
Studies on the efficacy of a new formulation of Uniconazole-P

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Growers in San Juan Capistrano and Camarillo

Uniconazole-P is used in 'Hass' avocado production to stop vegetative shoot growth at the apex of indeterminate floral shoots to increase fruit set and yield and after pruning to maintain tree size, especially in high-density plantings. Uniconazole-P has the potential to reduce pruning costs, but also to reduce fruit size and increase fruit drop. Depending on crop load, reducing vegetative shoot growth in spring or summer could mitigate or initiate alternate bearing. In order to be approved by the California Department of Pesticide Registration (DPR), a new formulation of Uniconazole-P, which did not contain the restricted component, was developed for use in California. The objectives were to determine the effectiveness of the new formulation of Uniconazole-P applied at the suggested rate for Sunny[®] in spring, summer, fall or winter to stop the growth of vegetative shoots at different stages of development (type 1 – shoots with zero to less than 6 mm of new growth, type 2 – shoots with 25 mm of new growth, and type 3 – shoots with advanced growth and red expanding leaves at the time of treatment) and to determine its effects on yield, including fruit size.

Results

Consistent with its role as a GA biosynthesis inhibitor, Uniconazole-P had a greater effect on internodal elongation (shoot length in cm) than on production of new nodes by the apical meristem. A node is the point of attachment of the leaf to the shoot; the distance/region between one node on a shoot to the next is the internode. Shortened internodes (reduced length between nodes) caused leaves and inflorescences to form tight clusters. However, the region between nodes typically elongated within 2 to 4 weeks after the Uniconazole-P application minimizing the difference in shoot length between Uniconazole-P treated trees and untreated control trees.



Example of the short internodes caused by application of Uniconazole-P.

The greatest reduction in vegetative shoot length achieved with Uniconazole-P was 6 cm (2.4 inches) for vegetative shoots with advanced growth (red expanding leaves at the time of application) by 12 weeks after the spring application in March at Camarillo. Growth was reduced only 3 cm or less for shoots at younger stages of development at Camarillo and for all shoots at San Juan Capistrano. At any application time, shoots at different stages of development were always present. Thus, efficacy was always variable. The spring application was also tested for its ability to reduce the growth of the vegetative shoot apex of indeterminate floral shoots. At the end of 12 weeks after application, growth was reduced 3 cm across shoots at all stages of development at the San Juan Capistrano orchard. At Camarillo, growth of the vegetative shoot apex of indeterminate floral shoots was reduced 8 cm (3.2 inches) for shoots already exhibiting red expanded leaves when the Uniconazole-P application was made, but only 3 cm or less for shoots that were younger at the time of application. To reduce competition and increase fruit set and size, growth of the vegetative shoot apex of indeterminate floral shoots would need to be stopped at a very early stage of development. Consistent with this interpretation, there were no significant differences in the number of fruit set by the spring bloom or in the size of these fruit in response to the spring Uniconazole-P application at either site.

The summer application of Uniconazole-P increased leaf burn for trees in both orchards. All applications of Uniconazole-P caused leaf curling/cupping for trees at both sites. Summer and fall Uniconazole-P applications caused leaf abscission at the San Juan Capistrano site; only summer Uniconazole-P caused leaf abscission at the Camarillo site. The fall Uniconazole-P application caused flowering (off-season bloom) in November at the San Juan Capistrano site.

At the San Juan Capistrano, total yield as kg/tree was lower in response to the fall and spring applications of Uniconazole-P (NS) and significantly reduced by the summer (33%) and winter (54%) applications, resulting in yield losses of 1,407 lb/110 trees/acre ($P = 0.0049$) and 2,328 lb/110 trees/acre ($P = 0.0049$) in total yield, respectively. For the summer and winter Uniconazole-P applications at this site, there was a corresponding significant decrease in yield of commercially valuable size fruit (packing carton sizes 60+48+40) of 44% (summer) and 64% (winter), due to significant decreases in the yield of fruit of packing carton sizes 48 and 40. This resulted in a net loss of 1,649 lb/110 trees/acre ($P < 0.0001$) and 2,400 lb/110 trees/acre ($P < 0.0001$) of commercially valuable size fruit, respectively. The fall application significantly reduced the yield of fruit of packing size 40 by 364 lb/110 trees/acre ($P < 0.0001$). At Camarillo, Uniconazole-P only slightly reduced total yield (NS). The summer Uniconazole-P application significantly increased the yield of fruit of packing carton sizes 84, 70 and 60, but reduced the yield of fruit of packing carton sizes 48 (NS) and 40 by 873 lb/110 trees/acre ($P = 0.0392$). The fall application also significantly reduced the yield of fruit of packing size 40 by 703 lb/110 trees/acre ($P = 0.0392$).

With regard to fruit quality, at San Juan Capistrano, the summer, fall and winter applications significantly reduce fruit length and width. The summer application significantly reduced mesocarp width (edible portion of the fruit), whereas the fall and winter applications reduced seed diameter with no increase in mesocarp width. At Camarillo, the summer and fall Uniconazole-P applications reduced the number of days for the fruit soften to eating quality by one day. The summer application reduced fruit length and the summer and fall applications reduce fruit width. As observed at San Juan Capistrano, at Camarillo the summer application significantly reduced mesocarp width (edible portion of the fruit) and the fall application reduced seed diameter.

Take Home Message

Due to the negative effects on yield, fruit size and fruit quality resulting from one application of the new formulation of Uniconazole-P at both sites in this research, it is not possible to increase the concentration of Uniconazole-P in an attempt to achieve a greater reduction in shoot growth as this would cause even greater reductions in yield, fruit size and quality. The new formulation of Uniconazole-P tested on 'Hass' avocado trees under California growing conditions in two separate orchards did not provide the benefits required for increasing production.

Benefits to the Industry

Development of a new Uniconazole-P formulation that could be approved by the DPR and determining its efficacy (also a DPR requirement) was the critical first step in making this material available to avocado growers in California. The results were not promising.

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