The Influence of Potassium on Crop Quality

What is the effect of K on crop quality? For some crops, improved quality might be more protein or higher forage feeding value for livestock. It could be improved persistence of alfalfa stands or reduced drying cost of corn grain or less dockage for diseased and shriveled soybean seed. For vegetables, it might be greater consumer acceptance. The economic return from the investment in K can originate from: (1) improvement in total yield; (2) a greater percentage of total yield which is marketable; (3) better crop quality; (4) lower cost per unit of production; (5) disease resistance; (6) stress tolerance; and (7) more effective use of other inputs such as nitrogen (N).

Potassium (K) is often described as the "quality nutrient" for crop production. With a shortage of K, photosynthesis, respiration, translocation, and a number of enzyme systems don't function very well. The result can be a reduction of plant growth and, often, of crop quality.

Potassium requirements for top profit production systems is best determined on a crop-by-crop basis. Inadequate K disrupts plant development in different ways. Plant symptoms or growth irregularities signal a shortage of K. Potassium benefits plant growth in the following ways.

Corn

- Earlier silking and longer grain fill
- Uniform maturity and grain moisture
- Improved stalk quality and reduced lodging
- More kernels per ear and better test weight
- Improved N use effectiveness

Soybeans

- Improved seed size
- Fewer shriveled and moldy beans
- Improved oil and protein content
- More and larger nodules for N fixation
- Better tolerance to pests and improved resistance to disease

Wheat

- Improved grain protein
- Better milling and baking qualities
- More efficient use of N
- Improved disease resistance

Forages

- Increased winter hardiness and stand longevity
- Increased protein quantity and quality
- Better N fixation and nodule activity
- Increased legumes in legume-grass swards
- Increased vitamin and mineral content
- Higher total digestible nutrients
- Improved palatability and digestibility of feed to animals

Fiber Crops

Cotton fiber quality is evaluated in terms of length, strength and fineness of the fiber as well as its color and cleanliness. Research studies show that K improves cotton boll size, micronaire, and strength of cotton fibers. Cloth

TABLE 1. Potassium and N increase marketable yield of tomatoes.

K_2O, lb/A	N, lb/A 120	180	240
	tons/A (% marketable)		
0	7.1 (41)	7.5 (56)	9.3 (55)
300	17.6 (80)	20.8 (85)	26.7 (85)

woven from K deficient cotton fiber resulted in an inferior grade of cloth due to unsatisfactory color dying resulting from the nappiness of the fiber.

Vegetables

Irish and sweet potatoes, cabbage, cassava, and other vegetable crops require K for both yield and quality. Where K is limited, tomatoes, potatoes and cabbage often show discoloration of the internal tissue.

Both tomatoes and potatoes respond well to applied K in terms of total yield and percent of that yield meeting strict market standards. Nitrogen and K interact to help achieve maximum economic yield (MEY) of tomatoes (**Table 1**).

Citrus

Potassium is essential for producing quality citrus. Research with "pineapple" oranges revealed that K influences size of fruit, thickness of the rind, and fruit color. Potassium also improved the acid/sugar ratio, soluble solids, and vitamin C content. The improved yield was due, in part, to reduced fruit fall from the tree and larger fruit size. Under conditions of severe K deficiency, stem end deterioration of fresh fruit results in greater loss during transport and a shorter shelf life in the super market.

Turf

Requirements for K are quality oriented and include grass color, turf density, winter hardiness, resistance to disease, and resilience to traffic. Potassium for improved root growth is believed to be one of the major benefits which allow turf grasses to grow out of stress conditions brought on by insects, disease, and adverse climatic conditions. Producers of sod are interested in how K can improve plant tiller count, rhizome length, and root density. Balancing K with N nutrition is key for maintaining a healthy, vigorous turf.

Tobacco

Plants fertilized with K resulted in increased K content, a reduction in nicotine, and an increase in sugar concentrations.

Grapes

Quality is influenced as K improves yield of marketable grapes and helps prevent cluster tip, uneven ripening, and pre-harvest shattering of fruit.

Sugarcane

Yield and quality are closely tied to K nutrition. This is due in part to K's influence on photosynthesis, total leaf area, drought stress, and disease resistance. A balanced fertilization program with N and K produces high juice quality and the most economical yield level.

Banana

Yield and quality are strongly influenced by K nutrition. It improves fruit weight and number per bunch. In addition, K stimulates earlier fruit shooting and shortens the number of days to fruit maturity. The beneficial effects of K on banana fruit quality continue over and above the level of K required for top fruit yield.

Summary

The role of K in crop quality has been documented throughout the world. The influence exists for crops grown in temperate and humid regions, for legumes and non legume plants, for annual and perennial crops, and for other crops needed for food, fiber or ornamental purposes.

The quantity of K required to obtain MEY plus quality varies with crop requirements for K in the growth environment. In some cases the amount of K required for top yield is adequate for top quality. In other cases, however, the desired level of crop quality and top profit require levels of K exceeding those normally needed for yield alone. This influence has been documented for crops such as tobacco, turf, ornamentals, and some food and fiber crops.

A balanced nutrition program allows K to contribute its best toward highest crop yield, quality and profitability. BC