Soybean Responses to Potassium Fertilization in a Low Fertility Oxisol

By C.M. Borkert and T. Yamada

Research on potassium (K) nutrition for soybean is providing guidelines for correcting nutrient deficiencies in low fertility soils of Brazil.

After nitrogen (N), K is the second most absorbed nutrient by soybean. A soybean crop takes up about 81 kg of N and 54 kg of soil K for every 1,000 kg (tonne) of harvested grain, which results in an annual export of 51 kg of N and 14.4 kg of K per tonne of grain (**Table 1**).

Aerial view of the experiment in low fertility soils, Brazil.

Sustained high yielding soybeans are fundamentally achieved by maintaining the best conditions for plant growth and for biological N fixation due to its overwhelming role in soybean production. This means that the soil's nutrient supplying power must be capable of meeting the nutrient demands of both the crop and the rhizobia. Besides K, other nutrients such as sulfur (S) and micronutrients are often deficient. Attention to balanced fertilization ensures the best response to all nutrients applied.

A study on soybean responses to K was conducted over a five-year period by researchers of the Brazilian Agricultural Research Corporation (EMBRAPA) National Soybean Research Center. The experiment was carried out on a dystrophic oxisol (latossolo roxo distrófico) with low overall fertility and a very low level of exchangeable soil K, 0.05 $cmol_c/dm^3$. The treatments were 0, 40, 80, 120, 160, and 200 kg K_2O/ha applied annually.

Table 1. Nutrients absorbed by the growing crop and exported in 1,000 kg of soybeans.

Nutrients	Absorbed	Exported	Exported/absorbed
	kg nutrients/1000 kg soybeans		%
N	81.5	51.0	62.5
P	8.1	6.4	79.0
K	54.5	14.4	26.4
Ca	27.2	2.5	9.2
Mg	9.3	2.5	26.8
S	4.6	2.4	52.2

Source: Flannery (1986, 1989).

Responses to Potassium

Response to K fertilization occurred when exchangeable soil K was below 40 mg K/kg of soil. It was also observed that K application rates greater than 80 kg of K_2O/ha were required to produce top yields and correct the soil K level after five years of experimentation (**Figure 1**).

This study has allowed researchers to define a range of sufficiency for

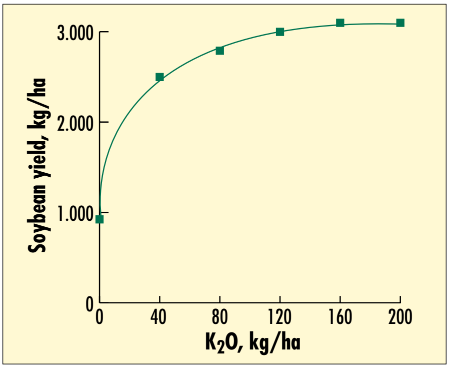

Figure 1. Soybean response to K fertilization in a low fertility oxisol (Borkert et al., 1993a).

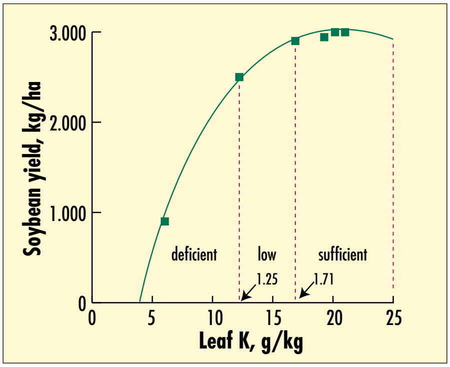

Figure 2. Relationship between leaf K and soybean yield (Borkert et al., 1993b).

leaf K concentration. These results agree with the overall ranges and categories given in previous literature (**Figure 2**).

The effect of K fertilization on seed quality was also evident as seed K concentration increased with higher K rates (**Figure 3**). The recommended threshold for superior seed quality of soybean corresponds to a K content of 12 g K/kg seed, which was achieved by applying more than 80 kg K_2O/ha.

The dystrophic oxisol studied was characterized by low fertility that included a significant K deficiency on soybean. This K deficiency occurs on 85 percent of the soils in 200 million hectares of Brazilian cerrado. High responses to K fertilization were evident when exchangeable K was below 40 mg K/kg of soil. In addition to increasing yield, a large improvement in seed quality was also observed with adequate K fertilization. **BCI**

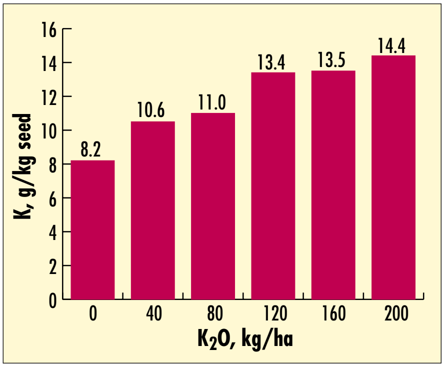

Figure 3. Relationship between K fertilization and K content in soybean seed.

C.M. Borkert is researcher with the Brazilian Agricultural Research Corporation (EMBRAPA), Londrina, Brazil. Dr. Yamada is Director, PPI/PPIC Brazil Program (POTAFOS), Piracicaba, Brazil.

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