

Title: DEVELOPMENT AND DEMONSTRATION OF NITROGEN BEST MANAGEMENT PRACTICES (BMP'S) FOR SWEET CORN IN THE LOW DESERT.

CDFA contract number: 98-0320

Project Leaders:

Jose L. Aguiar, UC Cooperative Extension Riverside County, Indio, CA

Keith Mayberry, UC Cooperative Extension Imperial County, Holtville, CA92250

Marita Cantwell-de-trejo, Department of Vegetable Crops University of California, Davis, CA 95616

Charles A. Sanchez, Yuma Agricultural Center, University of Arizona, 6425 W. 8th Street, Yuma, Arizona 85364

Cooperators:

Jeff Percy, Ocean Mist Farms, Coachella, CA

Joe Manion, Brett Manion, Precision Land Leveling & Farming, Indio, CA

Eric McGee, Western Farm Service, Madera, CA

Xunli Nie, Mann Laboratory University of California, Davis, CA

B. STATEMENT OF OBJECTIVES

The objective of these experiments were (1) evaluate and demonstrate efficient nitrogen fertilizer practices for sweet corn (2) develop and demonstrate diagnostic tools for N management of desert-grown sweet corn and (3) evaluate the effects of N management on post-harvest quality of sweet corn.

C. EXECUTIVE SUMMARY

Sweet corn is an important crop produced during the fall and spring period in the low desert of the southwestern United States. Large amounts of N fertilizer are typically used to produce high quality sweet corn. Rates of N applied to sweet corn often exceed 300 kg N/ha. Concern about nitrate contamination of ground and surface water from N fertilizer has prompted us to seek improved N management strategies for crop production systems in the desert. The objective of this project was to identify and demonstrate N best management practices (BMP's) for sweet corn.

In 1999, 2000, 2001, and 2002 we initiated studies aimed at evaluating several diagnostic tools for efficient N management of sweet corn. Diagnostic tools evaluated included a traditional stalk nitrate-N test, a traditional laboratory soil nitrate-N test, and a quick soil test. Studies were conducted in grower-cooperator fields throughout the Coachella Valley. These studies were designed to test the response of sweet corn to sidedress N fertilization and evaluate the effectiveness of various diagnostic plant and soil tests as predictive tools.

On most experiments stalk nitrate-N concentrations and soil nitrate-N values were above critical values. Furthermore there were few positive responses to N fertilizer. In fact, in a couple of experiments yields were decreased at the highest N rates. Sweet corn is grown in rotation with winter produce that received large N fertilizer applications. Overall these data indicate the sweet corn produced in rotation with winter produce will require little or no additional N for optimal crop production

Overall, a lack of yield response to N limited our ability to evaluate diagnostic tools. Nevertheless, based on soil tests from the sites where no response was observed and on soil tests where the one positive response to N fertilizer we observed, we believe the soil nitrate-N tests are viable tools for managing N for desert sweet corn production. A positive yield response was only observed when soil nitrate-N levels were less than 25 ppm. Because basal stalks are seldom available the first sidedress and because they generally produced variable results at subsequent sample times, we do not recommend the stalks nitrate-N as a basis for making sidedress N fertilization decisions.

Overall, there were few meaningful consistent differences in the post-harvest quality of sweet corn to N fertilization. In the one study where N fertilization substantially improved yields the ears from low N plots had higher solids and sugar probably reflective of lower maturity.

D. WORK DESCRIPTION (Tasks 1.1, 1.2, 1.4, 1.5, 2.1, 2.4, 2.5, 2.6)

All experiment-demonstrations were conducted in grower-cooperator fields in the Coachella valley from 1999 to 2002. These experiments are listed in Table 1. Details of these experiments have been provided in previous reports. Briefly, in all experiments sweet corn was seeded to stand in single row beds. Individual plots were 65 m² (15.24 x 4.26 m) in size. All pest control and cultural operations were performed using standard practices. All stands were established by sprinkler irrigation. After stand establishment, water was applied by furrow irrigation.

The experimental design always included plots that both did and did not receive sidedress N fertilization. In some instances the grower typically applied three sidedress N applications and the experiment consisted of the following 8 treatments in a 2³ factorial design.

- | | |
|--------------------------|---------------------------------------|
| 1. No sidedress N | 5. First and second sidedress |
| 2. First sidedress only | 6. First and third sidedress |
| 3. Second sidedress only | 7. Second and third sidedress |
| 4. Third sidedress only | 8. First, second, and third sidedress |

In other instances growers only apply two sidedress fertilizer applications and these

experiments consisted of the following 2² factorial design.

