

Effect of Tree Architecture on the Control of Alternaria Leaf Spot in Almonds

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Project Leader: Mario Viveros, UCCE Kern County

Cooperating Personnel: B. Teviotdale, J.E. Adaskaveg and P. Schrader, UC Kearney Ag Center, Parlier

Background

Alternaria Leaf Spot in Kern County appeared in 1980, and stayed dormant until 1993, when it appeared in large almond orchards and caused premature defoliation and poor nut removal at harvest. In 1999, this disease was not as bad as in previous years. However, we still found severely infected orchards. We have found Alternaria infected orchards in Delano, McFarland, Wasco, Shafter and Rosedale. This disease has caused premature defoliation and yield reduction, which can carry from 22% to 36%.

Orchard surveys have revealed that Alternaria infected orchards have two factors in common. First, the disease first appears on the outside and at mid-section of the canopy. This is the area that opens to the sky and subject to dew formation. Second, the worst Alternaria infested trees are those with an opened canopy center, which gives the tree an umbrella shape.

Objectives

1. Determine the degree of disease development and control of Alternaria due to tree architecture.
2. Evaluate Abound® fungicide sprays on control of Alternaria on tree architecture.

Objective 1

To determine the degree of disease development and control by tree architecture, experiment was established in a three-year-old orchard, which was infected with Alternaria. The orchard is planted to Sonora-Nonpareil-Butte in a 1:1 planting arrangement, row orientation is from east to west and is planted on the rectangle pattern at a distance of 20 x 18 ft. All three varieties are susceptible to Alternaria, but the most are Sonora and Butte. Each plot has a row of Sonora, Nonpareil and Butte. The guard row between each plot is a Nonpareil. The tree architecture was established by using a mechanical pruning machine, which topped, topped-hedged and hedged according to randomization of treatments.

The treatments were the following: 1) control, 2) hedged, 3) topped, and 4) topped and hedged. The control treatment will be pruned by hand, but hedging and topping will be done mechanically. The description of each treatment is the following:

Control: This treatment is the standard pruning system for most Kern County orchards. It consists of an open tree center and no crossing over limbs, as well as no water shoots growing through the canopy of the tree. The scaffolds are tied with a rope at the mid-section of the canopy. The rope is placed on the outside of the scaffold and goes around the canopy, making a complete loop.

Hedged: In this treatment, the trees were hedged down the tree row with a mechanical pruner leaving a six-foot wide avenue between rows.

Topped: In this treatment, the trees were topped to an average of 27 inches below the tree height by a mechanical pruner. The final tree height was 12.4 ft.

Topped and Hedged: In this treatment, the trees were topped and hedged down the tree row with a mechanical pruner. The topping was done by taking 27 inches from the tree's top, leaving 12.4 ft. high trees. The hedging was done by hedging down the tree row, leaving a 6 ft. avenue between rows. There were five replications of each treatment randomized in a complete block design.

In January, 2000, five trees were randomly selected from each variety on each plot. At a height of six inches above the ground, trunk circumference was taken. This height was marked with a nail for future tree circumference measurements. Two scaffolds from each tree were selected, one on the north and one on the south. They were selected to determine the degree of canopy openness from winter to summer. Each branch was marked at an approximate height of 10 ft. The mark was done with paint for initial and subsequent measurements. Holding a telescoping measuring pole, perpendicular to the ground, a measurement was taken from the ground to the painted mark and from the pole to the trunk. These measurements are referred as height and distance in our data. The initial height and distance measurements were made in the dormant season. A follow-up (second measurement) of height and distance was done at the onset of hull split. Trunk circumferences measurements were done in the dormant season (1999-2000) and they will be measured again in the following season.

Results

Objective 1. The results for Objective 1 are found on Table 1. A negative number (height) represents a drop from the first measurement to the second measurement. A positive number (distance) represents the amount of inches the scaffold moved away from the trunk. This is to say that the higher the negative number (height) and the higher the positive number (distance), the greater the openness of the tree.

