IMPLEMENTING A SYSTEMS APPROACH TO CONTROL NAVEL ORANGEWORM IN CALIFORNIA

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One of the challenges in implementing a systems approach to controlling the navel orangeworm in almonds and pistachios is the lack of understanding of the coverage of insecticide sprays combined with the difficulty in integrating new insecticides into existing management schemes. Insecticide spray rigs can be divided into two categories, power take off (PTO), powered by the drive train of the tractor, and engine driven (dedicated engine or engines to power the sprayer). PTO spray rigs are commonly used in pistachios because the trees are shorter (5-6 m) while engine driven spray rigs are used in mature almonds, which may be as tall as 9-10 m). Initial studies were conducted with PTO sprayers driven at a standard speed of 3.2 km/hour (2 mph) in order to determine the evenness of coverage, based on spray cards, between approximately 3 and 6 meters (10-18 ft, Figure 1). There is an approximate 50% loss in spray coverage by 12 feet, and a loss of more than 90% of the spray volume by 18 feet. In contrast, engine driven spray rigs provide superior coverage (Figure 2) and the 50% loss point is at 16 feet. In addition there is a volume effect, with greater coverage occurring at 150 gallons/acre compared to 100 gallons per acre. However, with increased spray volume comes problems of spray drift and possible contamination of ground water, therefore it is essential to optimize an application rate that both maximizes control and minimizes environmental contamination.

There are numerous insecticides that have recently been registered for control of navel orangeworm in pistachios. Field experiments were conducted to determine their duration of control. Insecticides were applied in a commercial orchard, at their recommended field rates, and vulnerable nuts were collected at intervals and challenged in the laboratory by placing eggs on these nuts. Survival to adult was determined for these insecticides and their duration of control relative to each other as well as reduction in survival relative to untreated pistachios collected on the same dates is reported in Table 1. Pyrethroid insecticides broke down after 21 days and the longest duration of control was achieved using a combination of insect growth regulator and pyrethroid.

Table 1. Duration of control of six insecticides applied, on August 16*, 2010.

Treatment	Survival	Reduction	Eggs
Day 24			
Control	41.64%		1,400
Brigade 24 oz	18.00%	56.78%	200
Bifenture 24 oz	20.00%	51.97%	200
Intrepid 24 oz	7.00%	83.19%	200
Warrior II 2.5 oz	9.00%	78.39%	200
Lambda-Cy* 5 oz	16.50%	60.38%	200
Intrepid 18 oz +Warrior II 2.5 oz + Sulfur 462 oz	1.500%	96.40%	200
Day 32			
Control	43.64%		2,500
Brigade 24 oz	16.00%	63.34%	300
Bifenture 24 oz	6.33%	85.49%	300
Intrepid 24 oz	2.00%	95.42%	300
Warrior II 2.5 oz	16.50%	62.19%	200
Lambda-Cy* 5 oz	11.00%	74.79%	300
Intrepid 18 oz +Warrior II 2.5 oz + Sulfur 462 oz	3.00%	93.13%	100
Day 39			
Control	34.11%		900
Brigade 24 oz	56.00%	**NONE**	100
Bifenture 24 oz	13.67%	59.93%	300
Intrepid 24 oz	**ND**		
Warrior II 2.5 oz	8.00%	76.55%	300
Lambda-Cy* 5 oz	4.00%	88.27%	300
Intrepid 18 oz +Warrior II 2.5 oz + Sulfur 462 oz	1.50%	95.60%	200
Day 53			
Control	23.70%		1,000
Brigade 24 oz	**ND**		
Bifenture 24 oz	61.50%	**NONE**	200
Intrepid 24 oz	28.25%	**NONE**	400
Warrior II 2.5 oz	17.00%	28.27%	200
Lambda-Cy* 5 oz	40.00%	**NONE**	200
Intrepid 18 oz +Warrior II 2.5 oz + Sulfur 462 oz	6.000%	74.68%	200

ND Not determined because samples were not collected. *Lambda-Cy was applied August 18.

