Banana Response to Potassium

By Antonio López and José Espinosa

Well-managed banana fields require a good supply of potassium (K) to replace that taken-up from the soil and removed in harvest. Research in Costa Rica continues to test response of banana to different rates and sources of K.

Due to high K accumulation in the fruit and plant tissue, K is considered the most important plant nutrient in banana production. It is the most abundant cation in the cells of the banana plant. Potassium does not play a direct role in the plant's cell structure; however, it is fundamental because it catalyzes important reactions such as respiration, photosynthesis, chlorophyll formation, and water regulation. The role of K in the transport and accumulation of sugars inside the plant is particularly important since these processes allow fruit fill and, therefore, yield accumulation.

Photo 1. Potassium deficiency results in the development of yellow-orange coloration on the tips of the older leaves of banana plants.

Potassium deficiency symptoms in banana are common in less fertile soils. However, typical symptoms are difficult to find in well-managed farms, which can not afford low nutrient supplies at any point in the crop cycle. Classic symptoms of K deficiency are described below.

Chlorosis of the leaves: The most characteristic symptom of plants lacking in K is the yellowing of the tip of the older leaves (Photo 1). As time progresses, leaves curl inward and die soon after (Photo 2).

Bunch deformation: Fruit bunches on K-deficient plants are short, slim and deformed because of poor fruit filling.

Stunted growth: It is common for K-deficient banana plants to exhibit slow growth which results in shortened internodes and a sturdy appearance (Photo 3).

The amount of K taken up from the soil and removed from the field as harvested

Table 1. Nutrient content of different banana soils (Andisols) in Costa Rica.

Site	pH (H_2O)	Al + H	K	Ca	Mg	P	O.M.,
		cmol/kg				mg/kg	%
1	4.89	1.32	0.51	4.4	2.4	13	5.9
2	4.71	1.64	0.73	5.0	3.1	18	5.1
3	4.67	1.64	0.72	3.7	2.0	17	7.3
4	4.85	1.76	0.56	5.6	2.5	4	8.9
5	4.74	1.08	0.35	2.1	1.3	5	6.9
6	4.74	1.08	0.63	3.2	2.1	8	8.6

Photo 2. In later stages of K deficiency, the ends of the leaves turn downward and quickly die.

bunches is very high. Estimated soil losses through fruit removal alone can be 400 kg K/ha/year with a production of 70 tonnes of fruit. For this reason, banana requires a good K supply, even in soils where K levels are considered high.

The importance of K in banana nutrition has created an abundance of research testing the response of banana to various K sources in different production areas throughout the world. Relevant results of Costa Rican research are discussed here.

Results of Banana Response to Different Potassium Sources in Costa Rica

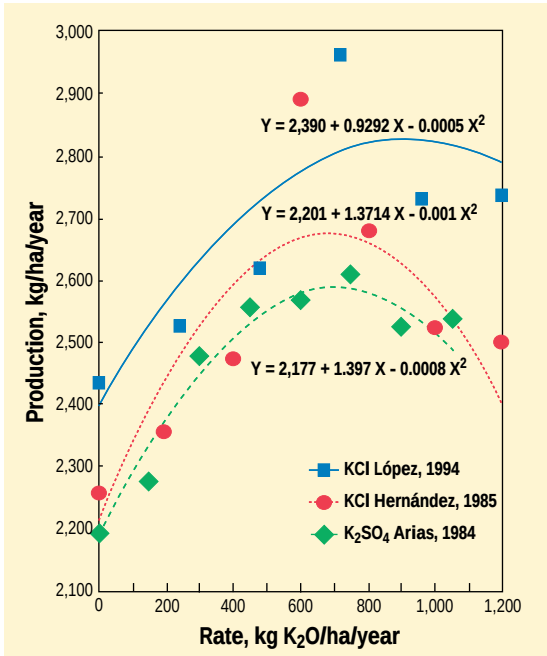

Figure 1. Response to K rates and sources in Costa Rica.

