

## Apple insect management by insecticides in Ohio, 2017

Preliminary report, 10/15/2017

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### **Methods:**

The trial was conducted in a 2-acre block of 15-year old apple trees at Ohio State University's Waterman Agricultural and Natural Resources Laboratory in Columbus, Franklin County. Plots were set up in a randomized complete block design with six treatments. The initial plan was for a single trial with four replicates in 'Scarlet Spur Red Delicious'. Once trees were in bloom, it became apparent that bloom was light to non-existent on about half of the trees. The Red Delicious plots were left for treatment by the original plan (Table 1), but an additional trial was set up in Gala (two replicates) and Golden Delicious (two replicates). The additional trial had no pre-bloom treatments but was nearly identical to the initial trial for post-bloom treatments (Table 2). There were five adjacent Scarlet Spur Red Delicious trees per plot, or three adjacent Gala or Golden Delicious trees per plot. Insecticides were applied in a volume of 75 gallons of water per acre by an AgTech 4002 airblast sprayer operated at pressure of 20 psi, with TeeJet 6510 and 6520 nozzle tips.

Table 1. Sequence and rates of products applied in Red Delicious apple insecticide trial, Columbus, Ohio, 2017.

Treatment	Half-inch green (3/30)	Pink bud (4/10)	Petal-fall (4/25)	1C (5/19; 264 DD after biofix on 4/27)	2C (6/2) & 3C (6/19)	4C	5C (7/20; 289 DD after re-biofix on 7/10) & 6C (8/2) & 7C (8/16)
1 FMC 1	Beleaf 50 SG 2.8 oz/A	Mustang Max: 4 fl oz/A	Gladiator 0.33EW: 18 fl oz/A + oil 0.5%	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	F4260 2.56 fl oz/A + Assail 30SG: 6 oz/A + oil 0.5%	-	Mustang Max: 4 fl oz/A + Avaunt 30WDG: 6 oz/A
2 FMC2	Beleaf 50 SG 2.8 oz/A	Mustang Max: 4 fl oz/A + Beleaf 50 SG 2.8 oz	Gladiator 0.33EW: 18 fl oz/A + oil 0.5%	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	Altacor 35WG: 3 oz/A	-	Mustang Max: 4 fl oz/A + Avaunt 30WDG: 6 oz/A
3 FMC3	Beleaf 50 SG 2.8 oz/A	Mustang Max: 4 fl oz/A + Beleaf 50 SG 2.8 oz	Gladiator 0.33EW: 18 fl oz/A + oil 0.5%	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	Delegate 25WG: 5.2 oz/A	-	Mustang Max: 4 fl oz/A + Altacor 35WG: 3 oz/A
4 Dupont	Esteem 35WP: 4 oz/A	-	Avaunt 30WDG: 6 oz/A	Assail 30SG: 6 oz/A + oil 0.5%	Assail 30SG: 6 oz/A + oil 0.5%	-	Altacor 35WG: 3 oz/A + Lannate LV, 3 pts/A
5 Standard	Lorsban Advanced: 1 qt/A	-	Avaunt 30WDG: 6 oz/A	Altacor 35WG: 3 oz/A	Altacor 35WG: 3 oz/A	-	Assail 30SG: 6 oz/A + oil 0.5% (+Belay 2.13SC, 6 fl oz/A, in 5C only)
6 untreated	-	-	-	-	-	-	-

Table 2. Sequence and rates of products applied in Gala and Golden Delicious apple insecticide trial, Columbus, Ohio, 2017.

Treatment	Half-inch green	Pink bud	Petal-fall (4/25)	1C (5/19; 264 DD after biofix on 4/27)	2C (6/2) & 3C (6/19)	4C	5C (7/20; 289 DD after re-biofix on 7/10) & 6C (8/2) & 7C (8/16)
1 FMC 1	-	-	Gladiator 0.33EW: 18 fl oz/A + oil 0.5% + Beleaf 50 SG 2.8 oz	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	F4260 2.56 fl oz/A + Assail 30SG: 6 oz/A + oil 0.5%	-	Mustang Max: 4 fl oz/A + Avaunt 30WDG: 6 oz/A
2 FMC2	-	-	Gladiator 0.33EW: 18 fl oz/A + oil 0.5% + Beleaf 50 SG 2.8 oz	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	Altacor 35WG: 3 oz/A	-	Mustang Max: 4 fl oz/A + Avaunt 30WDG: 6 oz/A
3 FMC3	-	-	Gladiator 0.33EW: 18 fl oz/A + oil 0.5% + Beleaf 50 SG 2.8 oz	Beleaf 50 SG 2.8 oz/A + NIS 0.25%	Delegate 25WG: 5.2 oz/A	-	Mustang Max: 4 fl oz/A + Altacor 35WG: 3 oz/A
4 Dupont	-	-	Avaunt 30WDG: 6 oz/A	Assail 30SG: 6 oz/A + oil 0.5%	Assail 30SG: 6 oz/A + oil 0.5%	-	Altacor 35WG: 3 oz/A + Lannate LV, 3 pts/A
5 Standard	-	-	Avaunt 30WDG: 6 oz/A	Altacor 35WG: 3 oz/A	Altacor 35WG: 3 oz/A	-	Assail 30SG: 6 oz/A + oil 0.5% (+Belay 2.13SC, 6 fl oz/A, in 5C only)
6 untreated	-	-	-	-	-	-	-

Plots were scouted for rosy apple aphid and woolly apple aphid on 5/10 and 5/23, and for green apple aphid and generalist predators on 6/1. Fruit were evaluated non-destructively on 7/5 for Red Delicious and on 7/6-7/11 for Gala and Golden Delicious. Fruit were examined at harvest on 9/8-9/12 for Gala, 9/12-9/15 for Golden Delicious, and 9/18-9/21 for Red Delicious.

