Managing Potassium in Rice Fields

Why Is It Important?

Potassium (K) is an essential nutrient for rice. It is important to have good K fertility not only for optimizing yields, but also K helps reduce the severity of some common plant diseases that we see (e.g. aggregate sheath spot and stem rot).

Deficiency Symptoms

K deficiency symptoms include (1) yellow/brown leaf margins, (2) dark brown spots on leaf surface, and (3) leaf bronzing (Figure 1).

Figure 1. Potassium deficiency symptoms. Yellow leaf margins and bronzing (top); brown spots (bottom). Source: top - IRRI (Rice Knowledge Bank), bottom - AgFax.

Potassium Fertilizers

In this Fact Sheet, we will be referring to elemental K, unless otherwise specified. To convert to K_2O, multiply elemental K value by 1.2.

The most common K fertilizer sources for rice are potassium chloride (muriate of potash; 60% K_2O) and potassium sulfate (sulfate of potash; 44% K_2O). Potassium nitrate is a common K fertilizer, however, it is generally advisable to avoid applying nitrate to rice fields, as it is highly susceptible to losses under flooded conditions.

How Much Potassium Is in a Rice Crop?

Rice takes up about the same amount of K as N during the growing season (about 150 lb K/ac in a 90 cwt yielding field). However, less K is usually applied as fertilizer because the soil supplies much of the K needs. At harvest, about 20% of the K is in the grain and 80% in the straw (grain is 0.29% K and straw 1.4% K). For example, in a field where the yield is 90 cwt, there is about 26 lb K/ac in the grain and 126 lb K/ac in the straw.

Maintaining Soil K Balances

If only grain is removed, roughly 26 lb K/ac (31 lb K_2O/ac) is removed in a 90 cwt yielding crop. This amount would need to be replaced to be applied to maintain soil K balances.

Straw removal has a large impact on K fertility. For modern, high yielding varieties, the amount of straw in a field is roughly equal to the amount of grain harvested from the field. Therefore, in a field that yielded 90 cwt, there is 4.5 tons of rice straw. For every ton of straw removed, about 28 lb K/ac (34 lb K_2O/ac) is removed with it (most

bailing operations remove about 40-80% of the straw). If this K is not replaced, depending on soil, the soil K reserves will become depleted and K deficiency symptoms will begin to appear with time.

Determining K Deficiencies

In the Sacramento Valley, K deficiencies are most common in soils with a low clay content and those on the eastern side of the Sacramento Valley (including the red soils). Plant sampling is a good way to determine a deficiency; however, by the time a deficiency is determined, it may be too late to correct. A Y-leaf sample taken between tillering and panicle initiation should have a K concentration of 1.5% or more. A flag-leaf sample taken around heading should have a K concentration of 1.2% or more.

Soil testing is another good option. The most common soil test is the ammonium acetate (NH_4OAc) extractable K test. With this method, when soil extractable K is less than 60 ppm, K fertilizer is definitely needed. If extractable K is between 60 and 120 ppm, K fertility is on the lower end and it is likely that deficiency symptoms may appear. In a study conducted on 55 California rice fields, if the extractable K levels were below 120 ppm, 27% of the fields showed K deficiency symptoms (low flag-leaf K values). Another soil test is the percent base saturation of K. If the K saturation is 1.6% or less then you should consider adding K fertilizer.

Soil Sampling Considerations

When testing the soil for K, be mindful of how you sample. In a study we did of 55 rice fields, we found that in 70% of the fields, the bottom check had higher K levels than the top check. This may be for a couple of reasons. First, it may be a legacy of field leveling. When leveling a field, it is likely that top soil (higher in K) is moved from the upper part (top check) of the field to the lower part (bottom check). A second reason is that K is relatively mobile in water and irrigation water can push K from the top checks to the lower checks in the field.

Other Considerations

Irrigation water is a source of K. In California well water had the highest and most variable K concentration (1.8 ppm), followed by the Sacramento river (1.2 ppm) and rivers coming from the Sierra Nevada mountain range (0.9 ppm).

Burning rice straw does not remove K, however the ash which contains the K can blow around the field resulting in non-uniform distribution.

For more on this topic:

- ✓ Agronomy Research and Information Center-Rice: rice.ucanr.edu
- ✓ Dobermann, A and T. Fairhurst. 2000. Rice: Nutrient Disorders & Nutrient Management. International Rice Research Institute.
- ✓ Linquist, B.A., M. Ruark, R. Mutters, C. Greer, and J. Hill. (2014). Nutrients and sediments in surface runoff water from rice fields: Implications for nutrient budgets and water quality. *Journal of Environmental Quality* 43:1725-1735.

Agronomy Research and Information Center

http://agric.ucdavis.edu/

University of California Cooperative Extension

Author(s): Bruce Linquist

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