

SOURCE-SINK RELATIONSHIP IN A CLIMBING POLE BEAN (*Phaseolus vulgaris* L.):
ITS EFFECT ON YIELD

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In beans the size of the source during flowering and grain filling stages has been known to limit the grain yield. Most of this information, has been obtained in determinate and indeterminate types of beans (types I, II & III). Limited information was available for type IV. The objective of the present work was to explore, in a climbing pole bean (type IV), the source-sink relationships after flowering, and its effect on grain yield.

MATERIALS AND METHODS. A pole bean with 150 days cycle (Cv. Negro 150) was planted at Chapingo, México (19°30'N, altitude 2200 m), in a randomized block design with four replications. The experimental plot consisted of four rows 0.8 m apart and 5 m long. Plants on the row were 15 cm apart. The population density was 7.8 plants m⁻². Fertilizer was applied before planting at the rate of 100-100-40.

One cane of *Arundo donax* (3 m high) was provided as a trellis for every five bean plants. This arrangement had been determined as favorable for growth in previous years. For the various treatments the two lateral leaflets were removed from every leaf, at one date, as follows: Treatment 1) Ten days before the beginning of flowering (65 days after planting); Treatment 2) At the beginning of flowering (80 days after planting); Treatment 3) Ten days after the beginning of flowering (95 days after planting); Treatment 4) Control. Intact plants.

The beginning of flowering (at 75 days of age) was taken as the date when 50 percent of the plants in the population had at least one flower. The flowering period lasted 30 days. Samples were taken at five dates: 81, 98, 116, 130 and 150 days after planting. Dry weight of leaves stems, and reproductive organs, were recorded. Grain yield was expressed at 12 percent water content.

RESULTS: No significant difference in yield was found among treatments one, three and four. There was a significant difference in yield between treatments two and four (control). Therefore, only the data for these last treatments will be presented.

The grain yield was 518.5 gm⁻² for treatment two and 403.6 gm⁻² for the control. Their harvest indices were 60.2 percent and 56.3 percent, respectively, indicating a higher efficiency for the treatment two as compared to the control. Yield components which were most correlated to yield ($r=0.9$) were number of normal pods and of empty pods (those in which all seeds aborted). On the other hand, the number of aborted seeds in normal pods did not affect yield.

Dry weight of vegetative parts (stem, petiole and leaf lamina) and of reproductive parts (flower buds, inflorescences, pods and seeds) was recorded and is presented in Figure 1. Leaf lamina accounted for forty percent of the vegetative parts, dry weight. Up to 120 days of age the dry weight of the vegetative parts was higher in the control than in treatment two. The exuberant growth in the control produced a high degree of

self-shading which might have limited yield. Afterwards this relationship was reversed, with a higher dry weight of treatment two probably contributing to the better grain filling. All in all, the amount of source represented by leaves (40 percent of total dry weight), in treatment two was sufficient to produce a good yield.

On the other hand, after 120 days, the dry weight of reproductive organs increased at a higher rate in treatment two as compared to the control, accounting for its higher yield. There was also a greater decrease in dry weight of stems (not shown in figure 1) in treatment two, which might point to a higher rate of translocation of transient photosynthates to the reproductive organs.

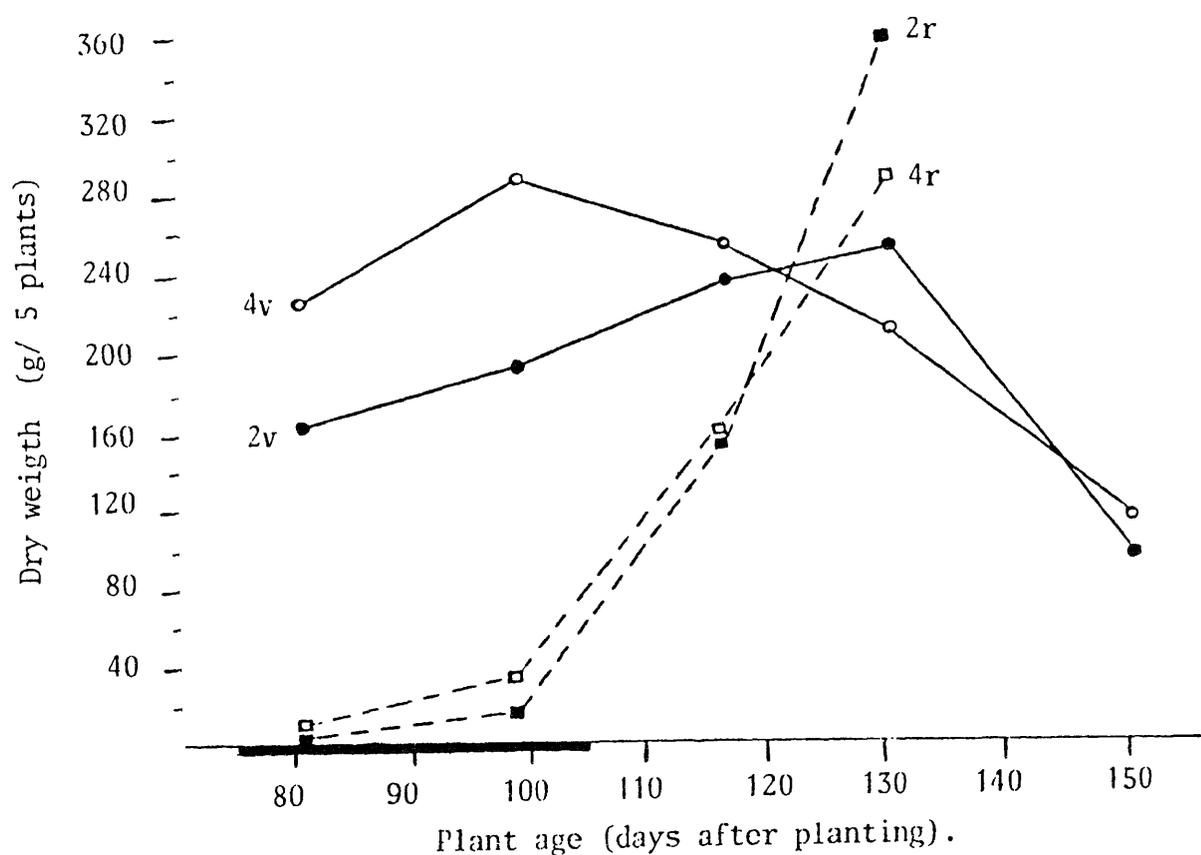


Fig. 1. Dry weight relationships between vegetative and reproductive parts of bean. (2v) Treatment 2, vegetative organs; (4v) Treatment 4 (control), vegetative organs; (2r) Treatment 2, reproductive organs (4r), Treatment 4, reproductive organs.