

# Nutrient Deficiency Symptoms in Rice

**Symptoms of nutrient deficiency or toxicity are not always readily apparent in a growing crop. Often, more than one nutrient or growing condition may be involved. In many field situations, when a deficiency is identified, it may be too late for treatment to correct the problem in the current crop.**

The following pages present some photos and brief information describing symptoms of nitrogen (N), phosphorus (P), potassium (K), and zinc (Zn) deficiencies in rice. More comprehensive information on these and other nutrients is available from various other sources, including the handbook, *Rice: Nutrient Disorders & Nutrient Management*, described on page 47.

## Nitrogen

Nitrogen deficiency is the most commonly detected nutrient disorder observed in rice. Old leaves and sometimes all leaves become light green and chlorotic at the tip. Leaves die under severe stress. Except for young leaves, which are greener, deficient leaves are narrow, short, erect, and lemon-yellowish. The entire field may appear yellowish. Nitrogen deficiency often occurs at critical growth stages such as tillering and panicle initiation, when the demand for N is large.

**Tillering** is reduced where N is deficient.



**Greater tillering** occurs where N fertilizer has been applied.



**Leaves are yellowish-green** in the omission plot where N has not been applied.

**Leaves are smaller** in N-deficient plants.





**Growth** may be greatly reduced by Zn deficiency (at left in photo).



**Zinc deficiency** results in stunting and uneven plant growth, as shown in foreground.

### Zinc

Zinc deficiency symptoms are more common on young or middle-aged leaves. Dusty brown spots appear on upper leaves of stunted plants, sometimes two to four weeks after transplanting, with uneven plant growth and patches of poorly established hills. Under severe deficiency, tillering decreases and time to crop maturity may be increased.

### Phosphorus

Stunted, dark green plants with erect leaves and reduced tillering may signal P deficiency. Leaves are narrow, short, very erect, and 'dirty' dark green. Stems are thin and spindly, and plant development is retarded. The number of leaves, panicles, and grains per panicle may also be reduced. Young leaves may appear to be healthy, but older leaves turn brown and die. Red and purple colors may develop in leaves if the variety has a tendency to produce anthocyanin. Leaves appear pale green when N and P deficiency occur simultaneously.

Phosphorus is particularly important in early growth stages. It is mobile within the plant and promotes root development, tillering, early flowering, and ripening (especially where the temperature is low). Addition of mineral P fertilizer is required when the rice plant's root system is not yet fully developed and the native soil P supply is small. Phosphorus is remobilized within the plant during later growth stages if sufficient P has been absorbed during early growth.

**Phosphorus-deficient** plants are stunted and small.



**Tillering** is reduced where P is deficient. Even under less pronounced P deficiency, stems are thin and spindly, and plant development is retarded.



**Leaf margins** become yellowish-brown when K is deficient. Dark brown spots appear on the leaf surface. Leaf bronzing is also a characteristic of K deficiency.



**Potassium deficiency symptoms** are more likely to occur in hybrid rice (at left in photo) than in modern inbred varieties (right).

## Potassium

While K does not have a pronounced effect on tillering, it does affect the number of spikelets per panicle, percentage of filled grains, and grain weight. Potassium improves the rice plant's tolerance of adverse climatic conditions, lodging, insect pests, and diseases. Deficiency symptoms tend to occur in older leaves first, because K is very mobile within the plant and is translocated to young leaves from old senescing leaves. Often, yield response to K fertilizer is observed only when the supplies of other nutrients, especially N and P, are sufficient.

Dark green plants with yellowish brown leaf margins or dark brown necrotic spots first appear on the tips of older leaves. Under severe K deficiency, leaf tips are yellowish brown. Symptoms appear first on older leaves, then along the leaf edge, and finally on the leaf base. Upper leaves are short, droopy, and "dirty" dark green. Older leaves change from yellow to brown and, if the deficiency is not corrected, discoloration gradually appears on younger leaves. Leaf symptoms of K deficiency are similar to those of tungro virus disease. Unlike K deficiency, however, tungro occurs as patches within a field, affecting single hills rather than the whole field. **BCI**



**Rice yields** are often constrained by unbalanced fertilization where the response to N and P is constrained by insufficient K.

**Potassium-deficient** rice plant roots may be covered with black iron sulfide (photo at left), compared with healthy rice roots which are covered with red-brown iron oxide (photo at right).

