

Using Regulated Deficit Irrigation to Optimize Fruit Size in Late Harvest Navels

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Grower profits with late harvest navels can be significantly reduced due to both excessively large fruit and granulation. We are evaluating regulated deficit irrigation (RDI) as a technique to produce optimal-sized high-quality fruit with late harvest (Lane Late) navels.

There are four RDI regimes in addition to a fully irrigated Control in a commercial orchard in eastern Tulare County. Three of the RDI treatments (T1, T2, and T3) impose stress in the early, middle, and late periods of the season, respectively, and a fourth (T4) imposes stress continuously throughout the season. To give the most realistic possible presentation of the results to date, we report mean values of the 2004 and 2005 harvests, the second and third harvest years of this experiment.

Cumulative mean applied water in 2003-4 for T1, T2, and T3 ranged from 24.9 to 30.9 inches while T4 applied 17.8 inches; less than half of the fully irrigated Control (38.8 inches). Individual fruit fresh weight at harvest was reduced by 4, 16, 24, and 32% for T1-T4, respectively, relative to the Control. There were no statistically significant differences in fruit load, although T3 and T4 had values 29% higher than the Control. These two treatments had “Fancy” fruit production similar to the Control while both T1 and T2 had significantly lower Fancy fruit.



With the exception of T1, fruit size distribution was greatly improved by the RDI, especially for T3 and T4 relative to the Control. For example, medium size fruit (56+72 fruit/box) accounted for only 8.1% of the crop in the Control versus 32.1 and 46.3 in T3 and T4, respectively. Conversely, the Control had 57.2% very large size fruit (24+36 fruit/box) compared with 18.0 and 9.8% for T3 and T4, respectively.

With the exception of T3, granulation was generally lower than the Control for the RDI regimes across all fruit sizes. For example, granulation for large size fruit (40+48 fruit/box) was 25.0% for the Control compared with 15.0 and 6.7% for T1 and T4, respectively. Open core was dramatically reduced in T3 relative to the Control.

Using market prices, we calculated mean gross revenue per acre for 2004-5 as \$4,460, \$3,130, \$5,880, and \$6,120 for T1-T4, respectively, compared with \$4,710/acre for the Control. The combination of reduced applied water and higher gross revenue due primarily to improved fruit size distributions resulted in significantly higher irrigation gross revenue productivity for three of the four RDI regimes; \$179, \$190, and \$343/inch for T1, T3, and T4, respectively, compared with \$122/inch for the Control.

The most important finding to date is that fruit size distribution can be improved with RDI for Lane Late. This dramatically increases crop value while saving irrigation water. We've also found that granulation and open core can be reduced with RDI. However, fruit quality can be diminished if stress is imposed only during early and midseason. To date, none of the RDI regimes have reduced fruit load – even season-long stress that applied less than 50% of seasonal potential water use. We did not anticipate these results with T4 over the long term; they are unprecedented in tree crops. We plan to continue this project through the 2006 harvest to confirm that this severe form of RDI can be imposed on a sustained basis without negative impacts on tree performance.

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