Importance of Potassium in Rice

Potassium (K) is an essential nutrient required by the plant to perform important plant functions, needed for osmoregulation, enzyme activation, regulation of cellular pH, cellular cation-anion balance, regulation of transpiration by stomata, and the transport of the products of photosynthesis (Dobermann and Fairhurst, 2000). Studies reported the following effects of fertilizer K application in rice (De Datta and Mikkelsen, 1985; Zayed et al., 2007; Bhiah et al., 2010; Saito et al., 2012; Sarwar, 2012; Uddin et al., 2013; Maryam and Amiri, 2014; Zain et al., 2014; Zaman et al., 2015). In K deficient soils, application of K helps to:

• improve root growth and plant vigor,
• prevent lodging and improve resistance to unfavorable weather conditions,
• enhance crop resistance to pests and diseases,
• improve tillering and shoot and root dry matter production,
• increase the number of filled grains and grain weight,
• reduce the concentration of environmental pollutants in rice grain,
• reduce Na+ concentration and increase availability of K+ in saline soils.

Comparing rice yields between plots applied with ample amount of N, P, and K (NPK) and plots that received N and P but without K (0K) in a long term experiment conducted in five Asian countries showed differences in short- and long-term yield responses to fertilizer K among sites (Witt et al., 2004). Yield responses to K application were generally small at start, but developed within a few seasons except for the site in Vietnam, where annual flooding supplies a large K load through sedimentation (Figure 1). This finding highlights the need for K application in rice not only to increase yield but also to prevent soil K mining to maintain soil productivity and prevent yield loss.

In India, on-farm studies across 45 locations in the Indo-Gangetic Plains revealed that average yield with ample application of NPK was 4701 kg/ha and yield loss due to no application of K was 90–1806 kg/ha with an average yield loss of 622 kg/ha across locations (Majumdar et al., 2012). Areas traditionally known as less responsive to K application showed yield loss of 500-1000 kg/ha in the K omission plot as compared to ample NPK plots. Yield loss was greater in hybrid rice, which has higher yield potential than high yielding inbred varieties (HYVs) and traditional varieties, and has higher demand for K.

A high yielding rice crop takes up 14.6 kg N, 2.7 kg P, and 15.9 kg K to produce a ton of grain yield (Buresh et al., 2010; Witt et al., 1999). A rice crop with a
yield of 6 t/ha will remove in its aboveground biomass (i.e., grain and straw) about 95 kg K/ha together with 88 kg N/ha and 16 kg P/ha. Many rice farmers in Asia often apply fertilizer N and P but seldom apply fertilizer K, leading to soil K mining and subsequently to yield decline. Thus, a nutrient management strategy that promotes balanced application of nutrients (including N, P, K, and micronutrients) is important to ensure sustainable productivity of Asian rice soils. The K management must maintain K supply at levels that do not limit crop growth, ensure optimal N use efficiency, increase plant resistance to pests and lodging, and avoid or minimize nutrient leaching (Dobermann and Witt, 2004).

Figure 1. Cumulative grain yield increase in fully fertilized plots (NPK) over plots without K (0K) application in long-term experiments at five sites in Asia, 1995-2002. (Source: Witt et al., 2004).

References:
Refer to the last printed page of this diary for sources.
References:

**Importance of Potassium in Rice**


Buress, R.J., M.F. Pampolino, and C. Witt. 2010. Field-specific potassium and phosphorus balances and fertilizer requirements for irrigated rice-based cropping systems. Plant and Soil 335: 35-64.


