 microns tend to bounce off leaves. A number of nozzle manufacturers offer low-drift nozzles to reduce drift. Correct nozzle selection is one of the most important yet inexpensive aspects of pesticide application.

The target

Asparagus ferns provide an excellent if in-penetrable target. A fine leaf and stalk provide for excellent droplet capture – similar fine structures are often used in spray drift measurement trials where, for example, pipe cleaners are used to provide a fine surface to collect very small droplets. Whilst this structure is good at collecting fine droplets, it can also be its downfall. Droplets are required not only to be the correct size to adhere to the fine leaflets but also enough mass to penetrate throughout the canopy. Too fine a droplet, ideal for adhering to the ferns, results in not enough penetration unless high pressure is used – this often leads to drift. Too large a droplet will bounce off the leaves and pass straight down to the ground. A compromise is required, fine to medium size droplets are the best for this task.

Growers should select the correct nozzle based upon application rate per acre from the nozzle catalogs, then refer to the spray quality classification tables to check that the nozzles produce a fine/medium spray quality.

As penetration into the canopy is critical, researchers have developed methods of improving boom design and nozzle type. In Germany, for example, large areas of asparagus are grown and researchers prefer the basic boom design as shown in figures 1 and 2. Directing individual nozzles to provide better penetration is crucial and in both cases the flow rate is matched to the growing canopy. Note in figure 1, the Agrotop method uses the nozzles angled forwards by 15^{o}. In figure 2, by Norbert Laun of DLR, Rheinpfalz, note the use of the Lechler IDK nozzles or off-centre tips fitted at the top and bottom of the booms, these nozzle tips reduce drift above the crop and losses to the soil.

In both cases they are using TD/AVI air induction nozzles, either standard or compact from Lechler or Agrotop.

