INFLUENCE OF SOURCE SINK MANIPULATION ON SOYBEAN SEED YIELD COMPONENTS

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Altona and Evans soybeans were planted to a density of 60 plants per m^2 in rows 50 cm apart at the Agricultural Experiment Station Farm in South Deerfield, Massachusetts. Normal cultural management practices were followed, the beans were inoculated with a granular soil applied peat based inoculum and weed control was achieved through the use of alachlor and linuron (Lasso and Lorox).

Defoliation and depodding treatments are illustrated in Figure 1 and were as follows:

(1) C - untreated check plants.
(2) CL - where the central leaflet was removed from each main axis leaf as it developed.
(3) ALP - where the trifoliate leaf and pods were removed from alternate main axis nodes.
(4) AP - where pods were removed from alternate main axis nodes.
(5) SP - where each main axis nodes had all but one pod removed.

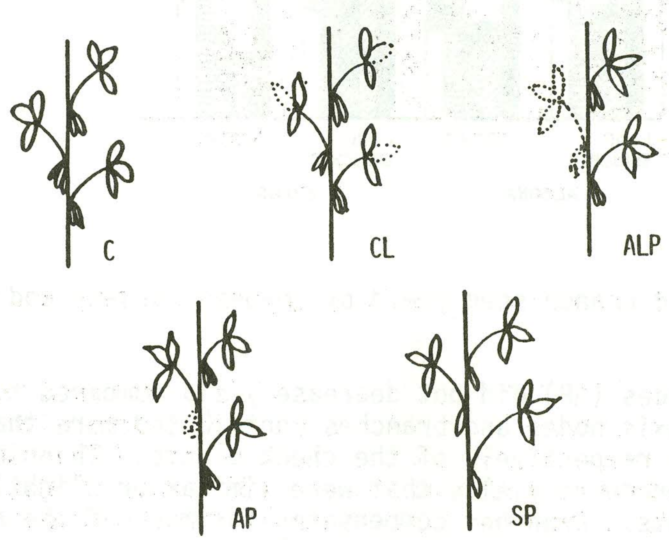

Figure 1. Defoliation and depodding treatments for Altona and Evans soybean in 1982.

These treatments were initiated at the onset of flowering (R1) for Altona which was 2 or 3 days prior to R1 for Evans. Also at this time in half the plots fences were positioned on either side of a center sample row sloping 45^{o} away from this sample row. These plots with the fences were called light enriched plots, where more light and perhaps CO_2 was introduced into the canopy of the sample row while changing less the competition among rows for the soybean root environment.

As shown in a previous paper, Evans was most responsive to light enrichment with an increased seed yield of 62% compared to control plants, while for Altona, light enriched produced only a 17% increase in seed yield per plant. An examination of the components of seed yield showed an increase in pod number per plant and a slight increase in seed size.

Seed yield per plant for checks and source-sink main are shown in Figure 2. Removing central leaflets (CLO or pods and trifoliate leaves from alternate (ALP) main axis nodes substantially reduced yields. Removing pods from

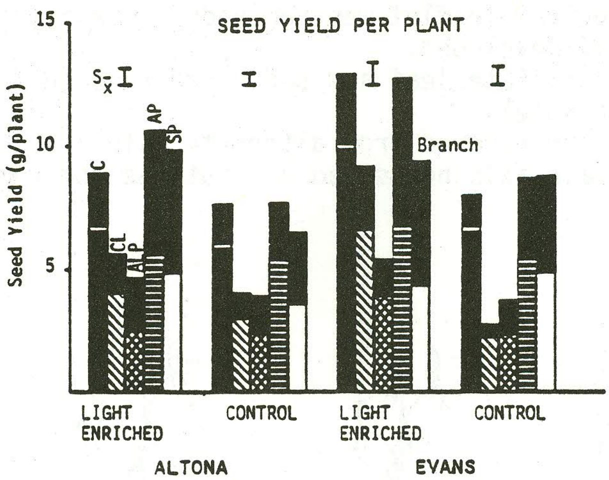

Figure 2. Mainstem and branch seed yield by soybean variety and treatment.

alternate main axis nodes (AP) did not decrease yield compared to check plants since remaining main axis nodes and branches contributed more than each main axis node and branches respectively of the check plants. Thinning pods to only 1 per main axis node produced yields that were similar or slightly reduced compared to check plants. Branches compensated for much of the reduced seed yield from main axis nodes compared to check plants.

