ACID AMENDMENT BENEFITS IN COTTON PRODUCTION THROUGH THE USE OF PREPLANT APPLICATION OF ACID FERTILIZERS

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Abstract

Yield response of Pima S7 and Phytogen 57 were improved during 1999 and 2000 with pre-plant applications of N-phuric 15-49-0 and Phosphoric 7-26-0-7. The economic yield response was improved because of the improved timing, placement, and increased nutrient availability due to the acidified root zone during early season stand establishment and fruit set. The pre-plant applications improved the calcium and phosphorus availability by lowering pH in the root zone. No negative affect was seen on impending nitrate conversion and nitrogen availability from the NH^3 sidedress.

Introduction

Cotton growers in the Tulare lake bottom of Kern County have historically known that the high pH Calcareous soil has fixed a large amount of applied and available phosphorus to the growing crop. Growers have known that by applying soil sulfur and lowering the soil pH that phosphorus nutrient availability and uptake were improved. The challenge is the timing and placement requirements of the sulfur and phosphorous applications compared to the nutrient demand. The advent of the acidic N-phuric material overwhelmingly improves timing control and the volume of soil acidified with applications taking place during the fall historically. During 1999, spring stand establishment was less than optimal. The overwhelming yield response is indicative of the poor germination and disease components of 1999. In contrast, spring of 2000 was much more agreeable to good spring conditions. The 2000 yield trial data indicates that the trials variability was less impressive than 1999.

Materials and Methods

These trials were conducted at Boswell Corcoran Ranch in Corcoran, CA in 1999 and 2000. A randomized design was used with two and four replications in 1999 and 2000 respectively. Treatments for 1999 consisted of N-phuric 15/49 at 21.60 gal./acre, Phosphoric Acid at 14.29 gal./acre, N-phuric at 31.55 ga./acre, and a control that received no treatment at the time of application on Dec. 15th. Treatments for 2000 consisted of Phosphuric at 30.0 gal./acre, N-phuric 15/49 at 30.0 gal./acre, Phosphoric Acid at 20 gal./acre, and a control that received no treatments at the time of application on February 20th. The materials for both years were applied 8 to 12 inches from the center of the bed and 6 inches deep.

Plots for both 1999 and 2000 were 2,520 feet in length and 30 rows wide with 30 inch beds. Pima S7 was grown in 1999 and Phytogen 57 was grown in 2000. The crop was planted April 15th in 1999, and March 27th in 2000 with plant populations of 30k/acre in 1999, and 42k/acre in 2000. All treatments were managed for optimal growth and harvest potential.

Soil samples in 1999 were taken on March 23rd and September 9th. In 2000, samples were taken on May 31st. The soils were sampled on the center of the bed, 7.5 inches from the center and 15 inches from the center (bottom of furrow). Samples were taken from the surface down to a depth of 30 inches. Soil samples were analyzed for NO^3-N, NH^4-N, pH, P, and Ca. Petioles were sampled and plants were mapped on June 22nd and July 15th in 1999. In 2000, plants were mapped on May 31st and on July 13th. Petioles were also sampled on July 13th. Petioles were analyzed for N, P, K, and Ca.

Each plot was machine harvested and weighed in a bollbuggy.

Results and Discussion

The effect of acid fertilizers on soil pH was seen in both 1999 and 2000, figures 1 and 2. Soil nitrate levels were higher throughout much of the sampling profile in 1999 and 2000, figures 3 and 4, respectively.

It has been difficult to economically justify adequate amounts of 11-52-0 to warrant a yield response of cotton on these highly Calcareous Tulare lake bottom soils.

During 1999 and 2000, acidic phosphate materials were documented to economically impact the yield potential during both years. 1999 showed an average yield response of 200 pounds per acre of Pima yield (approximately $150 net per acre). During 2000, approximately 60 pounds of lint yield was realized (approximately $20.00 per acre). In 1999, the highest treatment yielded 227 lbs. lint/acre over the control, and in 2000, 65 lbs. lint/acre over the control, table 1.

