

Foliar Fertilization of Soybeans

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Application opportunities:

1. Early season N,P,K (V4-V6)
2. Midseason micro-nutrients (B,Mn)
3. Podfill N,P,K,S (R2-R7)



Field trial success:

Iowa early season studies

1. Increases at 7 of 48 sites; decreases at 2 of 48 sites; average + 0.80 bu/a
2. Increases at 3 of 27 sites; decreases at 3 of 27 sites; average + 0.27 bu/a
3. No yield increases or decreases at 18 sites; average + 0.71 bu/a

Responses more likely with dry spring/early summer, where available P/K low, plant growth poor.

Application costs exceeded benefits



Podfill trial results:

Garcia and Hanway (1976)

Exp 1 = yield +1.2 to 7.0 bu/a
average = +3.62 bu/a

Exp 2 = yield -2.5 to +15.5 bu/a
average = +2.74 bu/a

Exp 3 = yield +22.2 to +23.4 bu/a

Exp 4 = yield -3.6 to +8.6 bu/a
average = +7.26 bu/a

Exp 5 = yield -0.5 to +5.7 bu/a
average = +6.40 bu/a

Exp 6 = yield -5.8 to +6.6 bu/a
average = -5.16 bu/a



Other studies:

Florida	-3.1 bu/a
Maryland	+8.89 bu/a
Minnesota	+0.65 bu/a
Wisconsin	+1.41 bu/a
Georgia	-4.43 bu/a
TVA various loc.	-5.51 bu/a



Response of soybeans to foliar fertilizer at several Minnesota locations

Treatment	Yield		
	Waseca	Becker	Rosemount
	----- bu/a -----		
Control	54	56	61
Foliar *	57	53	63
APP + UAN*	47	48	58

* 4 applications

Adapted from Rehm, 1997



Micronutrient studies mixed

- B increased pods/branch
sandy, low OM soils worse
- Mn increased yield on high OM,
high pH soils
- Premium mixes promoted



Summary of soybean yield and leaf tissue B, response to late season foliar B applications. Wisconsin, 1989-90.²

Foliar B Rate ¹ lb/a	11 in. rows				30 in. rows
	1989 Hancock	1989 Arlington	1990 Hancock	1990 Arlington	1990 Arlington
	----- Yield (bu/a) -----				
0	69.0	68.7	55.5	78.9	55.1
0.5	69.2	66.9	55.4	78.7	55.0
LSD (10%)	NS	1.2	NS	NS	NS
	----- Leaf Tissue B -----				
0	36.8	33.8	--	--	--
0.5	39.1	36.3	--	--	--
LSD (10%)	2.1	1.0	--	--	--

1 Applied as a foliar spray using 5 applications from GS R1 to R5.

2 Data presented are the mean of 16 N and/or variety combinations.

There were no B x N or B x variety interactions in any study.

Adapted from Oplinger et al 1993.

Summary of soybean responses to foliar or soil application of B from several states

Treatment	Yield *			
	IL	MO	OH	WI
	----- bu/a -----			
Control	42.2	43.0	52.4	51.2
Foliar +	43.2	43.3	53.3	51.5
Soil ‡	38.3	42.8	52.5	51.9

* Average of 2 years of data from 3 sites in IL, 2 in MO, 3 in OH, and 6 in WI

+ Data reported as average for the 0.25, 0.5, and 1.0 lb B/a rates

‡ 3lb B/a applied

Adapted from Oplinger et al, 1993.



Comparison of row vs. foliar manganese on soybean yield

Tmt	Mn rate	Yield	
		1970	1971
	lb Mn/a	-----	bu/a -----
Check		56.1	44.5
Row	10	61.8	60.8
Row	20	65.6	62.4
Row	40	--	62.5
Foliar (2x)	0.5	64.7	58.9
Foliar (2x)	1.0	62.1	59.9
Foliar (2x)	2.0	60.4	57.4

Adapted from Randall et al, 1975. All Mn as MnSO_4 ; yields similar with foliar Mn EDTA at one-third the rate.

Number of foliar applications needed to optimize soybean yields

Number of foliar applic	Yield		
	1970	1971-1	1971-2
	----- bu/a -----		
0	56.5	42.5	21.9
1	65.1	54.0	26.3
2	68.7	58.8	28.8
3	71.4	--	29.6

Each application contained 0.15 lb Mn/a as Mn EDTA;
applications in mid June, early July, and mid July.
Adapted from Randall et al, 1975



Example of “premium” soybean foliar fertilizer

Nutrient	Premium Fertilizer		UW recom ⁺
	Conc.	Amount *	
	%	lb/a	
Mn	3.2	0.31	0.30
Zn	3.1	0.21	0.25
Fe	0.3	0.03	0.45
B	0.2	0.02	0.10
Mo	0.01	0.01	0.05

* 2 qt/a applied twice.

+ Chelated form assuming need exists



Crop Booster Scoring Tips

High Yield Potential Soybeans (>50 bu)	10pts
Moderate Yield Potential (45 bu)	5 pts
Low Yield Potential (<40 bu)	0 pts
High pH Soils (7.0 or greater)	10 pts
Moderate pH (5.8-7.0)	5 pts
Low pH	0 pts
Fields with recent lime applications	10 pts
High phosphorus or zinc levels	10 pts
Moderate phosphorus levels	5 pts
High organic matter soils	7 pts
Heavy, wet, or poorly drained soils	10 pts
Drought conditions	5 pts
Flooded conditions for more than 3 days	7 pts
Tissue test levels 0-5ppm	20 pts
5-10ppm	10 pts
10-20ppm	5 pts



Example field

50 bu/a yield goal	10 pts
pH 7.3	10 pts
Not limed	0 pts
Soil test P = 40 ppm	5 pts
25% OM	0 pts
Kewaunee soil	10 pts
Not droughty	0 pts
Not flooded	0 pts
Tissue Mn = 18 ppm	5 pts
	<hr/>

40 pts

Key

- <30 Yield increase unlikely
- 30-60 High probability of an increase in yield
- >60 Make an application

Bottom line:

- Responses to foliar NPKS
 - early -- unlikely
 - podfill -- occasionally
- Responses to foliar micronutrients
 - Soil specific
 - Nutrient specific
 - Multiple applications often better



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