Figure 3 shows the distribution of pods per plant between main axis nodes and branches. Figures 2 and 3 show a close similarity which means many of the seed yield responses due to source-sink manipulation and light enrichment resulted from changes in the number and pattern of distribution of pods on the plants. That is, the CL and ALP treatments reduced pod number per plant; removing pods only from alternate nodes (AP) did not reduce pod number because

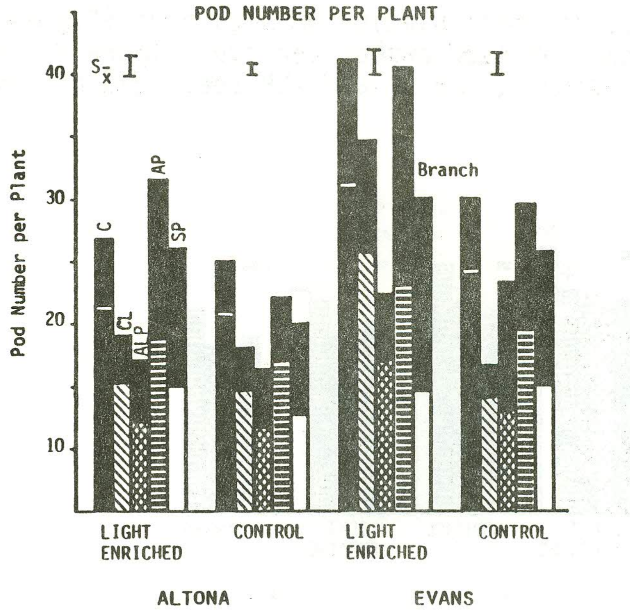

Figure 3. Mainstem and branch node fertility by soybean variety and treatment.

of increased pods mainly from branches; and thinning to a single pod on main axis nodes (SP) had variable results compared to check plants.

The effects of light enrichment and source-sink manipulation on seed number per pod (Figure 4) were smaller relative to changes in pod number per plant. Some differences, although small, were significantly different, and

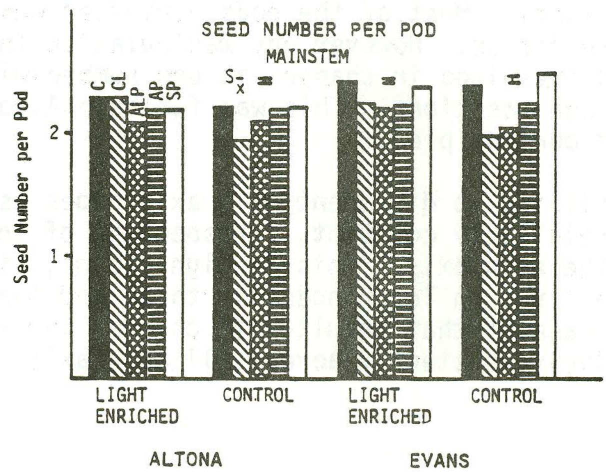

Figure 4. Mean seed number per pod for mainstem pods, by soybean variety and treatment.

there was a slight suggestion that light enrichment helped compensate for the removal of leaflets and leaves.

