

Research Note

COMPETITIVENESS OF SMOOTH PIGWEED, LARGE CRABGRASS AND SNAP BEAN UNDER GREENHOUSE CONDITIONS¹

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Large crabgrass [*Digitaria sanguinalis* (Scop.) L.] and smooth pigweed (*Amaranthus hybridus* L.) are common weeds in both temperate and tropical areas. Both are considered among the worst weeds in the world (Holm et al., 1977). Little is known about the competitiveness of large crabgrass and smooth pigweed growing with snap bean under field and greenhouse conditions. Information about weed competition may provide better understanding of the aggressivity of these two weed species. The objective of this study was to compare competitiveness of large crabgrass, smooth pigweed and snap bean under greenhouse conditions.

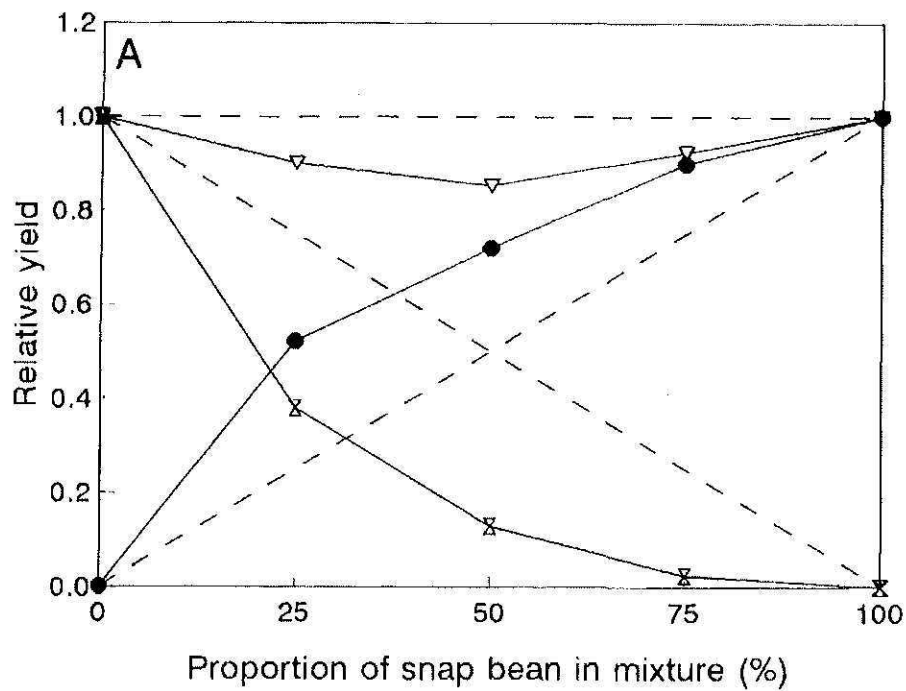
A replacement series study was used to determine the relative competitiveness of these three species. Two separate replacement series were included: snap bean versus large crabgrass, and snap bean versus smooth pigweed. Large crabgrass, smooth pigweed and snap bean were grown in monoculture and in mixed populations in 25-cm diameter plastic pots filled with a silt loam soil. The soil pH was 6.1 and organic matter content was 1.0%. Each series consisted of two monocultures and three mixtures (ratios). Planting ratios were 75:25, 50:50 and 25:75. For both monocultures and mixtures, planting density was four plants per pot. A randomized completely block design with eight replications was used. Plants were harvested five weeks after their emergence by cutting one cm above ground level. Plant dry weight was determined after drying at 34°C for 72 hours. Relative yields (r), relative yield total (RYT) and aggressivity (A) were calculated according to the following formulae (Satorre and Snaydon, 1992):

$$\begin{aligned} \text{relative yield; } r_a &= X_{ab}/X_{aa} \\ \text{relative yield total; RYT} &= r_a + r_b \\ \text{Aggressivity; } A &= (r_a - r_b)/\text{RYT} \end{aligned}$$

