Influence of soil K+ deficiency on soybean aphid population dynamics

Scott Myers
UW-Entomology

Background

2000 Aphids first discovered in Wisconsin.

Production fields showed large numbers of aphids in K+ deficient areas.

Aphids and K Deficiency in Other Areas?

Researchers in MI, IN have noted similar trends

Anecdotal data from MI:

growers who “potashed” had fewer aphids and didn’t have to spray fields.

K Deficiency and Leaf Yellowing

Symptoms appear on older lower leaves (because K is mobile in the plant).

Yellowing begins at the leaf margins and moves inward.

Plant stunting and reduced canopy

K Deficient Soybeans

Herbicide Injury

Objective

Determine the effect of K deficiency on soybean aphid population dynamics and resulting soybean yields.

Methods

- Small plot field experiments Arlington, WI
- 2001 and 2002
- Three K levels (high, med, low)
- Sprayed and unsprayed treatments at each K level.

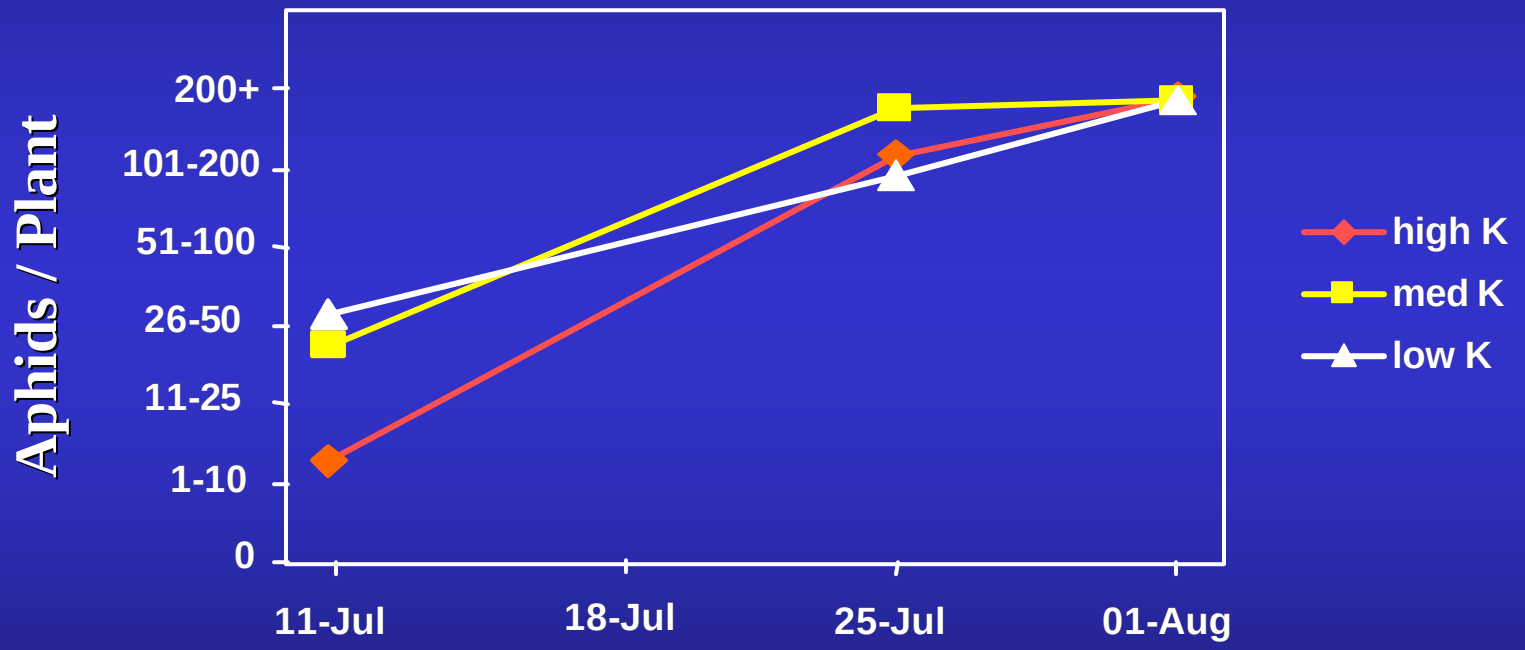
K Levels (averages)

Treatment	Soil Avail K (ppm)	Leaf Tissue K (ppm)
“high” K	111.4 A	1.88 A
“med” K	93.5 B	1.58 B
“low” K	60.8 C	1.01 C