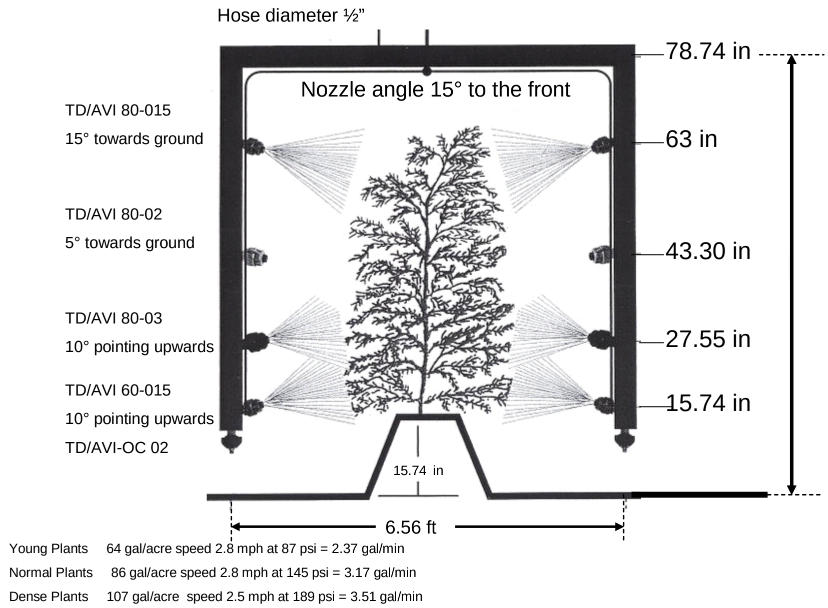

Figure 1 The Agrotop system

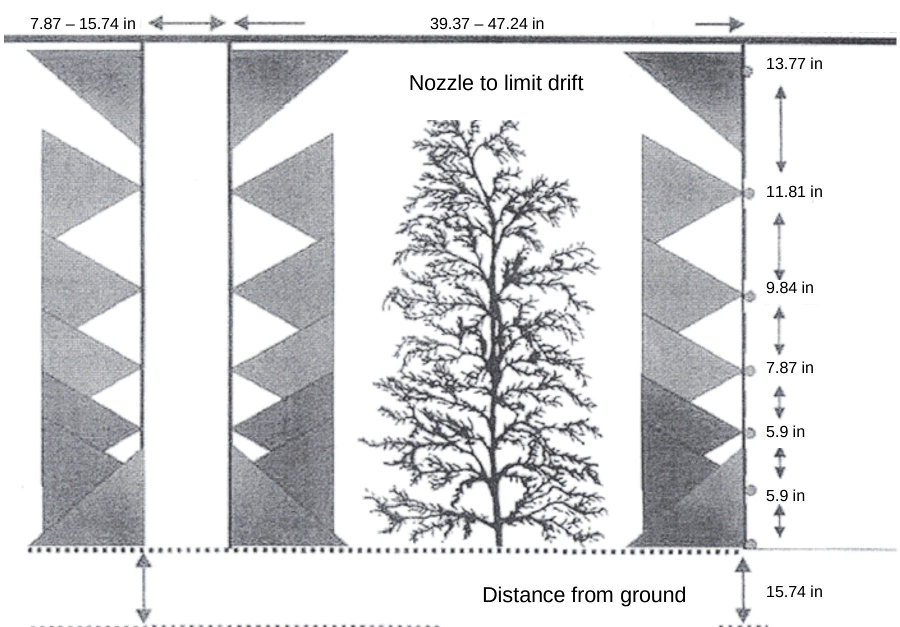

Figure 2 The Kahlsruhe system by Norbert Laun, DLR, Rheinpfalz

Asparagus Disease Update

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In Michigan, commercial asparagus production begins with seeds planted in nursery fields in early spring. Plants are grown until the following spring, when the young crowns are harvested, and then transplanted into production fields. Fusarium disease, caused by the fungi *Fusarium oxysporum* f.sp. *asparagi* and *F. proliferatum*, can kill seedlings in crown nurseries, plants in young asparagus fields, and cause a slow decline in productivity of mature fields. Losses due to Fusarium disease can be staggering because declining fields are abandoned early and years of productivity are lost. Currently, no fungicides are effective against *Fusarium* spp., cultural strategies (such as adding sodium chloride to the soil) have not helped, and breeding for genetic resistance to this disease has been unsuccessful. In 2004, disease symptoms caused by another soilborne fungus, *Phytophthora* sp., were noted in the experimental trials and grower fields after heavy rains. Investigation into this disease revealed that *Phytophthora* sp. is much more prevalent in the soils of the asparagus-growing region and more of a threat to asparagus production than previously thought.

The following objectives were proposed: (1) Evaluate the distribution of *Fusarium* spp. at different soil depths and the effectiveness of fumigants and crown soaks on Fusarium crown and root rot; (2) Evaluate preplant crown soaks for control of Fusarium and Phytophthora diseases; (3) Maintain and record data from established drip irrigation beds evaluating the effect of irrigation and drip-applied chemical and biological treatments on Fusarium and Phytophthora diseases.

Table 1. Products tested in asparagus field trials.

Product	Active ingredient	Labeled
Cannonball 50WP	fludioxonil	no
K-Pam	metam potassium	yes
Presidio 4FL...................................	fluopicolide	no
Ridomil Gold 4EC	mefenoxam	yes
Scholar 50WP	fludioxonil	no
Telone C-35	1,3-dichloropropene/chloropicrin	yes
Topsin 70WSB...............................	thiophanate-methyl	yes

Evaluation of fumigants and crown soaks for control of Fusarium crown and root rot of asparagus