### Results and Discussion:

A severe hail storm occurred on 6/19/2017, with strong winds from the west. This resulted in much damage to fruit, particularly on the west side of trees. Damage from codling moth was heavy. All insecticide programs resulted in fruit that was significantly less infested by internal Lepidoptera than untreated trees, but there were no significant differences among the insecticide treatments.

Table 3. Insect injury<sup>a</sup> to 'Red Delicious' apple fruit after treatment by six insecticide programs, evaluated destructively at harvest on 18-21 September 2017; mean of four blocked replicates at OSU's Waterman Lab, Columbus, Ohio.

Treatment (codling moth 1 <sup>st</sup> generation/ 2 <sup>nd</sup> generation)	% Internal Lepidoptera			% Plum curculio		% San Jose scale	% Tarnish ed plant bug	% Stink bug	% Leaf- roller (late)	% Clean of insect damage
	Entry <sup>b</sup>	Sting <sup>a</sup>	Total <sup>b</sup>	Ovipo- sition	Late feeding <sup>b</sup>					
FMC2	0.5 B	1.9	2.4 B	2.4	0	0.2	0	0.8	0.2	94.0 A
FMC1	1.4 B	1.0	2.5 B	3.8	0	0	0.2	0	0	93.5 A
FMC3	1.5 B	1.0	2.5 B	1.0	0	0.2	0.2	2.5	0	93.5 A
Standard	0.2 B	2.4	2.7 B	8.8	0.2	0.2	1.0	0	0	87.0 A
Dupont	1.8 B	2.5	4.2 B	7.5	0.2	0	1.0	0	0.2	86.0 A
untreated	35.8 A	7.3	43.1 A	4.2	0.6	2.8	1.0	0	0	46.4 B
<i>P (treatment effect)</i>	<i>&lt;0.0001</i>	<i>0.07</i>	<i>&lt;0.0001</i>	<i>0.17</i>	<i>0.41</i>	<i>0.23</i>	<i>0.84</i>	<i>0.57</i>	<i>0.45</i>	<i>&lt;0.0001</i>

<sup>a</sup> Values shown are actual percentages but ANOVA based on transformed values.

<sup>b</sup> Within each column, means followed by same letter are not significantly different ( $P>0.05$ ); mean separations by LSD. Values shown are actual percentages but ANOVA based on transformed values.

Table 4. Insect injury<sup>a</sup> to 'Gala' and 'Golden Delicious' apple fruit after treatment by six insecticide programs, evaluated destructively at harvest on 8-15 September 2017; mean of four blocked replicates at OSU's Waterman Lab, Columbus, Ohio.

Treatment (codling moth 1 <sup>st</sup> generation/ 2 <sup>nd</sup> generation)	% Internal Lepidoptera			% Plum curculio		% San Jose scale	% Tarnish ed plant bug	% Stink bug	% Leaf- roller (late)	% Clean of insect damage
	Entry <sup>b</sup>	Sting <sup>a</sup>	Total <sup>b</sup>	Ovipo- sition	Late feeding <sup>b</sup>					
Dupont	1.5 B	0.8 C	2.2 B	1.8	0	0	0.2	0.2	0	95.5 A
FMC1	2.0 B	0.8 C	2.8 B	3.0	0.2	0	0	0.2	0	93.5 A
FMC3	3.8 B	1.5 BC	5.2 B	2.0	1.8	0	0.5	1.0	0.2	89.0 A
FMC2	1.5 B	2.0 BC	3.5 B	6.8	0.8	0	0	0.8	0.2	87.8 A
Standard	1.2 B	4.0 AB	5.2 B	6.0	0.5	0	0.2	0	0	87.5 A
untreated	23.5 A	8.8 A	32.2 A	6.8	0.2	0.2	0	0.2	0.5	57.5 B
<i>P (treatment effect)</i>	<i>&lt;0.0001</i>	<i>0.0074</i>	<i>&lt;0.0001</i>	<i>0.08</i>	<i>0.10</i>	<i>0.45</i>	<i>0.38</i>	<i>0.53</i>	<i>0.38</i>	<i>0.0003</i>

<sup>a</sup> Values shown are actual percentages but ANOVA based on transformed values.

<sup>b</sup> Within each column, means followed by same letter are not significantly different ( $P>0.05$ ); mean separations by LSD. Values shown are actual percentages but ANOVA based on transformed values.