

## Phosphorus and Potassium Interactions in Acid Soils of the Eastern Plains of Colombia

By Luis A. León

Researchers are investigating the response of several maize varieties to phosphorus (P) and potassium (K) on an acid soil in the Eastern Plains of Colombia.

Most of the acid soils of the Eastern Plains of Colombia and the tropical lowlands of Brazil, Ecuador, Peru, Bolivia, and Venezuela are high in exchangeable aluminum (Al). Aluminum saturation is often higher than 80 percent in these soils. High amounts of calcite or dolomite limestone are required to reduce the Al saturation to less than 20 percent.

Phosphorus and K availabilities in these soils are generally very low. High rates of P and K are needed to obtain good maize yields, but in the case of the poorly developed Eastern Plains this could be logistically very expensive. If the farmers of the lowland tropics can use varieties resistant to acid soil, they could use less amendments, making P and K fertilizers comparable to those required when using varieties not resistant to acid soil.

The International Maize and Wheat Improvement Center (CIMMYT) has been studying the tolerance of maize to acidic soil conditions. However, it's unlikely that all maize varieties tolerant of soil acidity respond equally to P and K fertilization.

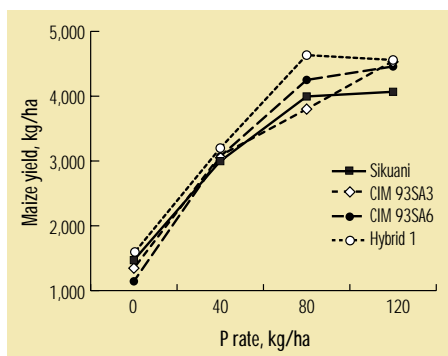


Figure 1. Yield response of four maize genotypes to different P rates (averaged over K rates) on an acid soil, Carimagua, Colombia.

### Materials and Methods

A field study was conducted in Carimagua in 1995 to evaluate the response of three maize varieties (ICA Sikuaní V 110, CIMCALI 93 SA3, and SIMCALI 93 SA6) and one hybrid (H1) to four rates of P and K (0, 40, 80, and 120 kg/ha). The study was located on an Oxisol with pH 4.7, 1.8 parts per million (ppm) Bray P-II, 0.04 meq/100g exchangeable K, and 87 percent Al saturation. Aluminum saturation was reduced to 55 percent using 1,034 kg/ha of dolomite limestone that was broadcast and incorporated 30 days before planting. Two applications of 60 kg N/ha were applied to all the plots. The experimental design consisted of a split plot with three replications. Phosphorus rates were

considered main plots, K rates sub-plots, and varieties sub-sub-plots.

## Results and Discussion

The hybrid tended to produce higher yields than the other maize varieties, although yield differences were not significant.

Response to P application was excellent in all four genotypes (Figure 1). Yields increased linearly with increasing P and reached an optimum at the 80 kg/ha rate in three of the four genotypes. The one exception, CIM 93SA3, continued to respond up to the 120 kg P/ha rate, but even at that rate it did not produce more than the hybrid at the 80 kg/ha rate. The optimum P rate for corn production on this acid soil appeared to be 80 kg/ha.

The varieties were not as responsive to applied K as they were to P. However, yield increases did occur at the 40 kg/ha rate in all four varieties and up to 80 kg/ha for CIM 93SA6 and the hybrid (Figure 2).

No responses to K were obtained when P was not applied, but increasing rates of P produced a good response to K application (Figure 3). The highest yields occurred at 120 kg P/ha and 80 kg K/ha. Low native P contents in this type of soil limit root growth and exploration and, therefore, restrict the uptake of other nutrients, particularly K.

Soil analysis following harvest showed P fertilization increased residual soil test P levels, but K application had less effect on exchangeable K (Table 1). Maize has a much higher demand for K than P. At the application rates in this study, little K was left over from the crop to build soil test K levels.

## Conclusion

Our research has shown that maize grown on the acid Oxisols of Colombia is responsive to P and K fertilization. High rates of P and K (80 to 120 kg/ha) are required for optimal production. We also found a strong interaction between P and K. Maize was most responsive to applied K when P was not limiting. At the rates used in this study, sufficient P was applied to optimize yields and

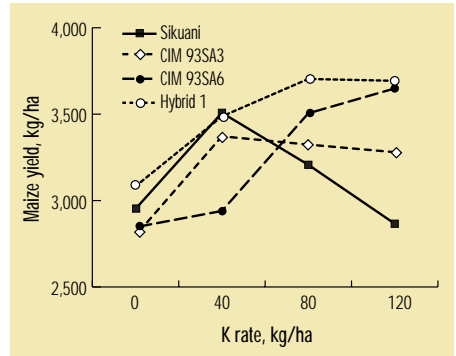


Figure 2. Yield response of four maize genotypes to different K rates (averaged over P rates) on an acid soil, Carimagua, Colombia.

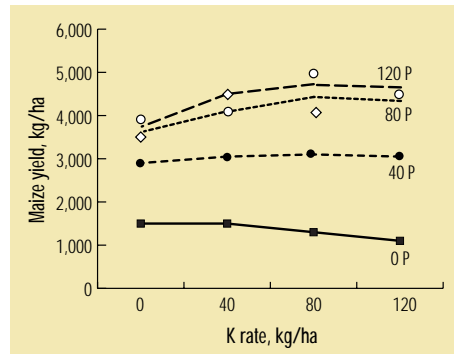


Figure 3. Phosphorus and K interaction in maize grown on an Oxisol, Carimagua, Colombia.

Table 1. Soil test P and K after harvest in response to P and K application on an acid soil, Carimagua, Colombia.

P or K rates, kg/ha	Bray P-II <sup>1</sup> , ppm	Exchangeable K <sup>1</sup> , ppm
0	2.7	0.04
40	7.2	0.06
80	13.1	0.09
120	19.4	0.11

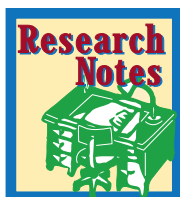
<sup>1</sup>Soil test P and K after harvest, initial soil P test = 1.8 ppm; initial soil K test = 0.04 meq/100g.

build soil test levels, but higher rates of K would be needed to increase soil K fertility. **BCI**

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## **India: Effect of Potassium on Yield and Quality of Potato**

This three-year study was conducted on 10 farmer fields in the Meerut region. The effects of sulfate of potash (SOP) on tuber yield, chip making quality, and post harvest storage were studied. Potato responded significantly to K fertilization. The following results characterize the study.

- Potassium ( $K_2O$ ) application rate of 150 kg/ha produced the highest tuber yields in each of the three years.
- Percent dry matter improved with K application up to 150 kg  $K_2O$ /ha.
- Chip quality was significantly improved in the last two years of the study in response to the application of 225 kg  $K_2O$ /ha.
- Sugar content decreased with K application.
- Potassium did not affect tuber loss two weeks after harvest, but an application rate of 150 kg  $K_2O$ /ha did reduce loss four weeks after harvest, resulting in a higher return when tubers were stored for longer periods.
- Split applications in the first year of the study did not offer any advantage. **BCI**

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