*Reduction is relative to the Control survival at each date

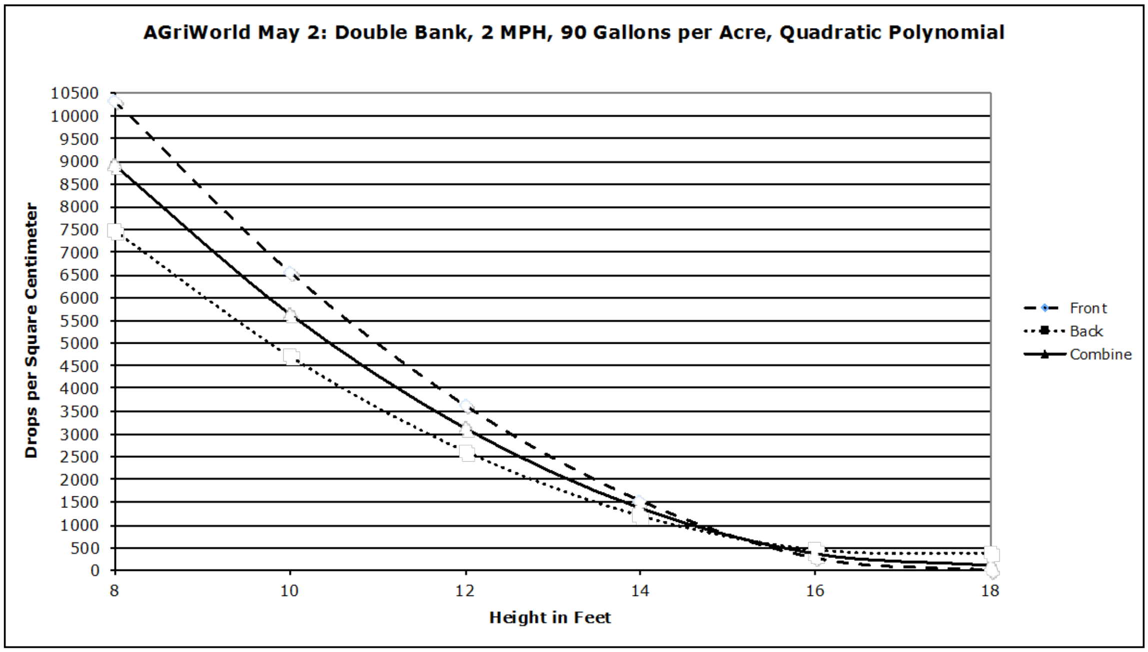
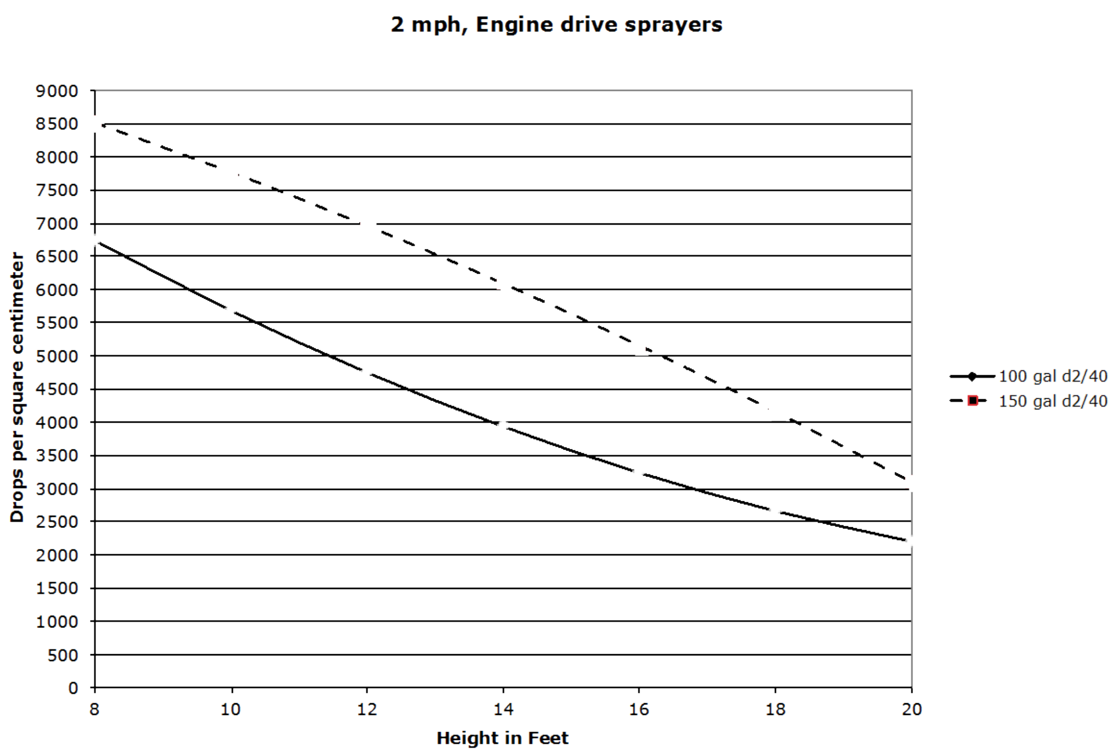

AGriWorld May 2: Double Bank, 2 MPH, 90 Gallons per Acre, Quadratic Polynomial
10500
10000
9500
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Drops per Square Centimeter
8
10
12
14
16
18
Height in Feet
Front
Back
Combine

Figure 2.


2 mph, Engine drive sprayers
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Drops per square centimeter
8
10
12
14
16
18
20
Height in Feet
100 gal d2/40
150 gal d2/40