Argentina

Effects of Phosphorus Placement for Corn with and without Irrigation

By Hugo Fontanetto and Nestor Darwich

Research in Buenos Aires Province found that corn yield differences due to placement methods were associated with P concentrations in the plant and number of kernels per ear.

SOILS in southeast Buenos Aires Province have a generalized deficiency of available phosphorus (P). Responses to P applications have been variable. Nevertheless, it is well known that the efficiency of P fertilizers depends on the method of application (placement) as well as the level of soil P availability.

A field experiment was conducted in the EEA Balcarce-INTA during the 1987-88 season to determine the effects of different methods of P placement to the soil under two water regimes. The absorption of P by corn plants and its influence on grain yield were evaluated.

A single cross hybrid (SPS 240) was planted at a density of 80,000 plants/ha on a clay loam soil (Typic Arguidoll) with 9.5 parts per million (ppm) of available P.

Four P treatments and two water regimes were arranged in an experimental design which allows direct comparisons. The main plot treatments were: without irrigation (SR) and with irrigation (CR), to maintain 60 percent of field capacity.

Subplots with the different methods of P application were: 1) control . . . no P added, 2) P added beside the seed, 3) P applied in narrow bands (5 cm) at a depth of 20 cm and 4) P applied in wide bands (35 cm) at a depth of 20 cm. The P (P_2O_5) rate applied was 47 kg/ha.

The availability of soil P at two times of the growing season (planting and R1:silking) in the subplots under the different treatments are shown in **Figure 1**. Irrigation did not change the availability of soil P.

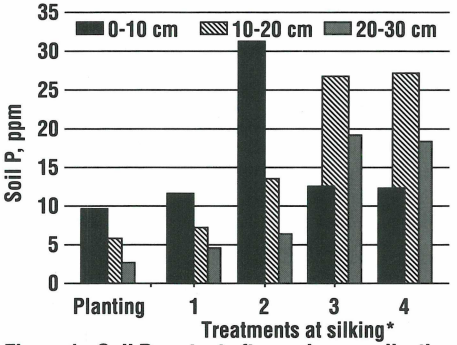

Figure 1. Soil P content after various application methods. (Argentina)

***1 = Control (No P), 2 = P beside the seed, 3 = P in narrow bands and 4 = P in wide bands.**

Figure 1 also shows that the lowest levels of available P occurred during the season when no P was applied. Application beside the seed resulted in the highest available P levels in the top 10 cm of soil. Between this depth and 30 cm, the highest contents were found with deep applications.

These results show that the different methods of P placement are effective in raising soil P levels according to the zone of application, and that the movement of P is limited since it stayed in the incorporation areas. Phosphorus distribution in the top 15 cm of profile remained uniform after several annual applications.

Grain yield was significantly affected by the different methods of P placement

Mr. Fontanetto is with the National Institute of Agricultural Technology (INTA), Agricultural Experiment Station (EEA), Rafaela, cc. 2300, Rafaela, Argentina. Dr. Darwich is with INTA, Unidad Integrada Balcarce, c.c. 276, 7620, Balcarce, Argentina.

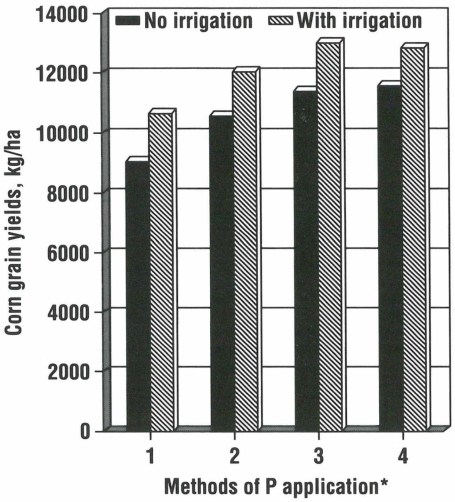

Figure 2. Corn grain yields, with and without irrigation and P addition. (Argentina)

***1 = Control (No P), 2 = P beside the seed, 3 = P in narrow bands and 4 = P in wide bands.**

and by supplemental irrigation, but no significant interaction was found amongst them. Irrigation produced higher yields than without irrigation (12,190 vs. 10,700 kg/ha). Yield was highest when P was banded in either wide or narrow bands (**Figure 2**).

Yield differences due to placement methods were associated with P concentrations in the plant and number of kernels per ear.

Conclusion

This study clearly shows that the method and depth of P incorporation affected fertilizer use efficiency and that the best yields occurred with greater distribution of P applied in the top 30 cm of the soil profile. This better distribution allowed a higher absorption of P, higher P contents in the plant, improved crop growth and higher grain yields.

Supplemental irrigation resulted in even better P absorption by the corn plants, causing higher grain yields than in plots without irrigation.

Neither soil P nor moisture deficiencies were severe enough to trigger a positive interaction between P placement and supplemental irrigation.

Under the conditions of southeast Buenos Aires Province, it is possible to obtain yield responses with deeper P applications, in soils with moderate contents of available P and in years with moisture deficits, especially in the months of January and February. ■

(Potassium Depletion . . . from page 25)

of fertilizer K per unit increase in available K before K depletion. After K depletion, the requirement rose to 2.5 to 3 units. The previously K depleted (Palam) soil required 3.85 units, even before K depletion and 5.26 with K depletion. Therefore, if present-day imbalanced fertilizer consumption continues . . . without K or with little K fertilizer . . . a situation will arise where there will be a need to increase K fertilizer rates by five to six times over recommended rates to obtain optimum soil K levels.

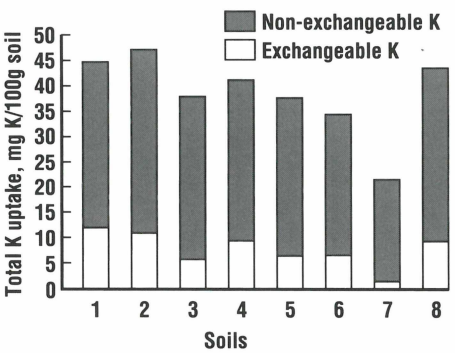

Figure 1. Relative contribution of K sources in eight soils toward K removals by seven cuts of sudan grass.

Conclusion

Our study clearly demonstrates the negative consequences of depleting soil K with intensive cropping without adequate K fertilization. Until potash prices stabilize in India, a majority of farmers will not purchase K fertilizers to feed K-starved soils. Depletion of soil K represents a deterioration of soil fertility and a loss in productivity. Infertile soils cannot support good crops and fulfill agricultural production targets which are being set by planners in order to feed the increasing population of India. ■