

KAFFKA, STEPHEN R., University of California - Davis, Department of Plant Sciences, One Shields Avenue, Mail Stop 1, Davis, CA 95616. **Fertilizer N effects on yield and root quality for high-yielding, fall-planted sugarbeets in the Imperial Valley.**

The highest average sugarbeet yields in the world are achieved in the Imperial Valley (IV) in California, an irrigated dessert region. Three trials were carried out over the 2004-08 period to evaluate optimal fertilizer levels for both gross and recoverable sugar yields. N fertilizer rates ranging from 0 to 290 lb/ac were compared. Beets were harvested three or four times from April to July and fresh weight and dry matter accumulation and root and sugar yields. Plant N uptake was evaluated at each harvest. Fertilizer responses were similar in all three years with highest root and gross sugar yields achieved at approximately 220 lb N ac⁻¹ in both June and July harvests (65 t ac⁻¹ /22,000 lb ac⁻¹). Fertilizer optima were lower for April and May harvests, respectively. Current sugarbeet varieties did not require greatly increased amounts of N fertilizer to achieve root and gross sugar yield levels nearly three times as great as those achieved in the 1950's at approximately similar N levels. We surmise that irrigation rates and primary tillage practices have not changed greatly over that time period, so current yields represent a significant improvement in efficiency over the last 50 years. Recoverable sugar yields were greatest at slightly lower rates, based on the use of the Carruthers formula. Between the second and third trials, a purity index was introduced, and crown removal emphasized by the industry. To address these changes, detailed analyses of whole root and crown quality were carried out as part of the third trial (2007-08) in this series, and economic returns calculated for different levels of crown removal. The crown fraction increased on average as a % of total root FW during the April to late June period from 11.9 to 12.9 to 13.7 %. Sucrose concentration differences in crown portions compared to whole roots were 5.0, 4.6 and 3.6 % lower and purity differences were 2.3 to 4.4 to 5.6 % lower over the three successive harvests. Despite these differences, economic returns were improved by crown removal only in the earliest harvest (mid-April). At mid May and late June harvests, conventional topping was more profitable than more severe crown removal calculated using the purity based formula established for the IV. Complete crown removal resulted in losses greater than \$150/ac at optimal fertilizer rates, but losses were lower at higher fertilizer N rates.