In the fall of 2005 a trial was established on a grower cooperator's farm in Oceana County, MI in a field with a history of asparagus production. Fumigant treatments consisted of K-Pam 60 gal/A, Telone C-35 35 gal/A (Table 1), and an untreated control and were replicated four times in a randomized complete block design. Fumigants were shank applied on 7 Oct 2005 to a depth of 10-12 in. in beds that were 13 ft wide by 80 ft long. Treatments were separated by a fumigated (Chloropicrin 100%) raised black-plastic-mulch-covered bed. Beds were seeded on 5 May 2006 using disinfested 'Millennium' asparagus seed in three rows 18 in apart in the center of the bed with a seed depth and a spacing of 2 in. After fumigation (21 Oct 2005) soil samples were taken from 5 points in the center of the beds to a depth of 30 in. using a JMC soil probe with a plastic liner to maintain the soil profile. Samples were divided into 6-in. increments and allowed to dry for 7 days. After drying soils were diluted in 0.05% water agar solution and then plated onto PPA or Komada's selective media. Plates were incubated for 7 days and resulting *Fusarium* colony-forming units (CFUs) were counted and identified. In Apr 2007, crowns were dug, rated and weighed.

CFUs were significantly higher for the untreated control plot compared to both fumigant treatments (Table 2). At the soil depth of 0-6", the Telone C-35 treatment had the fewest CFUs. Overall, the CFUs were lowest at the 6-12" level. When assessed in Oct 2006, the number of seedlings in each treatment plot did not differ significantly among treatments. In Apr 2007, the number of crowns that were scored favorably for low *Fusarium* infection (#1 = 0-1 *Fusarium* lesions per crown) were significantly higher for the fumigant treatments of K-Pam and Telone C-35 than for the untreated. There were significantly more unusable crowns from the untreated control than from the fumigated treatments. Although the crowns from the Telone C-35 treatment had the greatest mass as exhibited by fresh weight, they were not significantly different from the untreated control.

Table 2. Fumigants and crown soaks for Fusarium crown and root rot.

	CFUs[z] of *Fusarium* spp. after fumigation			Crown rating[y] (%) Apr 2007				
	Soil depth (in.)		Seedlings Oct 2006					
Treatment and rate/A	0-6	6-12	(plants/50 ft)	#1[x]	#2[x]	#3[x]	Unusable (#2,#3)	Weight (lb)
Untreated	18,450 b	4,600 b	216	17.7 b[w]	37.6 b	44.7 b	82.3 b	5.8
K-Pam 60 gal..................	1,510 a	70 a	228	85.6 a	10.5 a	4.0 a	14.4 a	6.9
Telone C-35 35 gal.........	440 a	200 a	235	95.3 a	3.9 a	0.8 a	4.7 a	10.3

[z]CFU = colony-forming units. Column means for CFUs with a letter in common are not significantly different (Tukey's test; *P*=0.05).
[y]Crowns rated as follows: #1=0-1 lesions per crown, #2=2-5 lesions, 3=>5 lesions.
[x]Percentage of crowns that were determined to meet the classification requirement.
[w]Column means with a letter in common or with no letter are not significantly different (Fisher LSD Method; *P*=0.05).

Evaluation of preplant crown soak treatments for control of Fusarium crown and root rot and Phytophthora spear and root rot

This experiment was conducted in a commercial field in Oceana County near the city of Hart, MI. The field has a history of several asparagus production plantings that suffered severe decline caused by *Fusarium and Phytophthora*. The soil at the site was a fine sandy loam and was previously planted to asparagus. Treatment plots were arranged in a randomized complete block design. Rows for the experiment were plowed by a single bottom plow to a depth of 12 in. and were spaced 5 ft apart. Treatment rows were 20 ft long and crown spacing in the row was 7.5 in. (27 crowns per row). Before planting, 'Jersey Knight' one-year old crowns were treated by soaking in a chemical solution for 10 min. Immediately after soaking, the crowns were planted in a single line on 17 May. Foliar diseases were controlled with applications of Bravo Weather Stik (2 pt/A) every 14 days starting on 15 Jun. Stand counts for the entire treatment rows were taken and each live fern was measured for height. Data were analyzed using Sigma Stat version 3.1 (Systat Software Inc.) and treatments were compared using the Fisher LSD multiple comparison test. Average monthly minimum and maximum air temperatures (°F) were: May (47.1and 71.8); Jun (53.7 and 79.7); Jul (57.4 and 79.2); and Aug (58.3 and 79.0). Rainfall totals (in.) were 2.2, 1.2, 2.1, and 2.5 for the same respective months.

