LIGHT RELATIONS AND YIELD IN SHORT-SEASON SOYBEANS

Julie Willcott, Stephen J. Herbert and Lui Zhi-yi
Department of Plant and Soil Sciences
University of Massachusetts

As part of the ongoing soybean research at the Massachusetts Agricultural Experiment Station Farm in South Deerfield, in 1982 we looked at light relations, growth patterns, yield components, and yield for two varieties of short-seasoned soybeans grown under different cultural conditions.

In study one, Altona (maturity group 00) and Evans (maturity group 0) were grown in 20 inch rows at a density of 250,000 plants/acre. At the time of first flowering the two rows on either side of the center row were pulled away from the center row through the use of chicken wire fences placed at a 45° angle to the ground. The yield from the light enriched treatment was compared to that from a control treatment. For both treatments, Evans significantly outyielded Altona (Table 1). The light enriched treatments had a highly significant yield advantage over the control treatments. For Evans, there was 64% increase in yeild with light enrichment; for Altona, there was a 15% increase. Light enriched plants had signficantly more pods per plant and significantly heavier seeds than did the control plants. Variety had a highly significant effect on pods per plant and seed size; Evans had more pods per plant but lighter seeds than Altona. This study demonstrated the importance of light entering into the crop canopy for high yields.

Table 1 Yield and Yield Components of Altona and Evans Soybeans Provided With Extra Light From the Commencement of Flowering.

	ALTONA		EVANS	
	Control	Light Enriched	Control	Light Enriched
Yield per plant	7.7g	8.9	7.9	12.9
Pods per plant	20.4	21.9	25.9	36.2
Seeds per pod	2.23	2.33	2.36	2.33
Seed size (mg/seed)	168	176	134	154

In another experiment (study two), the same two varieties were grown in two row widths, 10 and 30 inches, and three densities, 101,100, 207,300 and 303,500 plants/acre. Evans out yielded Altona by 32% (Table 2). For both varieties, narrow rows out yielded wide rows and high densities yielded more than low densities. With narrow rows, lower planting densities were required to achieve a maximum yield than were required for wide rows. For narrow row Evans, there was no advantage to increasing the densitiy above 101,100 plants/acre; for narrow row Altona, the yield advantage of densities greater than 202,300 plants/per acre was slight. When Evans was grown in wide rows, the yield advantage to increasing the density above 202,300 plants/acre was slight; Altona grown in wide rows continued to increase yield with increasing density for all densities observed.

Table 2 Seed Yields as Influenced by Variety, Row Width and Plant Density

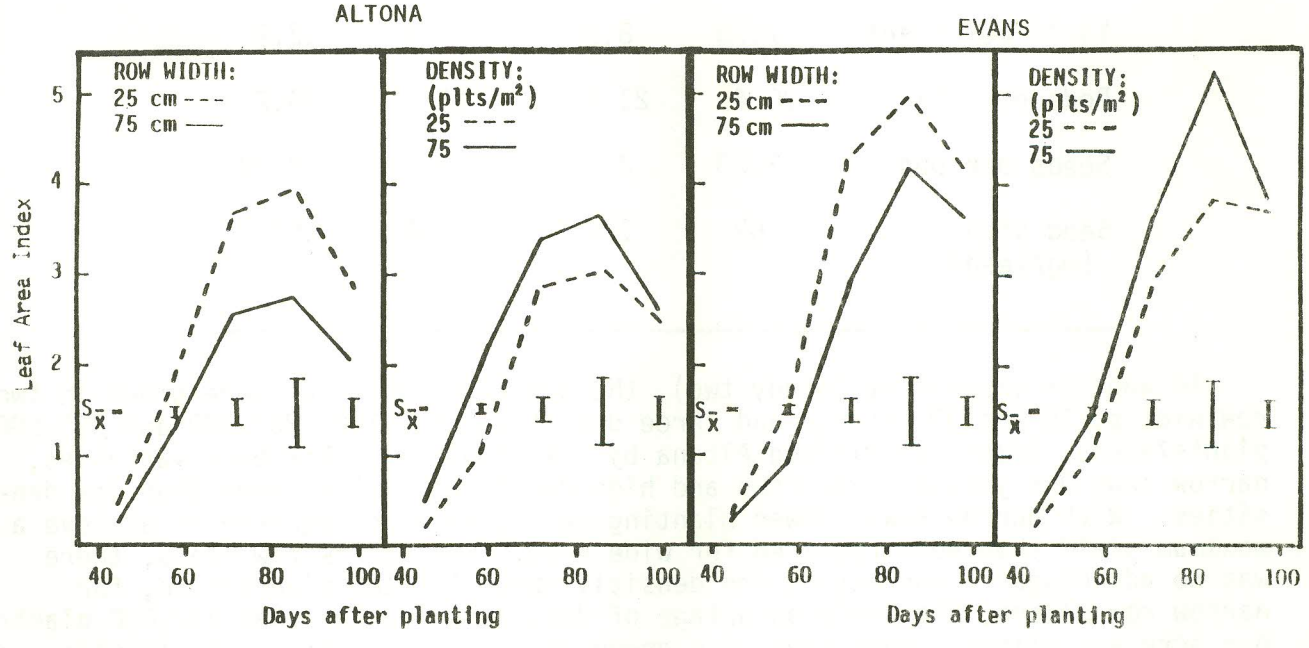
	Seed Yield[t]	
	Altona	Evans*
	- - - - (bu/acre) - - - -	
10 in row**		
low density	33	57
med	45	58
high	50	57
30 in row		
low density	32	36
med	34	48
high	41	53