- | | |
|---------------------------------|-------------------------------|
| 1. No sidedress N fertilization | 3. Second sidedress only |
| 2. First sidedress only | 4. First and second sidedress |

In all instances experiments consisted of randomized complete block designs with two to four replications. Rates of N used in each sidedress application were those actually used by cooperating growers and ranged from 70 to 200 kg N/ha (Table 2)

Our intention was to collect stalk and soil samples prior to each sidedress fertilizer N application to test diagnostic accuracy. However, in most cases the first sidedress occurred when the corn was too young for a first stalk sample (Table 3). However, we continued to collect stalk samples for the second sidedress in most experiments. Basal stalks were dried, ground, and nitrate-N was determined using methods described in previous reports.

During the first year soil samples were initially split into two subsets (A and B) of samples. For subset A, nitrate-N in field moist samples were determined using a quick test described in a previous report. For subset B, nitrate-N was determined using a standard laboratory procedure described previously. Based on the observation that both tests gave similar results, we relied solely on the quick test in subsequent years.

E. RESULTS, DISCUSSION AND CONCLUSIONS

An extensive body of tables and figures containing details of these experiments were presented in the 2000, 2001, 2002 reports and those tables and figures are not reproduced here. Because there is no additional data since our last report this report will only briefly summarize results and draw final conclusions.

Out of a total of 10 field experiments we observed growth increases in only two experiments and a yield increase in only one experiment. Interestingly, all sites except one where we observed a yield increase had pre-sidedress soil nitrate-N levels exceeding 25 ppm. There was only one experiment where a yield increase was observed. Sweet corn is grown in rotation with winter produce that received large N fertilizer applications. Apparently large amounts of residual N remain in these soils after winter produce is harvested. Overall these data indicate the sweet corn produced in rotation with winter produce will require little or no additional N for optimal crop production

The post-harvest quality data did occasionally show small differences in physical and chemical quality of sweet corn with N fertilization. However, the differences were generally inconsistent across experiments and small in magnitude. In the one study where N fertilization substantially improved yields the ears from low N plots had higher solids and sugar probably reflective of lower maturity. Overall, we conclude that the minor differences observed in post harvest quality to N fertilization are of minimal practical importance.

F. PROJECT EVALUATION

The costs of technologies proposed in this project are very minimal. However, so are the costs of N fertilizer to the grower. Nevertheless, the costs of soil tests submitted to a commercial laboratory or quick tests conducted by the grower are small compared to the excess N applied in these experiments. For example, the cost of testing three composite samples collected from 20 acres should be less than \$100.0. However, the cost of applying 100 lbs/A to 20 acres is almost 700 dollars.

Overall, a lack of response to N limited our ability to more rigorously evaluate diagnostic tools. We worked exclusively with grower-cooperators to enhance outreach activities. Unfortunately, high residual N is a common problem when conducting N fertilizer experiments in production fields. Perhaps in the future, some experiments should be conducted at University research farms to collect more data under N responsive conditions. Nevertheless, based on the 10 experiments we conducted, we believe the soil nitrate-N tests are viable tools for managing N for desert sweet corn production. Because stalks are seldom available the first sidedress and generally produce more variable results we do not recommend the stalks nitrate-N as a basis for making sidedress N fertilization decisions.

A main outcome of this project was the consistent observation that sweet corn grown in rotation with winter vegetables, which typically also receive large amounts of N fertilizer, requires little, if any, additional N for optimal production. Overall, growers are reluctant to cut N substantially because of anxiety about production and quality. The soil tests proposed in this proposal reduce the risks of cutting fertilization appreciably. We will continue our outreach activities with the objective of reducing wasteful N practices.

OUTREACH ACTIVITIES SUMMARY

Project Summaries:

Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert: New Projects, Fertilizer Research Education Program Conference November 17, 1998.

Irrigation management schemes to minimize losses of pesticides and fertilizers. Coachella Valley Farmers Meeting. July 7, 1999. Jose Aguiar spoke on Nitrogen Management for sweet corn. USDA Service Center.

UCCE Riverside County meeting with Blythe Officials: December 12, 1999. Research updates were presented to local officials. UCCE Office in Blythe.

Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert: Fertilizer Research Education Program Conference November 30, 1999.

Root and Leafy Vegetable Production in China and Best Management Practices for Sweet Corn. Jose Aguiar made the presentation. Coachella Valley Farmers Meeting. June 7, 2000. USDA Service Center.

Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert: Fertilizer Research Education Program Conference November 14, 2000.

Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert: Fertilizer Research Education Program Conference November 14, 2001.

Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert: Fertilizer Research Education Program Conference November 19, 2002.

Central Coast and Southern Region Academic Conference, Poster Presentation. October 23, 24, 2002.

Desert Vegetable Crops Workshop, Yuma, Arizona. Poster presentation. December 7, 2002.

14th Annual Desert Vegetable Crops Workshop, Holtville, California. Presentation. Development and Demonstration of N Best Management Practices for Sweet Corn in the Low Desert. December 2, 2003.