WESTERN CANADA

Potassium Fertigation of High Density Apple Orchards

By Denise Neilsen and Terry L. Roberts

Apple management in semi-arid, irrigated fruit growing regions of southern British Columbia, Canada, is undergoing rapid changes. Growers are replacing traditional low density orchards with high density systems containing 325 to more than 700 trees per acre. These high density orchards utilize new cultivars, dwarfing root stock and high frequency drip irrigation to supply water and plant nutrients.

Fertilizer application with drip irrigation is proving to be useful in improving nutrient management in high density orchards.

Fertilization with irrigation (fertigation) makes it easy to match nutrient application with plant growth. Small, frequent applications of fertilizer can be timed to the growth requirements of the trees. This is particularly important for high density plantings which must maximize early growth and yield. Fertigation provides greater flexibility in nutrient management, but it is not without some problems. High frequency drip irrigation concentrates root development in small volumes of soil beneath the irrigation emitter. Rapid acidification of this restricted soil volume has been observed due to the use of ammonium based fertilizers. The decline in pH affects nutrient availability and is causing growers to pay attention to nutrients for which they have not always been concerned, especially in the coarse textured soils typical of the region.

Acidification of the restricted soil volume near the soil surface and beneath

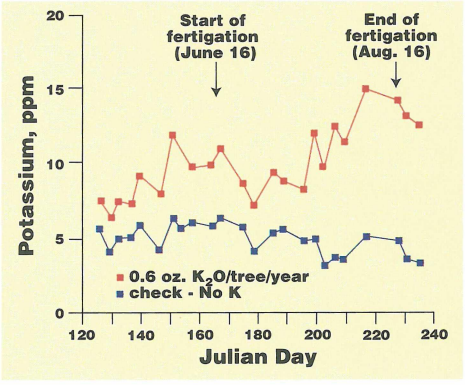

Figure 1. Soil solution K increases in response to K fertigation in a high density apple orchard in southern British Columbia.

HIGH DENSITY apple orchard with dwarf rootstock showing a drip irrigation system in southern British Columbia, Canada.

irrigation emitters is accompanied by leaching losses of plant nutrients. Two nutrients that appear to be most affected are potassium (K) and boron (B). A survey of 20 recently planted high density apple orchards in the Okanagan Valley of southern British Columbia showed that soil K beneath irrigation emitters was only 42 percent of K levels in the alley ways, and B was only 20 percent of that found in the alley ways. The reduced nutrient concentration in the root zone was reflected in lower leaf tissue concentrations and is causing nutritional problems in the apples. These orchards, most of which were only 2 to 5 years old, typically receive daily irrigation and multiple applications of nitrogen (N) and phosphorus (P) ... 0.35 to 1.4 oz. per tree ... in the first half of the growing season.

Such rapid changes in nutrient availability are causing researchers and growers to investigate methods of minimizing acidification and leaching losses and evaluate fertigation of additional nutrients.

Potassium is of particular interest because incidence of K deficiency in the Pacific Northwest region of North America has not previously been reported. Research conducted at Agriculture and Agri-Food Canada's Summerland Research Station is demonstrating that K deficiency in high density orchards can be alleviated. The graph in **Figure 1** shows how soil solution K levels below irrigation emitters can be increased and maintained through fertigation of 0.6 oz. K_2O per tree per year. In addition to increased availability of soil K, fertigation has also increased leaf K concentrations and fruit mineral content.

The positive influence of applied K on fruit yield is illustrated in **Table 1** with data from 3-year and 4-year-old apple trees. Potassium fertigation increased fruit yield by 12 percent in the younger trees and 20 percent in the older trees. Average fruit weight was increased 5 to 6 percent. Fruit quality was also improved and maturity hastened by K fertilization.

Results from these and other studies demonstrate the value in fertigating N, P and K in high density orchards. Nutritional problems developing with other nutrients will require further attention, but fertilizer application with drip irrigation is proving to be a valuable tool in nutrient management. BC

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TABLE 1. Potassium fertigation affects fruit yield of 3- and 4-year-old apple trees on dwarf rootstock.

K_2O Rate oz./tree/year	3-year-old trees		4-year-old trees	
	Yield, lb/tree	Mean fruit weight, oz.	Yield, lb/tree	Mean fruit weight, oz.
0	7.5	7.4	9.9	6.3
0.6	8.4	7.8	11.9	6.7