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# RESPONSE OF COWPEA (VIGNA UNGUICULATA (L), CULTIVAR ARAUCA, TO PLANTING DENSITY

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## ABSTRACT

Seed yield in Vigna unguiculata (L.). Cultivar Arauca was investigated over five planting densities ranging from 22,784 to 273,403 plants per hectare. Maximum seed yield (1466 kg/ha$^{-1}$) was attained at a relatively low density of 45,567 plants ha$^{-1}$ (spacing 24.0 cms by 91.4 cms.). At higher densities reduced numbers of pods per plant resulted in severe seed yield reduction but not as critical as the lower density. Little change in seed size or seeds per pod occurred.

## INTRODUCTION

Traditionally cowpea, Vigna unguiculata (L.), has been one of the major food legumes cultivated in Barbados, with seventy five percent of produce being consumed dry, (F.A.O. Report, 1977). Dry seed yields average 1,125 kg/ha$^{-1}$ over the 184 ha cultivated annually. The crop consisting of Black eye and Roundcifer (brown) types, is exclusively multiple cropped with sugarcane (Saccharum officinarum (L.).

The advent of improved germplasm necessitates delineation of its agronomic parameters consistent with incident environmental conditions. The present investigation was undertaken to ascertain the response of a new cowpea cultivar, Arauca, to plant density under rain-fed conditions in Barbados. Plant densities evident in this study result from varying intrarow spacings on a ridge and furrow cultivation system.

## MATERIALS AND METHODS

Seed yield responses to planting densities in Vigna unguiculata were examined using cultivar Arauca, (buff coloured seed, determinate and erect), imported from Venezuela in 1975. The experiment, hand-planted on a ridge and furrow system on October 29, 1980, examined yield responses using five (5) spacings varying from 48.0 cm by 91.4 cm to 4.0 cm by 91.4 cm (Table 1).

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This study, conducted under rainfed condition at Codrington Agricultural Research Station, Barbados, was based on a randomized block design with four replicates. Precipitation during the experimental period totalled 205.5 mm (October 11.0 mm; November 102.0 mm; December 84.0 mm; January 8.5 mm).

Table 1.--Sampling area allocation for seed yield determinations at varying densities of Vigna unguiculata

| Planting density (No. plants $ha^{-1}$) | Spacings (cm x cm) | Area for Seed Yield | | No. of Plants |
|---|---|---|---|---|
| | | $M^2$ | % plot | |
| 22,784 | 48.00 x 91.4 | 58.52 | 50% | 133 |
| 45,567 | 24.00 x 91.4 | 58.52 | 50% | 267 |
| 68,351 | 16.0 x 91.4 | 58.52 | 50% | 400 |
| 136,702 | 8.0 x 91.4 | 58.52 | 50% | 800 |
| 273,403 | 4.0 x 91.4 | 58.52 | 50% | 1,600 |

Seed was harvested on January 14, 1981, seventy eight (78) days after planting, when all pods had ripened. All pods were counted and then threshed to obtain the seed.

Seed yield per hectare, based on oven dried seed weight, (30°C for 24 hours), was calculated from the plot area harvested. The components of seed yield measured were the number of pods per plant, the number of seeds per pod and seed size. The latter was the mean weight (g) of one hundred seeds.

## RESULTS

The highest seed yield of 1,466 kg/$ha^{-1}$ obtained at a density of 45,567 plants/$ha^{-1}$ (24.0 cm by 91.4 cm) differed significantly from the yield produced at all other plant densities except 1,451 kg/$ha^{-1}$ achieved at 68,351 plants/$ha^{-1}$ (16.0 cm by 91.4 cm), Figure 1.

A 66 percent increase in yield was observed when density was increased from 22,874 plants/$ha^{-1}$ to 45,567 plants/$ha^{-1}$. Thereafter a slight decrease was followed by a sharp decline at higher densities. The lowest seed yield 882 kg/$ha^{-1}$ was significantly lower than those obtained at all other plant densities.

Significant reductions in the number of pods $plant^{-1}$ occurred with increasing plant density, but between density, differences in seed size