The trend for increased yield response seems to be dependent upon the ability to acidify the root zone during early development, and maintain adequate phosphorus and Calcium nutrient uptake during fruit set and boll development.

It was noticed that the acidifying affect of the root zone had no detrimental effect on nitrogen conversion of the applied NH^3 side dress in May. Equally important is that no appreciable increased leaching of nitrate nitrogen was observed.

Some of the yield increase may have been linked to the early root development, increased phosphorus uptake and increased disease resistance. These aspects of the research will be evaluated in future studies.

Table 1. Yield (pounds of Lint / Acre).

1999	
A. Control	839
B. N-phuric 15/49 22 gal./acre	973
C. Phos Acid 14 gal./acre	1075
D. N-phuric 31 gal./acre	1066
2000	
A. Phosphuric 30 gals./acre	968
B. N-phuric 15/49 30 gal./acre	961
C. Phosphoric Acid 20 gal./acre	941
D. Control	903

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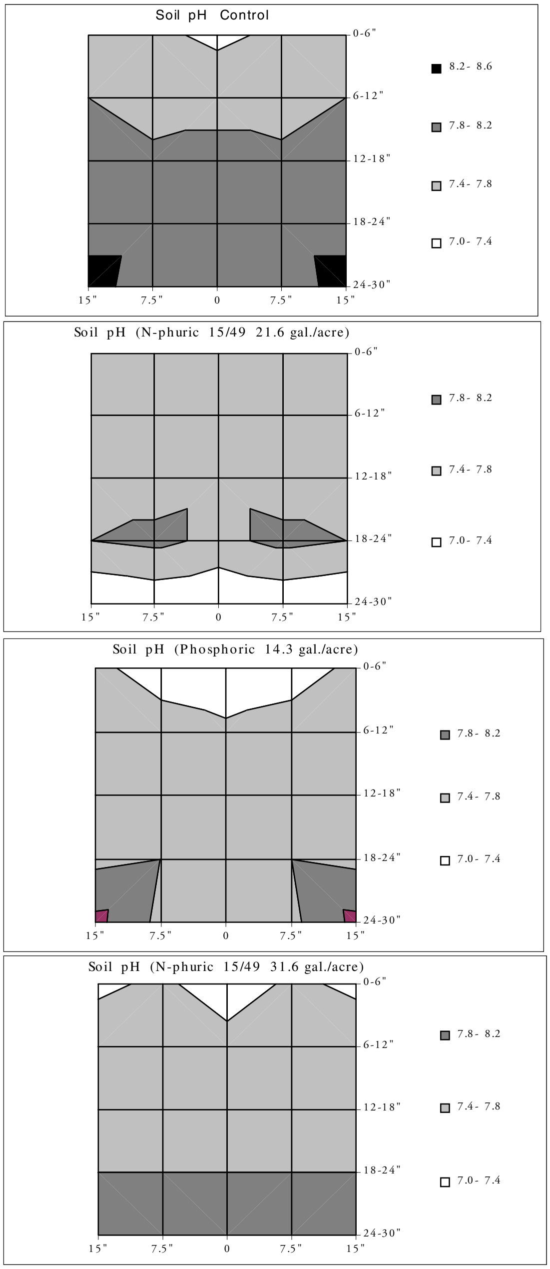

Figure 1. Soil pH on March 23, 1999.

