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SUMMARY OF 2008-09 LARGE SCALE IRRIGATION AND NITROGEN FERTILIZER MANAGEMENT TRIALS IN LETTUCE

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In 2008 and 2009 five large scale trials were conducted to demonstrate practices to improve irrigation and nitrogen fertilizer management in romaine and iceberg lettuce in the Salinas Valley. Managements included 1) scheduling irrigations based on weather and soil based information, and 2) using the nitrate quick test to match fertilizer rates with the nitrogen needs of the crop at different growth stages. These practices can improve the efficiency of water and fertilizer application, reduce losses and provide tools for optimizing yield and quality of lettuce. The combined nitrogen and water management practices were referred to as the BMP (best management practices).

Procedures Trials were designed to compare the BMP and standard grower practices on large replicated strips in commercial fields located in the northern and southern parts of the Salinas Valley (Table 1). The management strips were 160 feet wide by the length of the field. Trials ranged from 15 to 27 acres in size. Soil textures ranged from silty clay to sandy loam at the trial sites. Trial No. 1 was irrigated with overhead sprinklers throughout the crop cycle; all other crops were irrigated with sprinklers for approximately the first 30 days of the crop followed by surface placed drip tape until harvest. Irrigations were scheduled from estimated consumptive water use for lettuce which was based on CIMIS evapotranspiration data and the water holding capacity of the soil. Applied water of the different management treatments was monitored using flow meters. Nitrogen fertilizer recommendations were based on weekly determinations of soil nitrate in the top foot of soil using the nitrate quick test. Soil moisture data and plant biomass was compared weekly between management treatments. Leachate during irrigation events was sampled using a suction lysimeter. Yields evaluations of trials were made in two ways: 1) small plots (two 100 ft^2 13.3 ft plots) located within the management strips for all trials, and 2) cored lettuce using commercial equipment to harvest the center 12 beds of the management strips.

Summary of Results

Water and nitrogen fertilizer application was significantly reduced in the BMP treatment (Tables 2 and 3), averaging 121 lbs of N/acre and 11.2 inches of water for the BMP treatment and 176 lbs of N/acre and 13.7 inches of water in the grower standard treatment for all trial sites. The greatest reductions in nitrogen fertilizer and water were in Trial 1 and Trial 3, and 139 lbs of N/acre and 7.5 inches, respectively. Trial 2 had the least reduction in water and fertilizer because the grower standard practice was similar to the BMP treatment.

Monetary savings for applied fertilizer and water (Tables 2 & 3) were highest in Trial 1 site ($99/acre) and least for Trial 2 ($15/acre). Average savings in water and fertilizer for the 5 trials was $41/acre. Although average water savings were less than fertilizer savings ($9/acre for water and $33/acre for nitrogen fertilizer), careful water management is needed to prevent nitrogen fertilizer losses through leaching.

Evaluating root distribution and nitrate distribution by digging a pit down to 2.5 feet indicated that most roots were in the top foot of soil, but that most nitrate was lower in the profile (Figures 1 & 2). Monitoring of water use, soil moisture and nitrate concentration of leachate demonstrated that nitrate nitrogen leached below the 2 foot depth in both treatments. Nitrate-nitrogen concentrations in leachate sampled with a

Summary *(continued)*

suction lysimeter ranged from 105 to 178 ppm (Tables 4 & 5). During germination, there was less nitrate leached in the BMP treatment at one site where the germination water was carefully managed (Table 4), but the magnitude of savings were less at another site where more water applied to the BMP treatment during germination to compensate for hot weather conditions (Figure 3). However, after thinning and the installation of the drip system minimal losses of nitrate occurred in both the BMP and standard treatments because the applied water amounts were close to the crop evapotranspiration requirements. In contrast, following thinning and a sidedress application, higher leaching was observed in the standard treatment during a single sprinkler irrigation application (Table 5) because substantially more water was applied than the crop requirements.

Applying water rates closer to consumptive water use in the BMP treatment minimized nitrate leaching and reduced the economic loss of applied nitrogen to the crop.

Soil nitrate levels were higher in the BMP treatment over the course of the growing season in spite of the lower total nitrogen application. This observation indicates that by applying irrigation water at rates close to consumptive use of the crop, nitrate can be effectively maintained in the root zone and leaching losses can be minimized. This can save growers money (Table 2) and help to safeguard water quality.

Large scale commercial yield evaluations in four of the trials indicated that the BMP treatment yielded from 98 to 101% of the standard treatment (Table 6).

Conclusions

These trials demonstrated that careful water management and nitrogen fertilizer management can result in equivalent yields, save money and provide water quality benefits. In addition, reducing nitrate leaching could minimize nitrogen loading to our regional aquifer. The main tool for improving irrigation scheduling for lettuce is using CIMIS evapotranspiration data and soil water holding properties to estimate a reasonable irrigation schedule that will maintain yields and minimize percolation of nitrate. The nitrate quick test can provide guidance for management of fertilizer nitrogen. Taken together these techniques can provide growers with tools to help make decisions to improve the efficiency of lettuce production.