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Potential Use of Ethephon to Control Lodging of Soybeans

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Lodging is sometimes a serious problem with soybeans in Kentucky, especially with the full season crop. However, under excellent growing conditions, or if planting rates are too high, substantial lodging of double crop soybeans can also occur. If lodging occurs early during seed fill, it can reduce yields directly by causing poorer light use and increasing diseases. If lodging occurs late during seed fill, it will have little direct effect on yield, but may have an indirect effect by slowing down harvest and increasing harvest losses. Thus, the use of an inexpensive chemical to reduce soybean lodging is attractive. Our primary objective in this study was to determine if ethephon (Cerone) could reduce lodging of soybeans. Since we suspected that the shorter plants resulting from ethephon treatment might have set pods closer to the ground, our secondary objective was to determine if ethephon would have a detrimental effect on yield by causing greater harvest losses. While ethephon is not labeled for use on soybeans, we wanted to study its potential use for this important Kentucky crop.

Materials and Methods

The early Maturity Group IV varieties Ripley (a semi-dwarf determinate) and Southern States 443 (SS-443; normal height) were planted May 6 and June 16, 1987 and May 3 and July 14, 1988 on a Maury silt loam soil near Lexington. All tests were planted in 14 inch rows into wheat cover using no-till methods in order to conserve soil moisture. The wheat cover crop was killed with paraquat in late April of both years for each planting date. Plots were 10.5 feet wide by 20 feet long. A combination of herbicides and hand-hoeing was used to control weeds, and fertilizers were applied according to University of Kentucky recommendations. Ethephon was applied at 0.25 lb a.i./A in 30 gallons of water/A, using a CO_2 backpack sprayer. Treatments included an untreated control, and sprays at the 4 leaf, 6 leaf, or both 4 and 6 leaf stages. We measured lodging in the field just before harvest using a conventional scale, with 1.0 meaning all plants were upright, and 5.0 meaning all plants were laying flat. Harvest was with a small plot combine, and yields were calculated on a 13% moisture basis. Soybean plants were cut

level with the soil surface from 6 feet of an adjacent row for measurement of lowest pod height (to the bottom node with a pod attached) and plant height. The same plants were later cut at 2, 4, or 6 inches from the stem bottom in order to estimate potential stubble harvest losses if a combine had been operated at each of those cutting heights.

Results and Discussion

Lodging was not problem in this study, and except for the 1988 full season planting, the taller SS-443 lodged no more than the shorter Ripley (Table 1). Ripley consistently had lower pods than SS-443, although the 4.4 inch height measured in 1987 full season and 1988 double crop was not as low as some producers might expect for such short plants. Ripley yielded significantly more than SS-443 in 1987 full season and 1988 double crop. Yield differences in the other two studies did not differ between varieties. Ethephon reduced plant height when applied at either 4 leaf or 6 leaf stages, and that a further reduction in plant height was obtained when 0.25 lb/A was applied at both 4 leaf and 6 leaf stages (Table 2). In spite of reduced plant height, lodging was not influenced by ethephon. This could be a result of the low lodging pressure observed in these studies. Ethephon did not reduce lowest pod height or yield in our studies.

Stubble losses were worse for double crop soybeans than for the full season crop in 1988, but not in 1987 (Table 3). As expected, Ripley had greater stubble losses than SS-443. Use of ethephon did not increase stubble losses. This could have been expected since ethephon did not reduce lowest pod height (Table 2).

Conclusions

Ethephon reduced plant height, but did not affect lowest pod height. In our studies where lodging was not a problem, use of ethephon showed no effect on lodging. Although ethephon has some promise for lodging control, it is not currently labelled for use on soybeans. Planting shorter varieties (like Ripley or Essex) within a given Maturity Group would be the best current practice to use for reducing lodging in fields prone to this problem.

Kenneth L. Wells
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Table 1. Influence of year, planting date, and soybean variety on lowest pod height, plant height, lodging, and yield.

Year	Planting date	Variety	Lowest pod height	Plant height	Lodging[a]	Yield
			---inches---			bu/A
1987	FS[b]	Ripley	4.4	16	1.1	28.9
		SS-443	7.4	28	1.3	22.1
	DC	Ripley	5.6	20	1.0	18.4
		SS-443	7.0	22	1.1	14.2
1988	FS	Ripley	6.3	22	1.2	37.7
		SS-443	8.0	29	1.9	42.1
	DC	Ripley	4.4	18	1.0	27.6
		SS-443	6.5	22	1.0	21.8
		LSD(0.05)[c]	0.9	2	0.3	5.5

[a]Lodging score of 1.0 means all plants were standing straight up, while a score of 5 means that all plants were laying flat.

[b]FS, full season; DC, double crop.

[c]For comparing varieties within a year.

Table 2. Influence of ethephon on lowest pod height, plant height, lodging, and yield of soybeans (averaged across years, planting dates, and varieties).

Leaf stage at ethephon treatment	Lowest pod height	Plant height	Lodging[a]	Yield
	----inches----			bu/A
Untreated	6.5	23.6	1.2	27.0
4 leaf	6.3	22.0	1.2	26.6
6 leaf	6.0	21.8	1.2	27.0
4 and 6 leaf	6.0	21.1	1.1	25.7
LSD (0.05)[b]	NS[c]	0.7	NS	NS

[a]Lodging score of 1.0 means all plants standing straight up, while a score of 5 means that all plants were laying flat.

[b]LSD(0.05) for comparing ethephon means for each leaf stage treatment.

[c]NS, not significant

Table 3. Influence of year, planting date, variety, and ethephon on estimated stubble harvest losses of soybean.

Comparison	Treatment	Cutting height 2 inches	4 inches	6 inches
		----------	%[a]	----------
Year/planting date	1987 FS[b]	0.3	0.9	2.8
	1987 DC	0.2	0.9	3.7
	1988 FS	0.1	0.3	0.8
	1988 DC	0.7	2.8	5.6
	LSD(0.05)[c]	0.3	1.8	NS[d]
Variety	Ripley	0.5	2.0	4.8
	SS-443	0.2	0.4	1.6
	Sig. level	*	*	*
Ethephon	Control	0.2	0.9	2.4
	4 leaf	0.4	1.9	4.3
	6 leaf	0.4	1.0	2.9
	4 and 6 leaf	0.3	1.1	3.4
	LSD(0.05)	NS	NS	NS

[a]Percent of yield which would have been lost if combine was operated at the specified cutting height.
[b]FS, full season; DC, double crop.
[c]LSD(0.05) for comparing planting date/year combinations or ethephon treatments.
[d]NS, not significant; *, significant at 0.05 level.