Boron fertilization of soybeans has been shown to increase grain yield at locations across the world when the boron supplying power of the soil is inadequate\(^2\) even though soybeans are listed as tolerant to boron deficiency. University research has found soybean yield increases ranging from 2-17.9\(^1\) bushels per acre due to application of boron to boron deficient soybeans.

Boron deficiency in soybeans has been shown to delay soybean maturity by as much as two weeks thus exposing the crops to the risks of bad weather or shattering. “Timeliness of harvest is an important consideration and possible benefit of boron fertilization, which should be considered when growers decide whether to include boron as a part of their fertilization regime.”\(^1\)

Deficient soybeans have been showed to be stunted, produce fewer seeds per pod, weigh less per plant and have fewer nodes per plant\(^1\). Soybean seed produced by boron deficient plants and planted back into boron deficient conditions can suffer significant yield losses. Soybeans produced by boron deficient plants but planted in to adequate boron conditions produce well.

Under boron deficient conditions, soybean seed will have greatly reduced boron concentrations. Soybean seed produced in low boron conditions in commercial fields in Arkansas in 2003\(^1\) contained as little as 1.9 mg B/kg seed while boron concentrations in fields without boron deficiency produced seed containing from 26-27 mg B/kg\(^3\).

As with many other crops, the first signs of boron deficiency occurs in the roots. Root tips die causing new roots to initiate causing a rosette appearance. Foliar symptoms include death of the shoot growing point and subsequent proliferation of lateral shoots with brittle petioles\(^4\). Slaton observed deficiency symptoms that included delayed maturity and leaf senescence.

Beware of hidden hunger

In a study site in Arkansas in 2003 with a yield increase of more than 17 bushel per acre due to boron fertilization, no deficiency symptoms or apparent growth response to boron fertilization were observed until soybean plants neared maturity\(^1\). The delayed maturity of the boron deficient soybeans would be difficult to notice without boron sufficient soybeans in the field with which to compare.

Application of 1.0 lb B/acre, averaged across application times, increased soybean yields from 8.2 to 118% (3.9-17.4 bu/acre) above the unfertilized control.

Timing of application

Field studies in Arkansas on timing of boron application under conditions of boron deficiency showed that applications at the V2 stage at rates greater than or equal to 0.5 lb/A produced the best results.

Preplant granular applications of one pound per acre boron are effective in preventing boron deficiency.

If foliar fertilization is preferred, growers should apply 0.5 lb B/acre at least once. A second application of 0.25 or 0.50 lbs B/acre may provide additional yield benefits at a minimal cost in fields where severe boron deficiency has been observed.

At two Arkansas sites grain moisture measurements were greatest in the untreated checks and were indicative of the magnitude of the maturity differences observed.

Soybean growth and yield were generally maximized when boron was applied at rates from 0.5 to 1.0 lb B/acre.
Yield responses to applied boron may be inconsistent and seasonal, probably due to environmental effects on flowering and berry development. However, both yield and quality of grapes may be improved with boron applications because available boron levels are low in some soils.

Yield response to boron applications may diminish as the duration of boron deficiency is prolonged.

Boron deficiency in Arkansas was noted on alkaline silt loam soils in certain regions of the state. Other regions of the state with similar soils showed no boron deficiency.

### Soil test information

Soil tests of the four sites in Arkansas noted in this paper as have significant losses due to boron deficiency had soil tests of 0.35 to 0.5 ppm B which would not be considered deficient for soybeans.

### Tissue tests for boron

Various sources listed below list the following ranges of tissue values for boron in soybeans.

- Deficient: 9-10 or less than 10 ppm B
- Low: 10-20 or less than 20 ppm
- Sufficiency range: 20-60 ppm
- Normal: 20-80 or 21-55
- High: 50-100, greater than 80, 63, 50.1-80
- Excess: 63 greater than 80 or greater than 100 ppm

### References

7. Clemson University Lab web site.