There were no significant differences in tree openness (height and distance) in Nonpareil and Butte due to pruning method. However, the Sonora tree height dropped significantly more than Nonpareil and Butte. The drop was more on topped than on the topped-hedged and control treatment; however, it was not significantly different from the hedged treatment. The height drop on the Sonora was not due to crop load since meat pound per acre was not significant different between treatments and control.

Yields are very important in almond production. The impact of tree architecture due to different pruning methods was measured in this experiment. The yield data due to different pruning methods can be found on Table 1. Butte and Sonora yields were not affected by the pruning method. There were no significant differences between treatments and the control. The yields of Nonpareils, however, were affected by the pruning treatments. The yield of the topped-hedge treatment is significantly less than the control and topped, but it is not significantly less than the hedged treatment.

The Alternaria control due to tree architecture due to different pruning systems can be found on Table 2. There were no significant differences among pruning methods on the percent of Alternaria infected leaves.

Table 2. Percent of Alternaria infected leaves in tree architecture due to four pruning methods.

Pruning Method	Infected Leaves (%)
Hedged	12.8
Topped	14.3
Topped-hedged	11.2
Control	12.4

Objective 2

To determine the degree of disease control with Abound® sprays on tree architecture due to pruning methods, the orchard was divided in halves. One half received Abound® spray and the other half was left untreated. These treatments were randomized for each plot. There were three Abound® sprays (Ap. 24, May 8, and May 22) applied at 12 oz. per acre in 100 gallons of water. The degree of Alternaria control was based on tree defoliation in October. The reason being that defoliation is the end result of Alternaria infection.

Results

The percent of defoliation due to Alternaria in different pruning systems was not significantly different. However, the difference in defoliation between Abound® spray and untreated control was significantly different. The mean percent defoliation in the control was 28.41 and the mean percent defoliation on the Abound® spray treatment was 2.17. The significant level between these two treatments was at five percent.

Conclusion

The tree architecture due to different pruning methods didn't improve the control of Alternaria this year. However, this is not unexpected since it takes more than one year to position scaffolds and limbs in an upright position.

The yields of the Nonpareil were affected by the pruning methods. The hedged-topped method significantly reduced yields. This is expected since the more a tree is pruned, the greater reduction in bearing canopy.

There was no significant influence of tree architecture on tree openness on any of the varieties except Sonora. In this variety, the scaffolds move downward but not away from the trunk. This means that the tree opening occurred in the upper part of the tree. The opening of this variety is due to its growth habit and not to crop load, since there were no significant differences in crop load.

Table 1. Change in height and distance as well as kernel weight and meat pounds per acre for Nonpareil, Butte and Sonora due to four pruning methods.*Nonpareil*

Treatment	Height Change (inches)	Distance Change (inches)	Kernel Weight (g)	Meat Pounds/AC
Hedged	-11.48 a	8.20 a	1.32 a	1154 a
Topped	-21.75 a	9.36 a	1.30 a	1407 b
Topped/Hedged	-16.93 a	6.76 a	1.32 a	1314 ab
Control	-21.06 a	7.51 a	1.28 a	1453 b

Butte

Treatment	Height Change (inches)	Distance Change (inches)	Kernel Weight (g)	Meat Pounds/AC
Hedged	-15.22 a	7.44 a	1.00 a	1805 a
Topped	-10.57 a	9.28 a	1.00 a	1767 a
Topped/Hedged	-9.26 a	6.80 a	1.03 a	1685 a
Control	-10.88 a	5.48 a	1.00 a	2001 a

Sonora

Treatment	Height Change (inches)	Distance Change (inches)	Kernel Weight (g)	Meat Pounds/AC
Hedged	-16.23 ab	5.82 a	1.40 a	1723 a
Topped	-24.91 a	8.29 a	1.40 a	1752 a
Topped/Hedged	-9.04 b	7.28 a	1.44 a	1546 a
Control	-15.02 b	7.15 a	1.38 a	1859 a