ILLUSTRATED CONCEPTS IN TROPICAL AGRICULTURE
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NITROGEN AND POTASSIUM INTERACT TO SHAPE A YIELD RESPONSE SURFACE

Fig. 1. Aerial view of a block of bananas with 48 mats showing the interaction between N (increasing left to right) and K (increasing bottom to top).

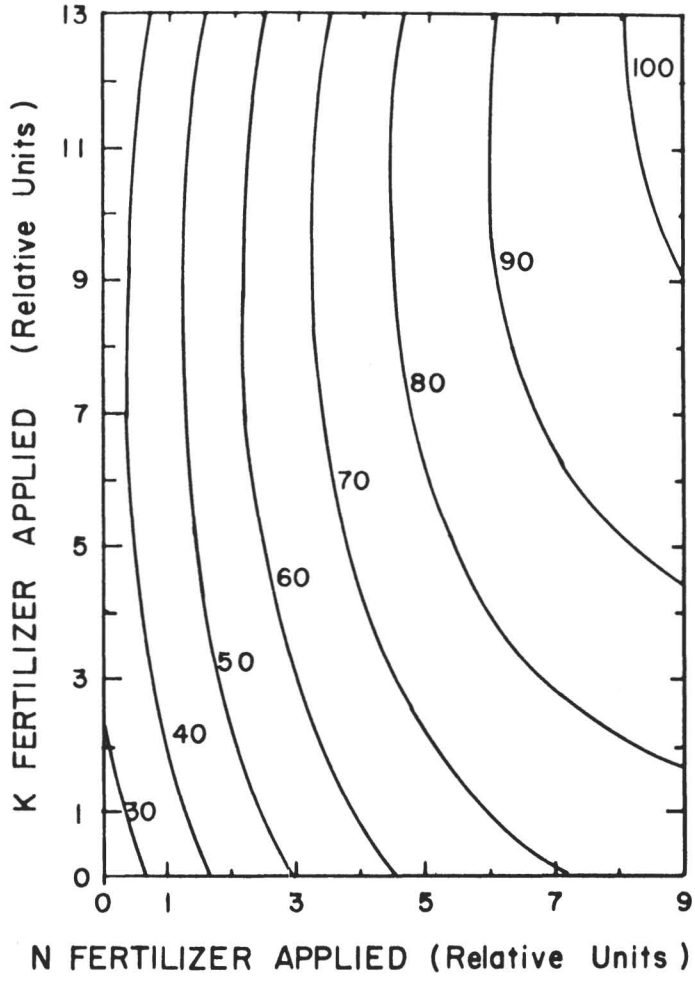

Fig. 2.Contours of mean banana yields as metric tons per hectare per year as influenced by N and K fertilization.

Acceptable yields of many crops, and especially bananas, are associated with the uptake of large quantities of nitrogen (N) and potassium (K). The vegetative tissues are rich in both N and K, and much K is harvested with the bunch. To meet these requirements, heavy fertilization is usually necessary.

When nutrients are supplied in fertilizers, their combined effects may be quite different from the sum of their individual effects. This relationship is commonly called nutrient *interaction.*

One example of interaction is illustrated in Figure 1. Portrayed is an aerial view of one block of a banana experiment at the Waimanalo Agricultural Experiment Station, Oahu, Hawaii. The block of banana plants represented by Figure 1 contained 48 mats; each mat with about 4 plants. The block was a part of a fertilizer experiment designed to demonstrate the interaction between N and K on leaf composition and fruit yield. The light areas are banana plants that show deficiency of N or K or both.

Fertilizer variables were applied systematically in strips across the blocks so that N increased gradually from none to large quantities in one direction, while K increased gradually perpendicular to the N fertilizer. Each mat on the block represented a different combination of N and K in the fertilizer. The fertilizers were reapplied to maintain standard levels of N and K in the leaves of plants from a centrally located control mat. This experimental arrangement is called a *continuous function or continuous variable* design.

The most obvious deficiency (light-colored vegetation) was due to insufficient N. At all levels of K, if N was withheld, N deficiency (as indicated by light green or yellow leaf color in the light areas of the photograph) was severe, but K deficiency was evident only where intermediate or high levels of N were employed in the absence of K fertilizer. Thus the visual expression of K deficiency depended upon the level of N supplied—evidence of the interaction between N and K.

The concept of interaction is illustrated again in Fig. 2, which presents mean yields of bananas as influenced by various combinations of N and K fertilizers. Low yields (30-40 tons per hectare) were very little influenced, if at all, by K levels where N was deficient. But yields of 80 to 100 tons per hectare per year were not attained, regardless of the level of N fertilization, unless K was also added in great quantities.

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