Fern emergence was similar for all treatments at the Jun rating, and stand counts did not differ significantly (Table 3). In Sep, treatments were not statistically different, but the untreated control had the lowest stand count and treatments with Ridomil Gold EC alone or in combination with Cannonball 50WP had the highest stand counts. In Jun there was a noticeable increase in height with treatments treated with Ridomil Gold EC or Presidio 4FL, but these differences were not significant. This height difference was not as noticeable in Sep as significant deer feeding damage occurred across the plot.

Table 3. Preplant crown soaks for Fusarium and Phytophthora diseases.

Treatment and rate/100 gal	Stand count			Height (in.)	
	Jun	Sep	Per acre	Jun	Sep
Untreated	34.5*	83.5	33,400	14.7	22.0
Cannonball 50WP 0.5 oz	37.5	89.3	35,720	16.1	24.2
Topsin M 1 lb	35.3	89.5	35,800	17.7	23.6
Ridomil Gold 4EC 1 fl oz	37.3	95.3	38,120	18.0	23.5
Presidio 4FL 4 fl oz	35.3	83.8	33,520	18.3	23.5
Cannonball 50WP 0.5 oz + Ridomil Gold 4EC 1 fl oz	34.0	94.8	37,920	17.0	22.8
Topsin M 1 lb + Ridomil Gold 4EC 1 fl oz	34.0	88.8	35,520	17.5	23.0
Cannonball 50WP 1 oz + Ridomil Gold 4EC 1 fl oz	39.5	100.0	40,000	16.8	22.8

*There were no significant differences among treatments (Fisher LSD Method; *P*=0.05).

Effect of irrigation and drip-applied chemical and biological treatments on Fusarium crown and root rot and Phytophthora spear and crown rot

The plot was established in 2003 under dry conditions, which favored *Fusarium* development. In 2004, *Phytophthora* symptoms, including water-soaking and shriveling of spears, were noticed during harvest, possibly enhanced by heavy rains during May. Weather conditions were dry and cool during Jul and Aug 2004. In 2005, hot dry conditions were normal for the growing season. Weather conditions in the 2006 growing season were approximately normal. However, there were several severe weather events late in the season limiting the number of ratings. In 2007 temperatures were approximately normal with below normal precipitation.

Table 4. Average total fern when asparagus was treated with mefenoxam or with drip treatments.

Treatment and rate	Total Fern				
	2003	2004	2005	2006	2007
Drip treatment amendment					
Untreated	-	163.8*	199.6 a	93.5	110.6
No mefenoxam	-	172.5	226.9 a	104.4	116.6
Mefenoxam 4 pt/A	-	171.8	249.0 b	96.3	111.2
Drip applied treatments					
Untreated	217.5 ab	164.4	224.8	94.4	110.9
Irrigated	225.9 a	184.7	242.3	100.0	122.2
Nonpathogenic *Fusarium* 2.6 gal/1000 row ft	207.9 ab	171.1	234.2	101.9	114.0
Topsin 70WSB 0.5 lb/A	200.4 b	167.8	233.1	93.9	110.1
Scholar 50WP 8 oz/100 gal	198.7 b	165.2	233.6	99.3	106.8

* Treatments with the same letter or with no letter are not significantly different (*P*>.05, Tukey-Kramer).

At the end of this multi-year study, differences among the treatments were not observed (Table 4). Although applications of mefenoxam appeared to be helpful to the health and total stand counts in 2005, the positive effect was not long lasting.

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