The effect of source-sink manipulation on seed size (Figure 5) did result in some larger changes than for seed number per pod (Figure 4), but also some close similarities. For example, the CL and ALP seeds did not greatly differ

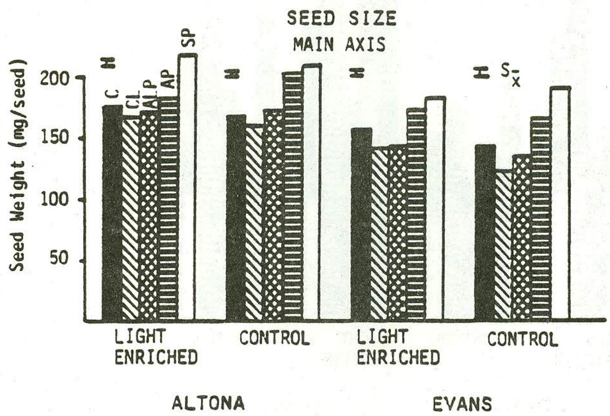

Figure 5. Mean seed size for mainstem seeds, by soybean variety and treatment.

in size from seeds from check plants, suggesting plants had earlier regulated sink size so each seed could be filled. Reducing sink size on the main axis throughout the flowering and podding period resulted in increased seed size of remaining seeds, especially for the SP treatment.

Figure 6 shows the distribution of main axis pods across main axis node positions in the soybean plants. Most of the pods harvested were from the lower-central region of the plants. However any manipulation in terms of removing leaves and/or pods resulted in changes in pod number with the response being evident across all node positions. This was for both Altona and Evans, both in light enriched and control plots.

Seed size for seeds filling at different main axis nodes is shown in Figure 7. Seed size was relatively constant, irrespective of the point of attachment of the pod to the main axis. This is significant, since pods form and seeds commence filling first on lower nodes in these indeterminate soybeans. Further, any treatment that resulted in changes in seed size had these changes occur relatively constantly across all main axis nodes.

