ILLUSTRATED CONCEPTS IN TROPICAL AGRICULTURE

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LOW SOIL TEMPERATURES DEPRESS ROOT ACTIVITY IN THE TROPICS

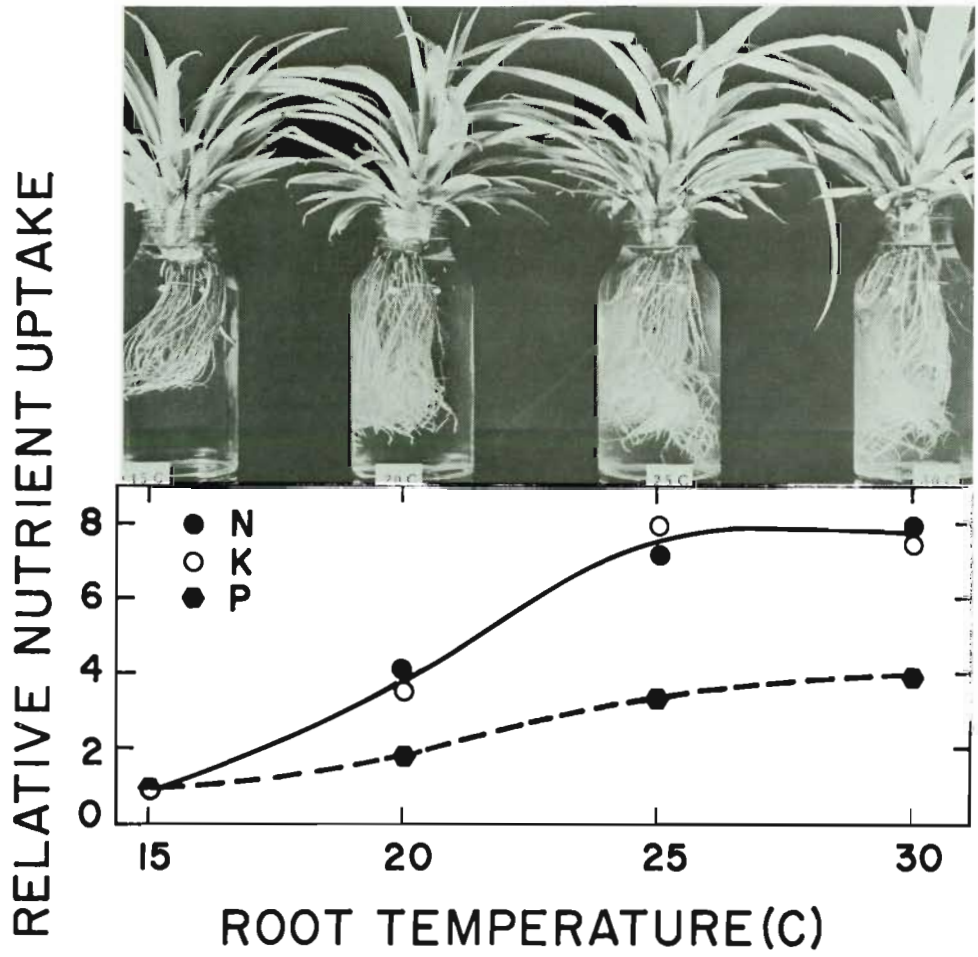

Fig. 1. Influence of root temperature on growth and nutrient uptake by pineapple.

Fig. 2. New planting of pineapple through black plastic mulch. Wahiawa, Oahu, Hawaii.

A common misconception about the tropics is that temperatures are torrid. In summer, in fact, the humid tropics are more temperate than much of the temperate zone. World maps of soil temperature[1] show that in July the 30 C isotherm passes across the southern United States, while mean soil temperature at low elevations near the equator is relatively constant at about 25 C throughout the year. Winter temperatures less than 20 C are not uncommon in many tropical areas.

Crop physiology, especially nutrient absorption, is closely related to soil temperature during growth. For example, in a study of the effects of soil temperature on sugar cane nutrition, Burr and Takahashi[2] report a nearly linear increase of nitrogen in leaves from 1.35% at a temperature of 15.6 C to 1.95% at 32.2 C.

Growth and uptake of nitrogen, phosphorus and potassium by pineapple roots during 40 days as influenced by root temperatures when air temperatures were uncontrolled are illustrated in Figure 1. At 15 C roots became suberized and the crowns lost weight by desiccation; at 25 C nutrient uptake and growth approached a maximum (Table 1).

One method of increasing soil temperature in the root zone is to use black plastic as a mulch as is done in the pineapple fields of Hawaii (Figure 2). The plastic mulch probably has value in several ways, but the effect on soil temperature is well documented. The data of Table 2 were collected in January at Wahiawa, Oahu, Hawaii, by P. C. Ekern.[3] Plant growth was increased one-third by using the black plastic mulch.

Soil temperatures less than 25 C may depress water and nutrient uptake, and, as a result, crop growth may be slowed or even suspended during the cool season in the tropics.

Table 1. Influence of root temperature on growth of pineapple

Root temperature (C)	Final root weight (g)	Top growth (g)
15	13	- 12
20	33	+ 92
25	37	+152
30	39	+191

Table 2. Influence of weather and black plastic mulch on air and soil temperatures

	Temperature (C)		
	Air	Soil (at 7.5 cm depth)	
Weather condition		Uncovered	Covered with black plastic
Cloudy, rainy days	19.3	19.7	20.0
Sunny days	20.6	20.7	23.2

[1]Chang, Jen-hu. 1958. Ground Temperature, Vols. I and II. Blue Hill Meteorological Observatory. Harvard University.

[2]Burr, G. O., and Takahashi, D. 1955. The Hawaiian Planters' Record 55:3-10.

[3]Ekern, P. C. 1967. Soil Science Society of America Proceedings 31: 270-275.