EFFECTS OF RDI ON APPLE TREE (cv. Royal Gala) GROWTH, YIELD AND FRUIT QUALITY IN A HUMID ENVIRONMENT

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To my Beloved Son Kahlil
who fills my life with joy

and In Memory of my Husband.

ABSTRACT

The feasibility of using Regulated Deficit Irrigation in the humid environment of New Zealand was evaluated on trees of apple cv. Royal Gala (*Malus domestica* Borkh.). The study was carried out in a glasshouse experiment and a field experiment. In the glasshouse experiment, it was evaluated the pattern of soil water extraction by the winter mutant of lucerne (*Medicago sativa sensu lato*) ASR13R from a 'synthetic' soil layered in the same way that it occurs in the research orchard, under trickle and sprinkler irrigation. Results indicated that lucerne extracted soil water at a high rate and explored deep areas of soil.

The field experiment was conducted during two consecutive seasons (1987-1989). Lucerne as under tree cover and black polyethylene mulch were compared with conventional herbicide strip to control excess of water in the root zone of the crop that would otherwise promote vegetative growth. These treatments were applied in combination with an irrigation schedule divided into three Phases. In Phase I, water was withheld, in Phase II RDI was compared with full irrigation, and during Phase III which coincided with the rapid fruit growth, all treatments received the full irrigation rate. During the first season, RDI and full irrigation treatments were based on 25% and 100% replacement EPS (evaporation in the planting square) respectively. In the second season, after a 50% of the soil water content in the top 600 mm of soil, between Drainage Upper Limit and the Lower Limit was reached, full irrigation treatments were replenished to the DUL, while RDI treatments received 25% of that amount. Results showed that under the conditions of this study evaluation of crop water requirements based on soil moisture measurements was more reliable than those based on pan evaporation.

The degree of reduction of summer pruning obtained under lucerne X RDI treatment,

reflected levels of soil and plant water deficit similar to those obtained in arid environments. Results confirmed my hypothesis that by using lucerne as under tree cover, a RDI strategy can be used in this environment. In contrast, black plastic mulch appeared to maintain soil moisture rather than prevent its accumulation. Nevertheless, effects were obtained which reflected positively in fruit growth and yield. Similar results were obtained under the control treatment, although it was less effective for in reducing tree vigour. The latter treatment, however, can be implemented in most orchards at no cost and generate important savings.

Apple fruit growth proved to be relatively insensitive to water deficit imposed during early stages of growth, whereas vegetative growth was checked. Restoring full irrigation to coincide with rapid fruit growth stimulated growth of RDI fruits resulting in higher yield under control and plastic X RDI. Lucerne showed higher rates of water use that were not compensated by the irrigation which affected fruit growth and size. Results showed that fruits from RDI treatments were firmer, accumulated higher T.S.S. and had lower bruise susceptibility than fruits from fully irrigated treatments. Fruit quality remained higher after 10 weeks of cool storage.

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