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## PLANT NUTRITION, FOOD QUALITY, AND HUMAN HEALTH

### **Management of plant nutrition can influence the quality of foods in many ways that affect human health.**

There are numerous aspects of quality that could be considered, but let's look at the major categories of proteins, minerals and vitamins.

**Since N is a major part of protein, applying N to cereals adds to the protein they produce.** In corn and wheat, rates of N for optimum protein levels are higher than those for optimum yield, but the nutritional value of such protein increases is limited owing to lower concentrations of lysine, an essential and often limiting amino acid. An exception is the Quality Protein Maize developed by plant breeding: its lysine concentration remains high, so when more N is applied, the protein has high quality. On the other hand, genetic improvements to N use efficiency in cereals may require careful attention to the impact on protein quantity and quality.

**Fertilizing rice with N boosts both yield and quality of protein.** While the yield effect is bigger, a small increase in protein quality arises, since the glutelin it promotes has higher concentrations of lysine. In potatoes, N increases starch and protein concentration while P, K, and S enhance protein biological value. Management tools that more precisely identify optimum source, rate, timing, and placement of N fertilizer can help attain these quality increases without undue impact on the environment. These tools may include controlled-release technologies or late foliar applications to boost N availability for protein production while keeping losses of surplus N to a minimum.

**Many of the mineral nutrients used in plant nutrition are also important minerals in the human diet.** The levels of Ca, Mg, K, Zn, and other minerals in foods are influenced by application of these nutrients to crops. In countries like Bangladesh and Nigeria, inadequate dietary intake of Ca is common. Around the world, 1.5 billion people suffer from inadequate intake of the micronutrient Zn. Supplementing crops with these nutrients can improve human health by boosting levels in crop products, and thereby dietary intake.

**Fruits and vegetables are important components of a healthy diet.** Scientific evidence from numerous sources has demonstrated that judicious fertilizer management can increase productivity and market value as well as the health-promoting properties of fruits and vegetables. Concentrations of carotenoids (Vitamin A precursors) tend to increase with N fertilization, whereas the concentration of vitamin C decreases. Foliar K with S can enhance sweetness, texture, color, vitamin C, beta-carotene, and folic acid contents of muskmelons. In pink grapefruit, supplemental foliar K can boost beta-carotene and vitamin C concentrations. Several studies on bananas have reported positive correlations between K nutrition and fruit quality parameters such as sugars and ascorbic acid, and negative correlations with fruit acidity.

**Fertilizers can also influence levels of health-promoting nutraceutical compounds in crops.** Soybeans growing on K-deficient soils in Ontario, Canada had isoflavone concentrations about 13% higher when fertilized with K. Potassium has also been reported to promote concentrations of lycopene in grapefruit and in tomatoes. The potent antioxidant pigments lutein and beta-carotene generally increase in concentration in response to N fertilization. Together with vitamins A, C, and E, they can help lower the risk of developing age-related macular degeneration, which is one of the leading causes of blindness.

**The mission of agriculture is to sustain human health.** There are many components of the world's agricultural systems that could change to accomplish this mission more effectively. Plant nutrition is one of them. Paying more attention to the impacts of plant nutrition on the quality of food is an area of great opportunity for improving the health of the human family.

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Abbreviations: N = nitrogen, P = phosphorus, K = potassium, S = sulfur, Ca = calcium, Mg = magnesium, Zn = zinc.

Note: *Plant Nutrition TODAY* articles are available online at the IPNI website: [www.ipni.net/pnt](http://www.ipni.net/pnt)