SEED SIZE VARIATION IN SHORT SEASON SOYBEAN

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The extent of seed filling can be an important factor influencing final seed yield. Soybean field experiments in 1979 resulted in Evans soybean with an average seed size of 125 mg per seed. In 1980 seeds were 33% longer (Table 1) averaging about 166 mg per seed. Plant numbers per unit area pod members per plant and seed numbers per pod were roughly the same for equivalent cultural management treatments between years thus in 1980 yields were about 30% greater than yields in 1979.

Subsequent research has been conducted to examine the variation and stability of seed size under differing management systems. It has been learned that seed size in fairly constant across main axis node positions in short season soybean plants (H eta al, 1984). Soybean plants produce mostly 2 and 3 seeded pods but there is a small percentage of 1 seeded pods and an even smaller percentage of 4 seeded pods. It was found that the number of seeds in a pod had little effect on the size of each seed (fig. 1). A seed from a one seeded pod was similar in size to a seed from a 4 seeded pod. This suggests the supply of assimilates to filling pods was proportion to the number of seeds each pod contained. Since seed size wa relatively constant across row widths and densities (Table 1) the data (fig. 1) suggests assimilate supply to a seed was similar regardless of whether a node had many pods and thus many seeds at that node.

Table 1. Mean* seed yield components for Altona and Evans soybean in 1983.

	Control	LE_1**	LE_2	LSD Ø.Ø5
Yield per plant (g)	8.3	2Ø.3	12.6	3.4
Pods per plant	19.4	46.1	25.4	6.6
Seed per pod	2.26	2.39	2.43	Ø.Ø8
Seed size (mg./seed)	188	188	2Ø6	13

*Data are means for Altona and Evans since cultivar treatment interactions were non significant.

**Light enrichment commenced at the V5 growth stage (LE_1) 8 days prior to flowering and at the R_4 growth stage (LE_2).

Main axis nodes positioned near the base of these indeterminate soybean plants commenced rapid filling of seeds up to 20 days earlier than pods at nodes position near the top of the plant. The constant nature of seed size across nodes then also suggests assimilate supply to a seed is similar regardless of whether the seed developed in a pod at an early flowering period or later in ontogeny.

Given these relationships for seed size in short season soybeans within a given year we attempted to simulate seed size variations found between years. Two methods were use to induce changes in seed size between treatments within a given year. Both involved releasing target plants from some interplant competition compared to non treated control or check plants. The first method was one of natural light enrichment. Light enrichment was provided to a sample row of plants by training away neighboring rows of plants at an angle of 45° with wire mesh fences. The aim here was to lessen inter-row competition for light with less change in root competition. These light enrichment treatments then could be imposed at various times throughout the growth cycles.

The second method of releasing target plants from some interplant competition was by the removal of alternate rows of soybean from the field at different times throughout the season. The initial row spacing of 10 inches is then changed to 20 inches after alternate row removal. The remaining rows of soybeans are then released from some inter-row plant competition.

Fences in the light enrichment study were installed 10 days prior to flowering at the U5 (5 vegetative leaves) growth stage, and later fences were installed toward the end of flowering and early pod fill, the R4 growth stage. The effect of light enrichment on yield was to increase seed yield per plant with the greatest increase from enrichment commencing prior to flowering. Going from 8.3 g per plant for the control to 20.3 g with early enrichment and 12.6 g with enrichment at the R_4 reproductive growth stage. The component counting for much of this yield difference was pod number per plant. Enrichment prior to flowering more than doubled pod number while later enrichment commencing when most flowering was completed resulted in only a 31% increase in pod number. Seed number per pod showed only a small variation compared to pod number per plant or seed size. Light enrichment starting prior to flowering resulted in no change in seed size, while enrichment commencing when flowering was almost complete increased seed size from 188 to 206 mg per seed.

In the row removal study conducted in 1984 results (table 3) followed somewhat similar trends to results in the light enrichment study. Release from inter-row competition increased yield per plant. Percentage increases in yield were some what less than the early light enrichment treatment probably because complete canopy closure still occurred in treated plots with early row removal at the U5 growth stage. In light enriched

plots canopy closure was prevented by the fences. An increase in pod number per plant accounted for the increased yield of plants with row removal prior to flowering while an increase in seed size (38%) accounted for most of the increased yield of plant when removal occurred at the late flowering early pod fill growth stage.

Table 2: Mean seed yield components for Altona and Evans soybean in 1984 with alternate rows removed prior to flowering and during late flowering.

	Control	Row Removal (V5)	Growth Stage (R4)
Yield per plant (g)	4.9	7.7	7.7
Pods per plant	15.7	22.7	17.2
Seeds per pod	2.40	2.43	2.52
Seeds size (mg/seed)	130	142	180

The lack of an increase in seed size from the earliest light enrichment and row removal treatments suggests plants released from inter plant competition adjusted their load to the perceived environment in much the same way plants increase pod number at low densities compared to high densities without changes in seeds per pod or seed size. Where there was an increase in seed size from light enrichment or row removal it occurred across all nodes with seeds from all pods weighing about the same regardless of whether the nodes contained 1, 2, 3 or 4 seeds. There results then help to explain the constant nature of seed size for widely differing cultural managements within a given year and the variation in seed size found between years. The data suggests variation between years is closely related seasonal environmental conditions.