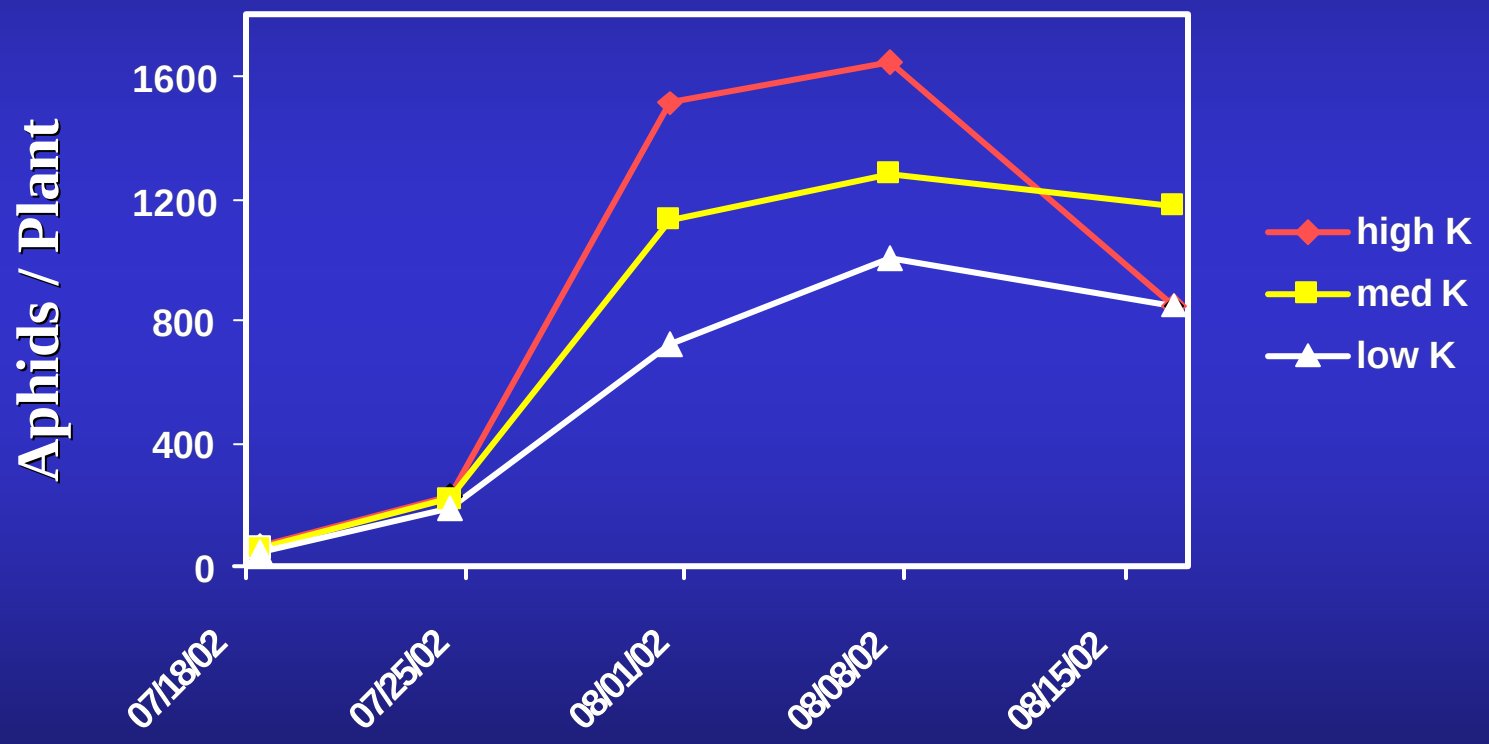
Aphid Sampling

- Aphid counts were taken from each plot
- 20 plants/plot in 2001 and 10 plants/plot in 2002
- Categories used to estimate aphid numbers in 2001
- Actual numbers per plant estimated in 2002

Whole Plant Aphid Counts at Three Soil K+ Levels (2001 Data)



Whole Plant Aphid Counts at Three Soil K+ Levels (2002 Data)



Soybean Yields for Aphid Infested and Non-infested Treatments at three K+ Levels (2001 data)

Treatment	Yield Bu/Acre
Unsprayed High K+	41.7 BC
Unsprayed Med K+	42.4 BC
Unsprayed Low K+	32.8 C
Sprayed High K+	54.9 A
Sprayed Med K+	51.1 AB
Sprayed Low K+	41.3 BC
LSD a=0.05	9.9

Soybean Yields for Aphid Infested and Non-infested Treatments at three K+ Levels (2002 data)

Treatment	Yield Bu/Acre
Unsprayed High K+	41.2 B
Unsprayed Med K+	34.3 C
Unsprayed Low K+	18.8 E
Sprayed High K+	48.4 A
Sprayed Med K+	42.3 B
Sprayed Low K+	24.6 D
LSD a=0.05	4.19

Yield Losses Due to K Deficiency

Minimal in 2001:

- **25% yield loss in sprayed low K vs high K**

More Substantial in 2002:

- **Significant yield losses among K treatments in both sprayed and unsprayed treatments.**

Yield Losses Due to K Deficiency

2002 Data in Bushels / Acre

K Treatment	Sprayed	Aphids
“high” K	48.4	41.2
“med” K	42.3 (-13 %)	34.3 (-17%)
“low” K	24.6 (-50%)	18.8 (-54%)

% Yield Loss Resulting From Aphid Infestation
(spray vs unsprayed)

Treatment	2001	2002
“high” K	24 %	15 %
“med” K	17 %	19 %
“low” K	21 %	23 %
Average	21 %	19 %

What's going on?

- Low K may be similar to effects of excess N.

- Low K disrupts protein synthesis from amino acid building blocks.

- Results in accumulation of amino acids and other N compounds in plant tissues

- Nitrogen is the limiting resource for sap feeding insects, so plants with excess N will be highly sought after.

Or . . .

- It may be that leaf yellowing resulting from inadequate K serves as an attractant to colonizing aphids.

- Yellow colors have been shown to attract other insects including aphids.

- Better explanation of data from this experiment.

Conclusions

- K deficiencies appear to promote aphid infestations.

- Yield losses in K deficient plots similar to those with ample soil K.

- Maintaining ample K may serve to deter aphid outbreaks, and help avoid insecticide applications.

Acknowledgements

John Wedberg
Dick Wolkowski
John Gaska

Wisconsin Soybean Marketing Board