* density significant at p = 0.05
** variety and row width significant at p = 0.01
[t] variety row width density interaction significant at p = 0.05

Yields were lower in 1982 than in previous years due to the unusually wet weather after planting. This weather had the same effect as a late planting; delayed emergence and therefore decreased vegetative growth and yield.

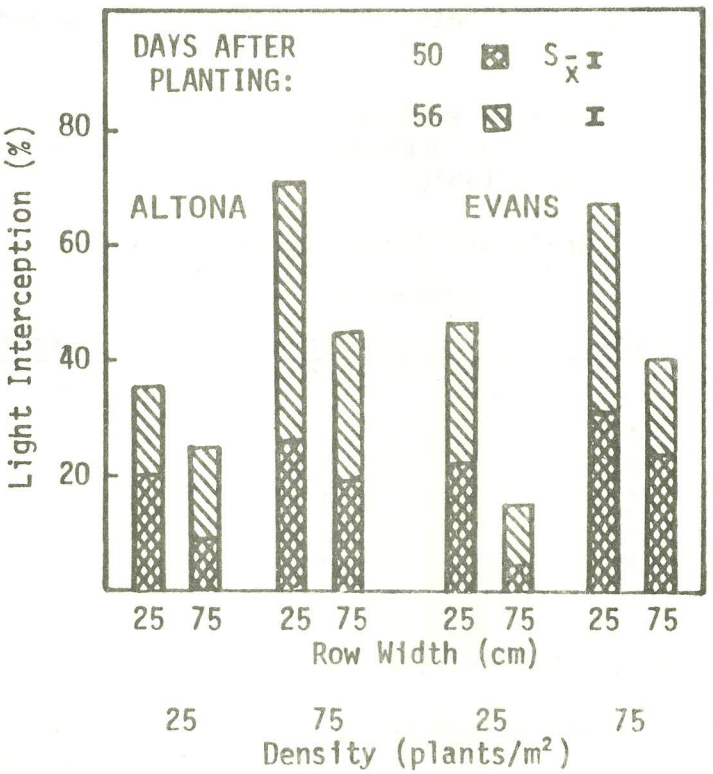
Leaf area index (LAI) is a measure of the available leaf area (i.e. photosynthetic surface) per unit land area. LAI was greater for narrow rows and high densities than for wide rows and low densities, respectively (Fig. 1). Evans had a greater LAI than did Altona.

Figure 1 Seasonal Leaf Area Index Accumulation for Altona and Evans Soybeans.



An increase in available leaf area can mean an increase in the amount of light intercepted. Measurements taken throughout the season showed this to be the case for our growing conditions. Narrow rows intercepted more light than did wide rows; high density treatments intercepted more light than did low density treatments (Fig. 2).

Figure 2 Percent Light Interception (as measured by across row readings) at 50 and 56 Days After Planting.



Increased light interception by the narrow rows and high densities made possible increased yield through the additional production of photosynthate. Cultural practices, such as narrow rows, which are advantageous in terms of yield may be so due to the increased light interception. Increased light levels, as shown by the light enrichment study, allow for an increased pod number per plant as well as a heavier seed.