Potassium needs of cereal crops

ATLANTA, GA – Wheat and other cereal crops require at least as much potassium (K) as they do nitrogen (N). High levels of K nutrition have many beneficial effects on the growth of these crops. These conclusions are part of a paper presented by Dr. James D. Beaton and Dr. G. S. Sekhon during proceedings of Potassium in Agriculture, An International Symposium.

Dr. Beaton, of Cochrane, Alberta, Canada is an Agronomist with the Potash & Phosphate Institute (PPI). Dr. Sekhon is Director of the Potash Research Institute of India. Following is a summary of their paper.

Grain yields are the product of: (1) the number of heads or ears per unit area, (2) the number of grains or kernels per ear or head, and (3) the single grain or kernel weight. Satisfactory K nutrition promotes the formation of larger grains through a more intensive and longer photosynthesis.

The flag and penultimate leaves are of special interest since they are major contributors to grain filling. Potassium, through its favorable effect on leaf area, chlorophyll concentration, and turgor, greatly influences the productive capacity and life of these leaves.

Potassium, by advancing flowering and delaying flag leaf senescence, extends the grain filling period which is necessary for the formation of large grains. Part of this effect of potassium seems to be related to retarded and restricted production of abscisic acid in the grain.

Small grains well-nourished with potassium have lower transpiration rates than those deficient in this nutrient. Increasing potassium decreases both numbers and width of stomata in wheat.

Protein synthesis and storage in the grain is promoted by ample potassium supply. It appears that the presence of potassium enhances translocation of nitrogenous compounds from the vegetative plant parts to the grain.

Potassium uptake by small grains grown under water-limiting conditions may be only about 45 pounds per acre (50 kilograms per hectare), but it can reach 360 to 450 pounds per acre (400 to 500 kilograms per hectare) under optimum growth conditions, particularly when high rates of N and phosphorus (P) are used. There can be large varietal differences in K uptake, generally being higher in varieties which produce larger amounts of straw.

Potassium requirements are greatest between the end of tillering and the start of flowering. Because 40 to 50 percent of the midseason potassium content is lost between flowering and maturity, measurements of potassium removal by crops at maturity will greatly underestimate actual K needs.

Wheat and small grain crops with high potassium nutrition are better able to cope with stress conditions, including disease, drought, excess sodium, temperature extremes, and lodging. Potassium consistently suppresses various rusts and often decreases the severity of infections of other diseases such as powdery mildew, bunt, stalk smuts, net blotch, glume blotch, take-all, common root rot and yellow dwarf virus.

Soil tests for plant-available potassium are reliable indicators of serious deficiencies of this nutrient. The profitability of potassium fertilization of wheat and other small grains is usually high on low potassium soils, and it may also be attractive in some cropping situations on soils testing high in available potassium.

Lack of sufficient potassium results in characteristic visual deficiency symptoms. There can also be undesirable changes such as greater susceptibility to diseases, lodging, and drought stress. Also, maturity may be delayed.

The dramatic influence of potassium deficiency on modification of root growth is not well known. Development of first-order and higher-order seminal and nodal roots is restricted by lack of potassium. Numbers of seminal axes and root length may also be suppressed by insufficient potassium.

Although mass flow transport of potassium to roots is not generally considered to be as important as diffusion, the relative role of these mechanisms apparently changes during the growing season due to fluctuations in both the potassium demand of cereals and the soil solution potassium concentration.

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