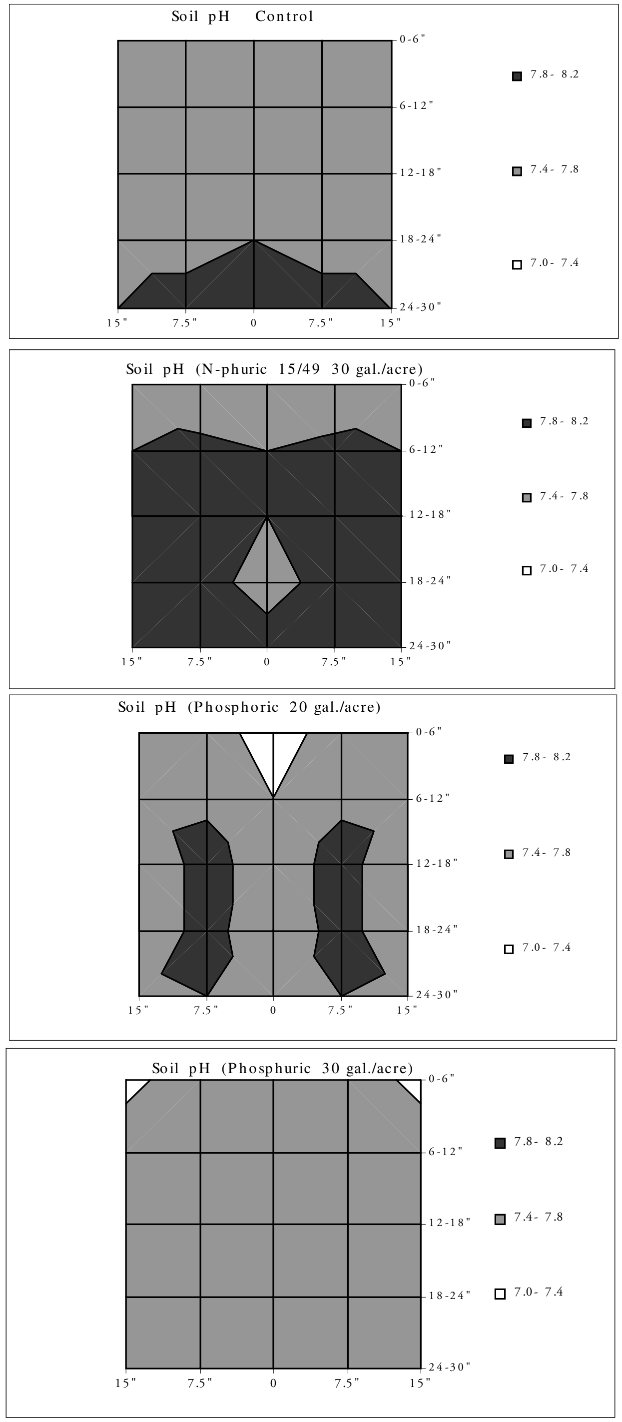

Figure 2. Soil pH on May 31, 2000.