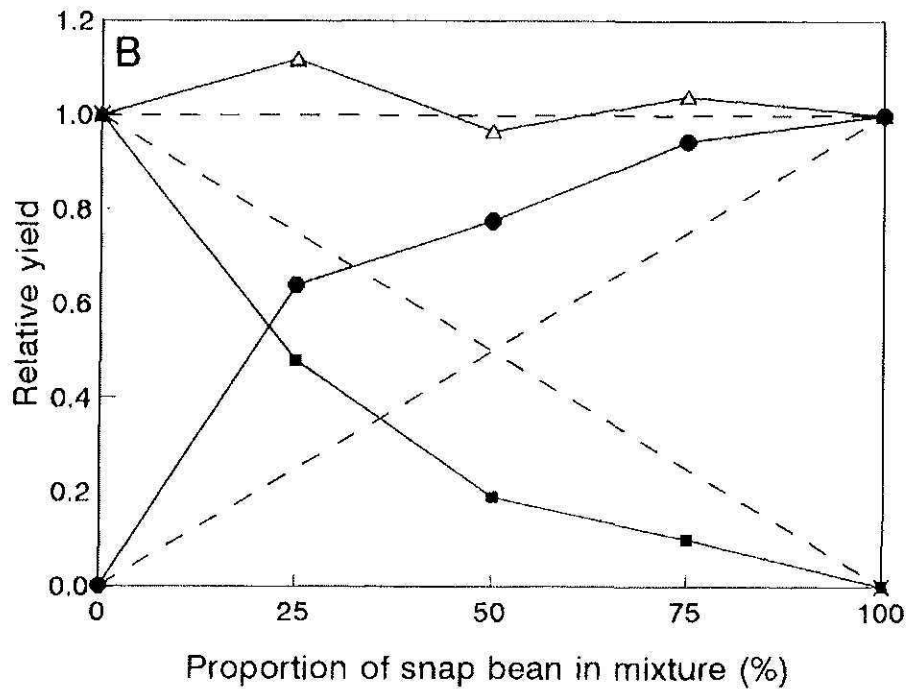
where r_a and r_b are relative yields of species a and b , respectively; X_{ab} is the yield of species a in mixture with species b ; X_{ba} is the yield of species b grown in mixture with species a ; X_{aa} and X_{bb} are monoculture yields of species a and b , respectively. Competitive ability was measured by aggressivity, which takes into account the effect of competition on both the crop and the weed (Satorre and Snaydon, 1992). Replacement diagrams for all replacement series are illustrated in Figure 1 (A and B). These diagrams are interpreted on the basis of the shape of the curve produced by each species in the series. The existence of a competitive relationship is indicated where the curve for one species is convex and for the other species concave. Mutually stimulatory and antagonistic relationships are indicated when the curves are convex or concave, respectively (Harper, 1977).

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● snap bean × large crabgrass ▽ relative yield total - - - theoretical values



● snap bean ■ smooth pigweed △ relative yield total - - - theoretical values

FIGURE 1. Replacement diagrams for snap bean versus large crabgrass (A) and snap bean versus smooth pigweed (B). Dashed lines represent theoretical relative yields in the absence of competition between species.

Relative yield of snap bean was greater, and that of large crabgrass was less, than the expected yield (Figure 1A). The same trend was observed in the snap bean and smooth pigweed diagram (Figure 1B). The diagram shows that the snap bean was more competitive than either large crabgrass or smooth pigweed. Values of aggressivity indices provide a quantitative measure of competitiveness. Aggressivity indices for snap bean versus large crabgrass, and snap bean versus smooth pigweed, were 0.70 and 0.64, respectively. No significant differences were observed between the two aggressivity indices.

This result indicates that snap bean was equally aggressive to both weeds. Snap bean characteristics, such as a relatively large cotyledon, rapid emergence and larger leaves during the first two weeks after emergence, provide mechanisms of competition for snap bean to be a more competitive species under the conditions studied (Lugo, 1993).

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