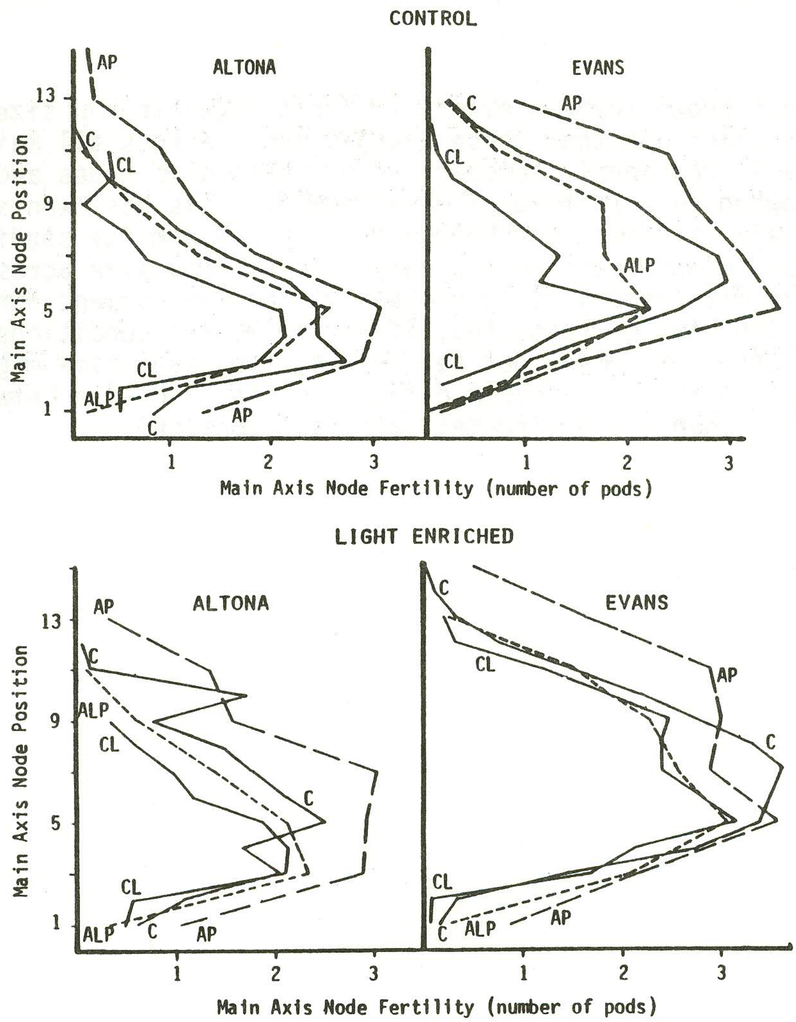

Figure 6. Mainstem node fertility by soybean variety and treatment.

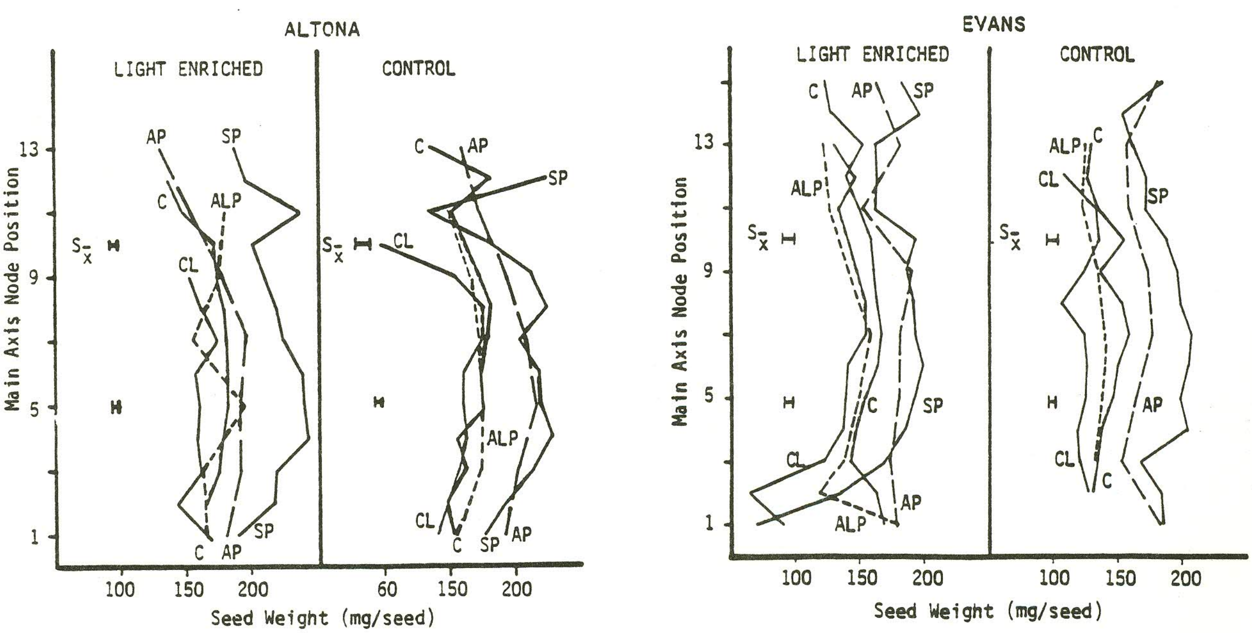

Figure 7. Mean seed weight of mainstem seeds, by soybean variety, treatment node position.

This paper has shown soybean plants to first regulate sink size by changes in pod number per plant and that these changes occur across all main axis nodes. Seed size is reasonably constant across main axis nodes and for branches within plants growing in a particular environment. This has been shown even for plants of widely different morphology as in plant density studies, where plants from low and high densities had very similar seed size across nodes. However, seed size was responsive to changes in the environment during the filling period. The results suggested, if environmental conditions for seed filling improved after the major pod set period, then seed size might be increased. Such results help explain differences in seed size between years where factors other than the environment are held constant.