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EFFECT OF POPULATION DENSITY IN THE YIELD COMPONENTS OF A SHORT POLE BEAN (P. vulgaris L.) and SCARLET RUNNER BEAN (P. coccineus L.)

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The knowledge of yield components is useful both for plant breeding work and to discern the best agronomic management in beans. Studies of yield components of indeterminate beans cultivated with trellises, are sparse and incomplete.

The present work examines, at the level of the individual plant and of the population, 1) the effect of various population densities on: biomass, yield and yield components; 2) the differences in plant morphology at maturity. The work was conducted from April to October 1977 at Chapingo, Mex, which has temperate subhumid climate with 640mm average yearly rainfall and is at 2240m altitude.

A short pole bean P. vulgaris L. "Flor de Mayo" (from Zacatecas state), and a long stemmed (more than 4m) scarlet runner bean ("ayocote") P. coccineus L. X-16432, from Tlaxcala, were planted at 8.3, 5.2 and 3.8cm between plants, in rows 1.2m apart, giving populations equivalent to 10, 16 and 22 plants per square meter. NPK fertilizer at 100-100-60 was applied and supplemental irrigation provided.

The plants were trained to 4m trellises made with Arundo and bamboo poles, wire and cotton string.

A statistical design with 4 replications was used. For the yield data, each useful plot consisted of two 5-meter central lengths of row. For the data of biomass and yield compoenents a 2-meter of row from the yield-data plot was sampled.

Results and Discussion: At the level of individual plant, biomass (of aerial portion) and seed yield decreased as population density increased. The decrease in seed yield was due to the lower number of pods with seeds at harvest. Other components such as the number of seeds/pod and seed size (weight of 100 seeds), did not change significantly. Also unaffected by changes in population density were those factors that usually are responsible for the decrease in seed yield such as: percentage of abscissed reproductive organs (buds, flowers, young pods), percentage of aborted seeds, and percentage of those pods which remain attached to the plant up to the harvest time but with all seeds aborted ("seedless pods"). No effect of population density was detected in the partition percentage dry weight among the various aerial organs of the plant.

At the population level, the increase in density did not significantly affect: a)biomass production (dry weight/m^2); and b)seed yield/m^2. One factor to explain this might be that, at low densities, the decrease due to the smaller number of plants/m^2 was compensated by the higher yield per plant.

The average yield (with 10% humidity) in P. vulgaris was 330 g/m^2 (life cycle 144 days; days to flowering, 63). In P. coccineus it was 100 g/m^2. The low yield in P. coccineus might be ascribed to the fact that all the densities tried encouraged a very luxurious vegetative growth (life cycle 202 days; initiation of flowering at 100 days), and consequent heavy mutual shading of plants.

P. vulgaris plants had a main stem of 15-20 nodes. Most of the inflorescenses were borne in the primary branches of the first six or seven nodes. The plants were 1.6m high and at no time competed very much for light. The main stem of P. coccineus had some 35 nodes. The number of primary branches was influenced by the population density (11, 9, and 2 branches in the lowest, intermediate and highest density).

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VARIETAL RESPONSE OF SNAP BEANS TO PEANUT STUNT VIRUS

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Since the late 1960's, intermittant outbreaks of virus diseases have occurred in snap beans in the Middle Atlantic and Southeastern States of the United States. During this same period, several workers have identified Peanut Stunt Virus (PSV) as causing a disease of snap beans in this region.

Since the early 1970's, we have been sampling bean plots and fields in the States of New Jersey, Maryland, and Delaware and have had samples sent to us from commercial fields in those States and in Pennsylvania. From 1971 to 1977, of approximately 160 virus isolates, 50% were identified as PSV, 40% as Bean Yellow Mosaic Virus, and 10% as other viruses (Bean Common Mosaic Virus, Cucumber Mosaic Virus, etc.). Identification of PSV isolates was by host symptoms and serology (serology tests were performed by Dr. Howard Waterworth).

Previous workers have reported that all bean cultivars are susceptible to PSV, although type of symptoms differ. However, it has appeared to us that in commercial fields, certain cultivars were more heavily damaged than others. Furthermore, when we inoculated limited numbers of cultivars in the greenhouse with PSV, symptoms ranged from very severe on some cultivars to very mild on others. These observations have led us to assess a large number of snap bean cultivars in the greenhouse for reaction to PSV.

Bean plants, 3 to a 10 cm plastic pot, were inoculated mechanically a week after planting by rubbing the primary leaves, previously dusted with carborundum, with buffered crude sap extracted from infected plants. After approximately three weeks, plants were rated on the basis of severity of symptoms and degree of stunting as:

Resistant - Leaves with mild mosaic symptoms, little or no deformation; flowers and pods normal or nearly normal; plants normal in size or, if free of symptoms, slightly stunted.