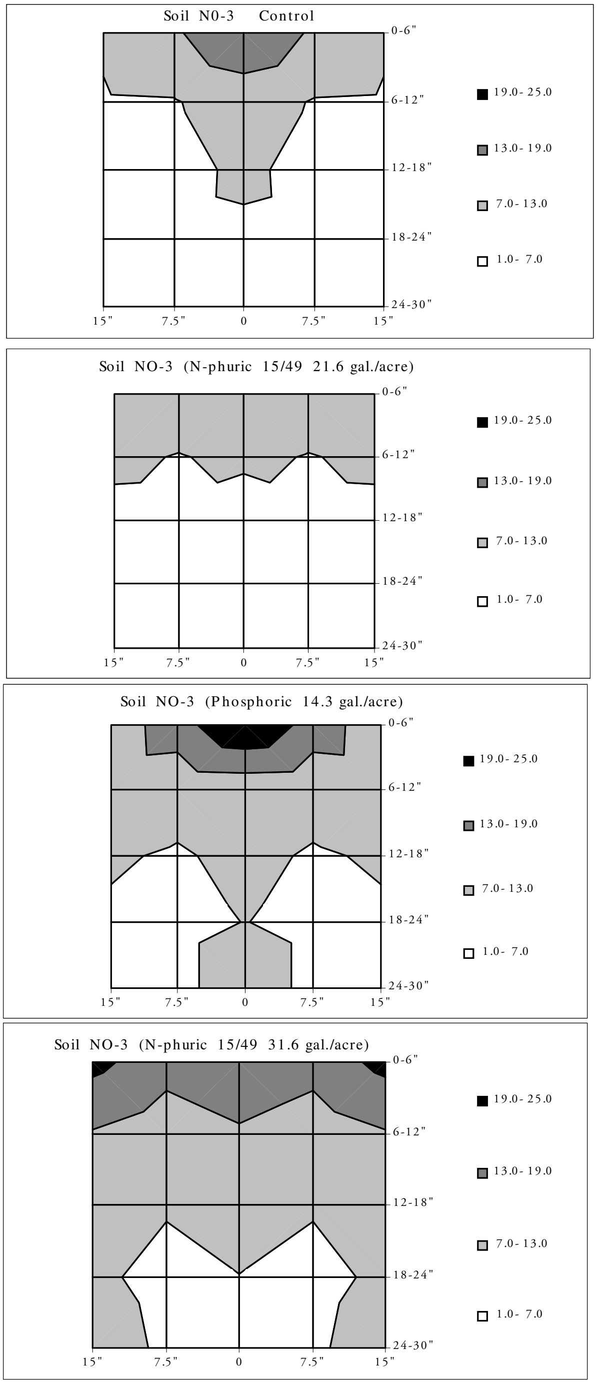

Figure 3. Soil N0^3 on March 23, 1999.

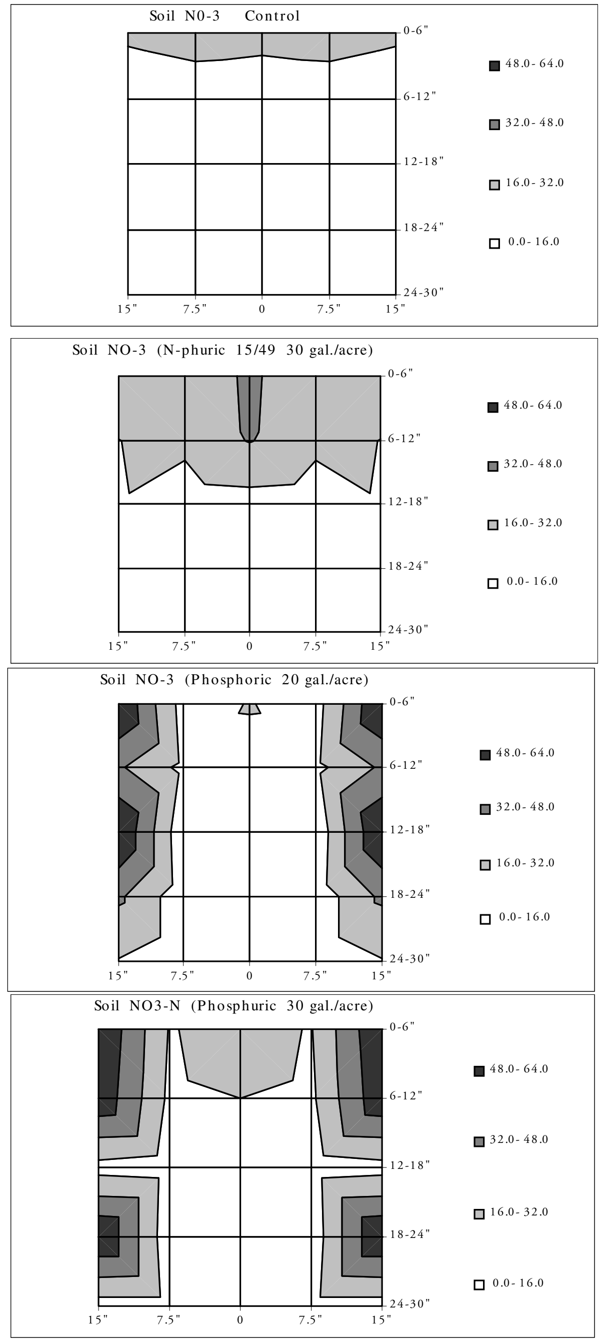

Figure 4. Soil N0^3 on May 31, 2000.