

Weed Management Improves Yield and Quality of 'Valencia' Oranges¹

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Additional index words. *Citrus sinensis*, paraquat, simazine, weed control

Abstract. Bermudagrass (*Cynodon dactylon* (L.) Pers.) interference reduced yield of 'Valencia' oranges (*Citrus sinensis* (L.) Osbeck) more than annual weeds. Both types of vegetation also resulted in decreased leaf nitrogen, increased juice content, soluble solids, and titratable acid. Bermudagrass competition resulted in increased fruit size. Complete or partial weed control eliminated or reduced adverse effects of competitive vegetation on fruit production.

Weeds in citrus orchards may reduce yield and affect fruit quality (6). Nontillage methods of weed control with oil-spray increased fruit production (3, 5, 6, 7). Fruit from nontilled orchards compared with that from cultivated or cover-cropped orchards is larger, matures earlier, and has a higher juice content (5, 6, 7). The effects of soil-residual herbicides on yield or fruit quality of 'Valencia' oranges were similar to those of weed oil (4). The effects of paraquat (1,1'-dimethyl-4,4'-bipyridinium ion) on fruit yield and quality are not known.

This is a report on the effects of different weed populations, weed control, and irrigation methods on yield and fruit quality of 'Valencia' oranges trees. The trees, planted in 1965, were maintained 12 years under furrow irrigation, and kept weed-free with simazine [2-chloro-4,6-bis(ethylamino)-s-triazine] and weed oil. In Spring 1977, one-half of the orchard was converted to sprinkler irrigation and the other half remained in furrow irrigation.

To establish weedy plots, the soil was rotary-tilled to a 5 cm depth to prepare the seed bed, dilute simazine in the soil, and move annual weed seeds to the soil surface for germination. Naturally occurring annual broadleaf weeds, such as redroot pigweed (*Amaranthus retroflexus* L.), horseweed [*Conyza canadensis* (L.) Cronq.], bullthistle [*Cirsium vulgare* (Savi) Tenore], pale smartweed (*Polygonum lapathifolium* L.), mixed annual grasses (*Bromus* and *Hordeum* sp.) and other species were allowed to germinate and grow. 'Tifway' bermudagrass stolens were incorporated into the top 2 cm of soil. Ammonium nitrate at the rate of 121 kg N/ha was applied annually in March. Weed vegetation was allowed to become established for 2 years on all plots except those where no weeds were allowed to grow.

The first paraquat treatments were made in Spring 1979 to plots containing either mixtures of annual weeds or bermudagrass. Neither annual weeds nor bermudagrass were eradicated but regrew after each treatment. Bermudagrass was resprayed when regrowth

reached about 50%, and annual weeds were resprayed before regrowth was 30 cm tall and covered 50% of the plot surface. Annual weeds were suppressed with 5 paraquat treatments, while bermudagrass required 7 treatments at 0.6 kg/ha in 468 l/ha of water. Complete weed control was achieved during the two years of the experiment by virtue of simazine residues in the undisturbed soil, by the lack of viable weed seed in the surface soil, and by hand removal of the few seedlings that emerged. Annual weeds and bermudagrass covered over 95% of the soil surface of plots where no weed control was practiced.

Yield, fruit quality, and nitrogen content of leaves were determined in 6 replicated single tree plots in blocks which were surrounded by border trees. There were 3 blocks of bermudagrass under sprinkler irrigation and 3 blocks of annual weeds under either furrow or sprinkler irrigation. Spring cycle leaves from non-fruiting terminals were collected when they were 6 months old and analyzed for nitrogen. At harvest, 18 fruit were picked at random from each tree for quality determinations. Fruit, yield, size, juice content, total titratable acidity, total soluble solids, solids/acid ratio, and leaf nitrogen concentration are shown in Table 1.

Yield, fruit quality, and leaf nitrogen were not influenced by irrigation method. Yield reduction from bermudagrass was twice from annual weeds. Bermudagrass cover resulted in increased fruit size. The 2 types of vegetation did not influence fruit quality and leaf nit-

rogen content. Complete control of annual weeds with simazine and the absence of bermudagrass resulted in higher fruit yield but did not influence fruit quality or leaf nitrogen content, compared with control by paraquat. Uncontrolled annual weed and bermudagrass cover reduced fruit yield and leaf nitrogen, and acids in the fruit. The solids/acid ratio was unaffected.

Differences in fruit quality appear to have resulted from the amount of competitive vegetation. Leaf nitrogen content appears to be related to fruit quality (1, 8). Perhaps the reduced leaf nitrogen and lower fruit yield observed in this research resulted from competition of annual weeds or bermudagrass for soil nitrogen.

Yield was reduced more by bermudagrass than by annual weeds although the leaf nitrogen level was the same under both vegetation treatments. Larger yield reduction with bermudagrass may result from greater competition for nitrogen and water, and from allelopathic effects (2).

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Table 1. Average yield, fruit quality, and leaf nitrogen content of 'Valencia' orange grown under different types of irrigation, vegetation, and control.

Variable Comparison	Yield (kg/tree)	Fruit diam (mm)	Juice (%)	Soluble solids (%)	Acid (%)	Solid/acid ratio	Leaf nitrogen (%)
Irrigation							
Furrow	49.3 a ^c	65.7 a	56.4 a	13.2 a	1.2 a	11.0 a	2.2 a
Sprinkler	41.2 a	66.3 a	54.6 a	12.9 a	1.2 a	10.6 a	2.2 a
Vegetation							
Annual weeds	41.3 a	66.0 a	55.5 a	12.8 a	1.2 a	10.6 a	2.2 a
Bermudagrass	24.0 b	66.4 a	55.3 a	12.9 a	1.2 a	10.4 a	2.2 a
Annual weeds							
Complete control	62.4 a	65.6 a	55.5 a	12.5 b	1.2 b	11.0 a	2.4 a
Paraquat	53.0 b	65.9 a	55.6 a	12.4 b	1.2 b	10.5 a	2.4 a
No control	29.6 c	65.5 a	55.2 b	13.7 a	1.3 a	11.0 a	2.0 b
Bermudagrass							
Complete control	66.9 a	64.9 b	53.9 b	12.6 b	1.2 b	10.6 a	2.4 b
Paraquat	33.0 b	64.7 b	54.9 b	12.7 ab	1.2 b	10.7 a	2.4 b
No control	15.0 c	68.2 a	56.4 a	12.9 a	1.3 a	10.2 a	1.8 a

^cMean separation in columns within each variable by analysis of variance and Duncan's multiple range, 5% level.

¹Received for publication July 10, 1981.

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