UPPER SOYBEAN LEAVES BEGIN SHOWING POTASSIUM DEFICIENCY SMYPTOMS SINCE EARLY AUGUST

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Since the first or second week of August, soybean in several fields began showing typical potassium (K) deficiency symptom in leaves located in the middle to upper canopy. This is not surprising in fields or portions of fields with soil-test values in the very low or low K soil-test interpretation categories that did not received adequate preplant K fertilization. Potassium deficiency symptoms are well-known and very common in older leaves at early growth stages. Due to poorly understood reasons, during the last couple of decades K deficiency symptoms in upper soybean leaves also have become common at middle to late reproductive stages. Moreover, K deficiency symptoms can develop in upper leaves even with well-fertilized soybean and when no deficiency was observed at early stages, mainly when drought conditions develop during late spring or summer.

In low-testing or draughty soils, K deficiency symptoms may develop from the V3 stage up to more advanced vegetative stages mainly in the older leaves, but with severe deficiency, symptoms may progress to the upper leaves later on. Figure 1 shows examples of typical soybean K deficiency symptoms at early growth stages. The symptom is yellowing of the leaflet margins with mild deficiency that become brown or necrotic with extreme deficiency. The symptoms in older leaves sometimes remain until the reproductive stages, but often are not seen because the leaves have been shed or partially decomposed. The reason symptoms are observed mainly in the older leaves at early vegetative growth stages is because K is very mobile within the plant and with a deficiency K is translocated from older leaves to new leaves.

Figure 1. Soybean potassium deficiency symptoms at early vegetative growth stages.

The K deficiency symptoms at early vegetative stages should not be confounded with soybean iron deficiency chlorosis (IDC), which often occurs in high-pH (calcareous) soils. In

contrast to K deficiency, the IDC symptoms are yellowing of the interveinal area of mainly entire young leaflets. With extreme iron deficiency, however, brown and necrosis may occur in leaf margins. The ICM News article "Is It Iron or Potassium Deficiency?" refers to IDC symptoms in soybean.

The K deficiency symptoms in soybean at middle to late reproductive stages are similar to those observed early in older leaves. Figure 2 shows typical examples of soybean K deficiency symptoms at reproductive stages. The physiological reasons for late-season development of deficiency symptoms during the last couple of decades are not entirely clear. Perhaps with increasing soybean yield potential there is more K translocation from middle or upper leaves to developing pods and grain.

Figure 2. Soybean potassium deficiency symptoms during the reproductive growth stages.

Observations during many years have shown that severe K deficiency can advance soybean maturity. Therefore, it is not surprising to see senescing soybean, with most leaves yellow or brown, in low-testing field areas a few days before plants in other parts of a field. Figure 3 shows an example observed in research plots. It should be remembered, however, that deficiency of other nutrients, diseases or excessively wet or dry soil also can advance soybean senescence.

Figure 3. Potassium deficiency advances soybean senescence.

Several soybean diseases caused by fungi and viruses can also produce yellowing of soybean upper leaves, which also may advance plant and leaf senesce. Sometimes, the disease symptoms and K deficiency symptoms occur at the same time. This is not surprising because Iowa research has demonstrated that K deficiency aggravates the incidence or severity of several soybean leaf diseases. Part of this research was summarized in the proceedings article for the 2016 ISU Extension ICM conference "Watch potassium management - It also affects corn response to nitrogen and soybean diseases". Additional field observations suggest possible interactions with soybean cyst nematode (SCN) and aphid infestation levels. That is, upper canopy K deficiency symptoms can develop in field areas associated with SCN or aphids.

Sometimes it is difficult to distinguish between K deficiency and disease symptoms in upper soybean leaves during reproductive stages, unless the plants or leaves are submitted to a plant pathology lab for study. Soil and leaf K testing of apparently normal and affected field areas also may help identify the cause for the symptoms. Recently published interpretations for K tissue testing can be useful for soybean plants at the V5 to V6 vegetative growth stages or for upper leaves at the R2 to R3 reproductive growth stages, but not for later growth stages. This is because leaf K concentrations decline during later growth stages. You can see the tissue test interpretations in ISU Extension publication CROP 3153 "Phosphorus and Potassium Tissue Testing in Corn and Soybean".