FINAL REPORT

EFFICACY DATA FOR USE OF UREA COMBINED WITH 6-BENZYLADENINE (BA) IN 100 GALLONS OF WATER/ACRE FOR REGISTRATION OF BA TO REDUCE ALTERNATE BEARING IN PISTACHIO AND INCREASE CUMULATIVE YIELD

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SUMMARY

Alternate bearing in pistachio (Pistacia vera L., cv. Kerman) is due to the excessive abscission of the floral buds for the next year's crop during the heavy on-year. Abscission of floral buds begins at nut fill (June) and proceeds through July. The floral buds are considered poor competitors in relation to the developing nuts. Whereas this mechanism was known, the physiological basis for floral bud abscission was not known.

Results from our basic research documented that the concentrations of two important cytokinins, zeatin riboside and isopentyladenosine, each decreased 40% in floral buds on shoots carrying an on-year crop [greater than 70 nuts (fruit) per branch]. The decrease in cytokinin concentration would reduce the sink-strength of the buds and render them less competitive. During the period from June 6 to July 26, the nuts were releasing the growth-inhibiting, abscission-promoting hormone abscisic acid (ABA). We quantified a 25% increase in ABA concentration in the floral buds during this period. This hormone imbalance in the floral buds is consistent with the failure of the floral buds to compete successfully against the developing nuts and is likely an important factor causing their abscission.

In branch studies, foliar application of the cytokinin 6-benzyladenine (the commercial product Accel®, Valent Bioscience) at 25 mg/L and low-biuret urea at 0.25% N applied in early June and again in early July increased bud retention on branches carrying greater than 70 nuts per branch by 3-fold and 1.6-fold in two different years, respectively, compared to the number of buds retained on untreated branches. Increased bud retention correlated with increased concentrations of both zeatin riboside and isopentyladenosine and a reduced level of ABA in buds on treated branches compared to those from untreated branches.

We now have five years of yield data from the research at S&J Ranch testing the effectiveness of treatments to prevent floral bud abscission. The 5-year cumulative yield was significantly higher for trees treated with urea (0.25%) combined with 6-benzyladenine (25 mg/L) in June and July than control trees. Thus, foliar application of 6.25 lbs. N (0.25% N) as urea combined with 28 g 6-benzyladenine (25 mg/L) (Accel®)/300 gallons water/100 trees/acre in early June and again in early July resulted in a net increase 2.4 US tons split nuts (dry weight)/acre (based on 128 trees/acre) compared to the control trees. This concluded our research at S&J Ranch, whom we would like to thank immensely for their generous cooperation.

While effective, Accel® is not yet registered for use on pistachio. In this project, we are confirming the efficacy of the urea plus 6-benzyladenine treatment, testing variations of this treatment to fine tune it and to reduce the cost of the treatment, e.g., applying the treatment only

in on-years, and collecting efficacy data to be used for registration of 6-benzyladenine on pistachio.

In the first year of this project, an on-year, we applied the treatments. No treatment significantly affected yield relative to the control. This was our experience in the previous study at S&J Ranch for the effect of the treatment during the on-year. There were, however, significant treatment effects on yield related to interactions between the concentration of VBC 3001 and urea. It is clear that urea can partially replace VBC 3001 in the on-year. Whether these effects will be observed in the off-year remains to be seen. We will harvest the first off-year crop in August-September 2002.

PROCEDURES

Last year in an orchard in the on-year we applied the following treatments to 15 individual tree replicates per treatment. Treatments were applied with a backpack air blast sprayer to simulate a commercial application. All treatments were applied in early June and again in early July in 100 gallons of water/acre. The treatments were the following: (1) 6.28 lbs. N/acre as low biuret urea plus 0.5 qts. VBC 3001 (8.9 g BA)/acre; (2) 6.28 lbs. N as low biuret urea plus 1.0 qt. VBC 3001 (17.9 g BA)/acre; (3) 6.28 lbs. N/acre as low biuret urea plus 1.5 qts. VBC 3001 (26.8 g BA)/acre; (4) 1.5 qts. VBC 3001 (26.8 g BA)/acre; and (5) untreated control.

At the time of commercial harvest, we determined the kg of nuts per tree, the proportion of split nuts versus nonsplit nuts, and the proportion of aborted and blank nuts, on both a fresh and dry weight basis. A cost:benefit analysis will be done at the end of each 2-year period with a final analysis based on cumulative yield done at the end of the second year.

Commercial shaking and catching equipment was used to harvest the plots. Yield (kg nuts/tree) was determined in the field using a portable bin scale. Subsamples (100 nuts/tree) were collected and nut quality analyzed for blank nuts (no evidence of embryo growth), aborted nuts (terminated embryo growth), nonsplit nuts, split nuts, fresh and dry weights of nut components (hulls, shells and kernels). Harvestability, i.e., the effectiveness of mechanical shaking, is based on total yield.

RESULTS AND DISCUSSION

This is the first year of this project. We only have harvest data for the on-year. No treatment significantly affected yield relative to the control (Table 1). This was our experience in the previous study at S&J Ranch for the effect of the treatment during the on-year. There were, however, significant treatment effects on yield related to interactions between the concentration of VBC 3001 and urea. It is clear that urea can partially replace VBC 3001 in the on-year. Whether these effects will be observed in the off-year remains to be seen. We will harvest the first off-year crop in August-September 2002.

CONCLUSION AND PRACTICAL APPLICATION

Foliar application of 6.25 lbs. N as low-biuret urea combined with 28 g 6-benzyladenine (Accel®) (Valent BioScience)/300 gallons water/100 trees/acre in early June and again in early significantly increased cumulative yield for the five years of the study and for the two off-year crops. This treatment remains significantly better than other treatments tested to date for

increasing yield in the off-year. However, 6-benzyladenine (Accel®) is not available for use on pistachio at this time. The results of this project will provide data to be used towards the registration of 6-benzyladenine for use on pistachio.

LITERATURE CITED

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Table 1. Effect of foliar-applied 6-benzyladenine (VBC 3001) with and without urea (6.28 lbs. N/acre) early in June and again early in July on yield of pistachio, cv. Kerman, during the current on-year.

Treatment	kg fruit (fresh wt)/tree	kg split nuts (dry wt)/tree
VBC (1.5 qt/acre)	55.5 a[z]	18.2 a
VBC (1.5 qt/acre) plus urea	52.8 ab	15.8 ab
VBC (1.0 qt/acre) plus urea	54.7 a	18.0 a
VBC (0.5 qt/acre) plus urea	46.1 b	14.6 b
Control – none	51.2 ab	16.7 ab
P-value	0.07	0.02

[y]VBC 3001, 1.5 qt = 26.8 g 6-benzyladenine

[z]Values within a vertical column followed by different letters are significantly different by Duncan's multiple range test at $P \leq 0.05$.