

Potassium Is Important for Fresh Market Quality

By A. E. Ludwick

Potassium (K) is often described as the "quality element". A shortage of K adversely affects photosynthesis, respiration, translocation, and a number of enzyme systems. This frequently results in small or misshapen produce, more disease and insect damage, and shorter shelf life.

PROFIT in vegetable and fruit production can originate from: 1) more total yield; 2) greater percentage of total yield that is marketable; better quality; and/or better efficiency (lower unit costs of production). All are important and all are directly affected by fertilizer selection and management.

Fresh Market—A Special Case

The goal in any nutrient management program should be to provide balanced nutrition throughout the growing season, avoiding deficiencies of any nutrient on the one hand and excess applications on the other.

Potassium can be a special concern in production of crops for the fresh market. It is required in large amounts, similar to and frequently greater than that of nitrogen (N). It moves to plant roots primarily by diffusion, not by mass flow as with N, so it is more subject to "environmentally induced" deficiencies such as cool soil temperature, unfavorable moisture conditions, and soil compaction. Potential deficiencies are accentuated for many vegetables because they grow rapidly and have limited rooting systems. Even under excellent management there may be short periods of reduced K uptake immediately following irrigation because of oxygen depletion affecting root respiration. Such temporary shortages can reduce yield and quality.

Potassium—Essential in Many Ways

Potassium is involved in numerous metabolic pathways within the plant. Over 60

enzyme systems are activated by K. It is difficult to imagine a growth or reproduction process in plants that is not directly or indirectly impacted in a very significant way by K. Potassium plays the following roles:

Photosynthesis

- Coloration of leafy vegetables (healthy green color)
- Uniformity of ripening
- Growth rate

Synthesis of amino acids and protein

- Food quality

Carbohydrate synthesis and translocation

- Bud development
- Sugar content
- Enhanced flavor

Lignin and cellulose development

- Firm stems and stalks
- Resistance to bruising and physical breakdown
- Longer shelf life

Disease and insect resistance

- Thicker epidermal layer
- Fewer blemishes
- Higher market grade
- Less culls and waste

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Root growth

- More effective utilization of soil moisture
- Improved nutrient uptake
- Greater root vigor

Quality—Consumers' Demand

High produce quality is essential for profitable production. Quality can be measured in many ways. High on the list for consumer acceptance is produce of uniform size, color, and maturity, with enhanced flavor, free of blemishes or unusual markings, and free of any sign of disease. Potassium plays a significant role in all of these considerations.

An example of the benefit of K on crop quality is presented in **Table 1**. The importance of balanced nutrition is also demonstrated. In this case, fertilizing tomatoes with a combination of N and K produced substantially more total yield and a dramatically greater yield of marketable fruit.

There was only a modest yield increase to applied N when K was not applied. Only

about half of the fruit was marketable. Applying K along with N more than doubled and nearly tripled yields in several cases. These higher total yields were accompanied by percent marketable yields ranging from 71 to 85.

Such examples emphasize the importance of a carefully planned nutrition program. Not only were yield and quality dramatically increased, but fertilizer use efficiency was also greatly increased. In the case of N, the greater yield would take up substantially more N, leaving less nitrate in the soil profile following harvest.

It has been recognized for decades that K will enhance plants' ability to resist disease. This is not isolated to a few crop species, but covers a wide spectrum of both plants and pathogens. Although there are many interacting factors that determine host susceptibility, K is one important management tool that is often effective in reducing the severity of attack. Frequently produce quality is directly related to the presence or absence of disease problems.

Table 1. Total and marketable yield of tomatoes are benefited by N and K nutrition.

K ₂ O, lb/A	N, lb/A		
	120	180	240
	Yield, tons/A and % marketable ()		
0	7.1(41)	7.5(56)	9.3(55)
300 (preplant)	15.1(71)	15.5(76)	16.2(77)
150 preplant+	17.6(80)	20.8(85)	26.7(85)
150 sidedress			

() = Amount (%) of total yield that is marketable.
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Summary

In the final analysis, K does not work alone. Rather, it functions with other essential nutrients and crop management inputs to produce the final product. The importance of balanced nutrition and efficient use of all plant nutrients is recognized. The special role of K in crop quality is of particular importance for overall production profitability. ■



ONION harvest in the Imperial Valley of California.



LETTUCE production in the Salinas Valley.