Numerous researchers in Costa Rica have tested the response of banana to different sources and rates of K in several years of field study. This work has defined K fertilizer recommendations used today in Costa Rica and in all banana-producing countries of Central and South America. Soils utilized in these studies were Andisols (volcanic), which are characterized by their relative low fertility (Table 1). Yield responses from past banana experiments on K in Costa Rica are presented in Table 2 and Figure 1.

In all years studied, the best economic responses were obtained with annual K rates ranging from 600 to 675 kg K_2O/ha (Figure 1). Consistent responses to fertilizer K in soils with relatively high K content obviously point to the high K requirement of banana and the large quantities of K being removed from the field. These prescribed levels of fertilizer K produced K concentrations greater than 3.6 percent in foliar tissues, which are considered appropriate for normal crop development. Higher K rates are not advised to avoid induced Mg deficiencies through ion competition.

It is apparent that both sources of K were equally effective in terms of yield response,

Table 2. Yield response to K sources and rates in Costa Rica.

K_2O rate kg/ha	Yield boxes/ha/year*	K_2O rate kg/ha	Yield boxes/ha/year	K_2O rate kg/ha	Yield boxes/ha/year
K_2SO_4, 1984		KCl, 1985		KCl, 1994	
0	2,195	0	2,260	0	2,435
150	2,280	200	2,360	250	2,527
300	2,460	400	2,475	500	2,620
450	2,555	600	2,890	750	2,958
600	2,570	800	2,680	1,000	2,733
750	2,610	1,000	2,530	1,250	2,738
900	2,530	1,200	2,505		
1,050	2,540				

*Exportable banana boxes = 18.14 kg

but from an economic point of view, potassium chloride (KCl) continues to be the most widely used K source in banana production. Concerns have been raised regarding possible negative effects due to the high chloride (Cl) content of KCl (47 percent). However, research conducted in Costa Rica has demonstrated that although KCl application at rates over 1,000 kg K_2O/ha results in high Cl levels in leaf tissue, no negative effects on fruit yield are present.

The main advantage of KCl is the low cost per unit of the nutrient. Other K sources perform well in banana production, but are mainly used to satisfy the plant's need for secondary nutrients such as sulfur (S) or magnesium (Mg). The remaining portion of K required by the plant is subsequently met through application of KCl. BCI

Photo 3. The obstruction of normal leaf development is generally associated with K deficiency. However, this symptom can be due to any other factor that affects normal root development and restricts K uptake.

Ing. López is with Corporacion Bananera Nacional (CORBANA), Costa Rica. Dr. Espinosa is Director, PPI/PPIC Northern Latin America Program (INPOFOS), Quito, Ecuador.

Bibliography

Arias, H. 1984. Respuesta del banano (Musa AAA), subgrupo Cavendish "Gran Enano", a dosis crecientes de sulfato de potasio en un suelo Oxic Dystropepts de Río Jiménez, Provincia de Limón. Tesis Ing. Agr. Universidad de Costa Rica. 89 p.

Hernández, M. 1985. Respuesta del banano clon "Gran Enano", a la fertilización potásica en un suelo Typic Dystropepts de Cariari, Cantón de Pococí. Tesis Ing. Agr. Universidad de Costa Rica. 118 p.

Hernández, E., Casanova, A. y Bracho, G. 1977. Efecto de la fertilización en plátano sobre la comparación de hojas y frutos y sobre el rendimiento. Revista de la Facultad de Agronomía de la Universidad de Zulia, Maracaibo 3(4):49-66.

Lahav, E. 1974. The influence of potassium on the content of macroelements in the banana sucker. Agrochimica 28(1-2):194-203.

López, A. 1991. Fertilización del cultivo de banano con diferentes dosis de nitrógeno, fósforo y potasio. In: Memorias del X ACORBAT, Villahermosa, Tabasco, México. p 65-79.

Banana has a high content of vitamins and minerals, but is known for its high K content of 370 mg/100 g of pulp.