

Petroleum Oils as Navel Orange and Tangelo Fruit Thinning Agents

Project Leader:

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Since the 2001-02 crop year, the major objective of this project has been to determine how a summer application of 10 gallons of a 440-weight narrow-range petroleum oil in a 200-gallon per-acre spray solution affects the alternate bearing, fruit size and yield of Minneola tangelo. In this report, the year refers to the year that the crop was harvested (which was in the spring following the previous year's late summer oil application).

Although the original title of this project has been retained for continuity, petroleum oil as used in this study has not yet thinned Minneola tangelo fruit. Effects on yield and fruit size have been measured that appear to be attributable to a summer oil application, but whether these differences are real remains a question.

Harvest results in 2001, the first year of the experiment and a year of heavy June fruit drop, showed that oil-treated trees had produced more fruit than non-treated trees. This result was unexpected, in that the oil was not applied until July 1, well after fruit set. Why fruit numbers should increase for oil-treated trees between July 1 and the March 4 harvest date was not clear. Although the treatments were replicated six times (two trees per replicate), a response of this magnitude, especially in the first year when no response was expected, suggested a statistical anomaly.

We repeated the experiment by treating these same trees with oil August 6, 2002, and while differences between fruit numbers in different size categories between treated and untreated trees were not generally statistically significant, they were sometimes much greater on average. In September 2003, the experimental site was moved to a new area of the orchard, and the number of replications was increased to eight. Two years of data have now been collected from this second site (2003 and 2004).

Some results from the two different sites within this orchard are shown in Table I. At both sites, averaged between the two years of experimentation at each site, more large fruit (colossal and supercolossal sizes) were harvested from oil-treated trees. Oil-treated trees produced more fruit annually on average than did untreated trees at Site 1. Total annual fruit numbers were not different between treated and untreated trees at Site 2.

The fruit-size response was different between the two sites. At Site 1, the percentage of colossal and super colossal fruit remained similar between treated and untreated trees, but since the total number of fruit was greater in the oil-treated trees, the number of large fruit was correspondingly greater. At Site 2, total fruit numbers were similar between oil-treated and untreated trees, but the percentage of colossal and super colossal fruit was greater for oil-treated trees. Annually, oil-treated trees at Site 1 produced 3,872 more colossal and supercolossal fruit per acre than untreated trees, while at Site 2 oil-treated trees produced 6,413 more colossal and super colossal fruit than did the untreated trees.

At the present time, no explanation for why the oil application in August or September should increase total fruit numbers or the percentage of larger-sized fruit has been forthcoming. Fruit drop was monitored on a weekly basis beginning October 11, 2004 through February 18, 2005 to determine if oil was reducing fruit drop. However, no difference in fruit drop between oil-treated and untreated trees was observed, and very little drop occurred by the March 9, 2005 harvest date (approximately 0.6 fruit per tree per day in each treatment), yet the oil-treated trees produced more large fruit at harvest than did the untreated trees that year. Pest levels were very low in this orchard all years, suggesting that the oil affect is not related to improved control of insects or mites.

Oil did not appear to affect the relationship between the numbers of fruit larger than jumbo (i.e. mammoth, colossal and super colossal) produced per tree versus the total number of fruit produced per tree, over the four years of experimentation. When a linear function was fitted to this relationship separately for oil-treated trees and those left untreated, the slope and intercept of the resulting lines were not significantly different from each other (see Figure 1). This suggests that the proportion of fruit at any yield level that was larger than jumbo was not different between oil-treated and untreated trees. In light of the data displayed in Table 1, the effect of oil appears to be limited to either increasing the total number of fruit per tree or in increasing the percentage of colossal and super colossal fruit at the expense of mammoth-sized fruit.

Oil treatments aside, the results displayed in Figure 1 show that mature Minneola tangelo trees in the San Joaquin Valley were able to produce proportionately similar numbers of large sized fruit up to a total fruit production level of over 1,200 fruit per tree (over 146,000 fruit per acre). Anything occurring in this orchard to reduce yield levels below 146,000 fruit per acre (such as severe pruning or adverse weather conditions during fruit set), would be expected to reduce the sum of the mammoth, colossal and super colossal fruit proportionately.

Oil was again applied in September 2005, similarly to the previous two years at Site 2, with an anticipated harvest in March, 2006.

Table 1. Mean number of large fruit per tree and total fruit per tree compared between oil treated and untreated trees at two separate locations and time intervals within an orchard in Kern County, California, 2001-2004.

treatment	Site 1, 2001 and 2002		Site 2, 2003 and 2004	
	large fruit ^z	total fruit ^y	large fruit ^z	total fruit ^y
untreated	252 ax	399 a	331 a	739 a
oil treated	320 b	502 b	384 b	747 a

^z Large fruit refers to the number of colossal and supercolossal sized fruit per tree.

^y Total fruit is the total number of fruit per tree.

^x Different letters following values within the same column denote significant differences by Fisher's protected LSD test at (P :s0.05). Site 1 had 6 replicates and Site 2 had 8 replicates and each treated or untreated plot within a replicate was composed of 2 trees. Experimental design was a RCBD ANOVA with repeated measures.

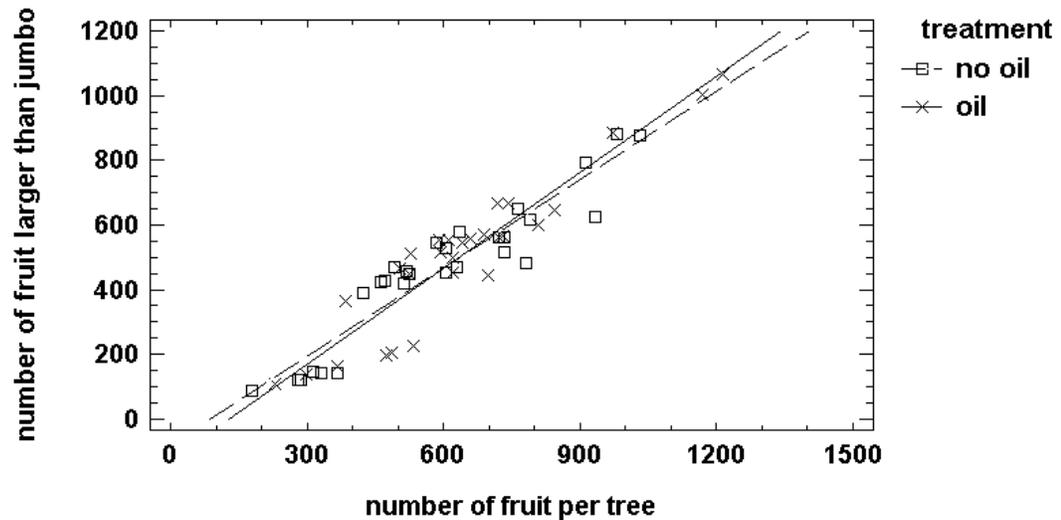


Figure 1. The relationship between the number of fruit per tree and the number of commercially-sized fruit per tree (i.e. fruit that are sized mammoth, colossal and supercolossal) for oil-treated and untreated Minneola tangelo trees in Kern County, California, 2001-2004.

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