row basis. All grove modification of the existing irrigation systems was donated by Fruit Growers Supply and the Sunkist Research Foundation. Again, detailed freeze assessment was conducted on both the trees and fruit following the December 1998 freeze. There were no consistent differences detected in the level of freeze damage related to nitrogen treatment.

[z] Foliar Application: Low Biuret Urea will be applied to foliage at a rate of 0.25 lb/tree per application. Trees receiving one application will have urea applied in late May. Trees receiving 2 applications will have an additional application in late winter. Trees receiving 4 applications will have additional applications at the pre-bloom stage and 30 days following the late May application.

[y] Soil Application: All applications will be made through the irrigation system: 1 = single application per year in late winter; 2 = split application, late winter and early summer; C = Applied with every irrigation from late winter through summer.

[x] Soil Nitrogen will be applied as in the "C" treatment described above for the soil applications.

Regulated Deficit Irrigation for Orange Under High Evaporative Demand in California

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The 1998-99 season was the third year of a study evaluating regulated deficit irrigation (RDI) on mature orange trees. This technique purposely imposes tree water deficits during stress-tolerant times of the season. The goal is to reduce orchard water use (ETc) while not reducing and possibly enhancing crop revenue primarily by improving fruit quality.

We imposed numerous RDI regimes that stress the trees during a variety of time periods during the season. The trees are 'Frost Nucellar' located in a commercial orchard near McFarland in Kern Co. Of particular interest is the impact of RDI on peel defects including those due to fruit development factors, puff/crease, and insects. Additionally, water stress effects on post harvest fruit quality are being investigated.

The previous two seasons showed that citrus fruit possess a characteristic that promotes successful RDI – the ability to have accelerated growth after the reintroduction of full irrigation following the period of stress.

The freeze severely damaged most fruit in this growing area. In fact, the damage was so severe in our experimental block that the grower/cooperator decided not to harvest. Since the freeze offered us an unexpected opportunity to evaluate the effects of RDI on freeze tolerance, we harvested our trees with the financial assistance of the Citrus Research Board. All fruit yield and quality parameters previously evaluated were assessed in the freeze year with the exception of post harvest fruit quality. Additionally, fruit was sliced and graded with industry standards to determine freeze damage: 0-20%, 20-40%, and greater than 40% damage.

Once again, the RDI regimes that stressed the trees early in the season (Apr.-Jun.) reduced puff and crease (average of about 2% of harvested fruit) relative to the fully irrigated control (about 6% of harvested fruit). Later season stress (Jul.-Aug.) tended to result in higher puff and crease (about 13% of harvested fruit). However, the effect of RDI on puff and crease was far outweighed by the impact on freeze damage.

Most of the RDI regimes resulted in lower freeze damage. Notable were the later season stress regimes that resulted in about 50% of the harvested fruit having 0-20% damage. This compares with only about 30% of the harvested fruit in the fully irrigated control having this minimal damage. We believe that the later season stress increased the soluble solids level (sugars) in the fruit, imparting a freeze tolerance. There was little difference in the harvested fruit loads between the RDI treatments and the fully irrigated control. Thus, the almost two-fold increase in gross revenue from the late season stress regimes was due to less freeze damage.

Growers in freeze-prone areas might consider late season stress to engender freeze tolerance in the fruit. However, the downside is that fruit size may be slightly reduced.

Development of an Integrated Farming System for Citrus and its Comparison to a Conventional Farming System

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The use of cover crops in citrus production in the San Joaquin Valley has been limited.Concern of increased frost risk from lower minimum temperatures during the frost season has been a major factor in this regard.There has been increased interest in use of cover crops in the past few years and the research discussed here was initiated to add to our information regarding cover crops in citrus production. More specific goals included measurement of orchard temperature,movement of nitrate in the soil profile, monitor soil water dynamics, sample for citrus nematode and Phytophthora (a soil pathogen) as well as gopher activity.

A field trial with cover crops was initiated in 1996 in commercial citrus and the current report summarizes activities concerning the cover planted in November of 1998. The cover crop was a mixture of clovers, fescue, brome and alfalfa seeded at a rate of 25# per acre. Two treatments were established namely the cover and a bare orchard floor maintained vegetation free. Treatments were eight rows wide the width of the orchard with treatments replicated and randomized.

Temperature sensors installed at a height of five feet in thermometer shelters which recorded the temperature every half hour. Neutron probe access tubes and tensiometers were installed under the emitters of the low volume irrigation system as well as in the middles between the rows. Water meters installed in each plot monitored the volume of water applied during the irrigation season. Samples were taken for the presence of citrus nematode and