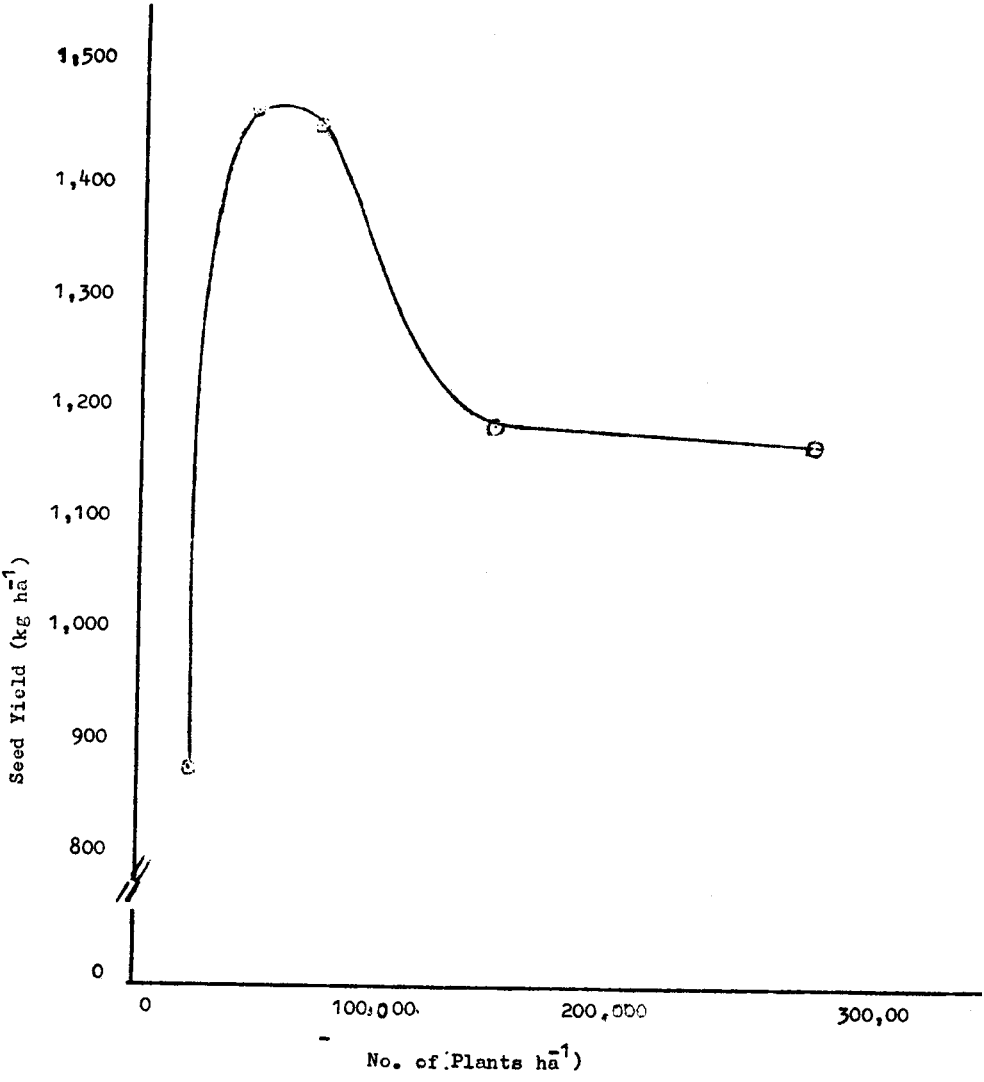


Figure 1. Seed yield per hectare as a function of the number of V. unguiculata plants per hectare

and the number of seed/pod were negligible (Table 2). The number of pods per plant was negatively associated with plant density (r =-0.834**). The relationship was probably the result of reduced plant development with progressively increasing plant densities.

Table 2.--Effect of plant density on seed yield component of V. unguiculata

| Treatment | No. plants $ha^{-1}$ | Plants contributing to seed yield | No. Seeds $Pod^{-1}$ | Weight (g) 100 seeds | No. Pods $plant^{-1}$ | Seed Yield |
|---|---|---|---|---|---|---|
| | | | | | | $kg/ha^{-1}$ |
| 1. | 22,874 | 133 | 9.00 | 16.27 | 26.33 | 882 |
| 2. | 45,567 | 267 | 11.25 | 15.41 | 19.10 | 1,466 |
| 3. | 68,351 | 400 | 10.25 | 16.21 | 12.33 | 1,451 |
| 4. | 136,702 | 800 | 8.75 | 16.17 | 6.08 | 1,188 |
| 5. | 273,403 | 1,600 | 10.25 | 14.59 | 2.86 | 1,174 |
| LSD:5% | | NSA | 1.63 | 1.39 | 2.74 | 22 |
| 1% | | | 2.28 | 1.95 | 3.84 | 32 |

[a]Not statistically analyzed.

## DISCUSSION

The seed yield/density relationship was similar to those described by Lang et al. (1956) and Akinola and Whiteman (1975) for maize and pigeon pea respectively. The yield per hectare trend suggests that lower yields would be anticipated at densities higher and lower than 45,567 plants $ha^{-1}$ under the conditions of this experiment. At higher densities the reproductive performance as measured by the number of pods per plant was adversely affected. Observations indicate that plant mortality in the stand at the incidence of powdery mildew (Erysiphe polygoni, increased qualitatively with increasing plant density. Possibly at the lowest density the maximum individual plant development for the genotype in that environment was achieved.

The recommended densities for seed production as reported for V. unguiculata are 55,556 plants $ha^{-1}$, 30.0 cm by 60.0 cm, (Acland 1971) and 172,676 to 215,278 plants 76.0 to 91.4 cm by 5.1 to 7.6 cm, (Purseglove 1974). Estimated yields indicated were 340 to 450 kg $ha^{-1}$ and 672 to 1,120 kg $ha^{-1}$, respectively. These yields vary from the findings in the present study and differ from current practice in Barbados where a density of 28,716 plants $ha^{-1}$ on a ridge and furrow system is characteristic. (Two rows per ridge,

spacing of 152.4 cm by 45.7 cm.). These differences recorded may be due to genotype, environment, or both.

Although a plant density of 45,567 plants $ha^{-1}$ gave maximum yield in cultivar Arauca when sown in October, this would not necessarily be the optimum planting density for other planting dates or cultivars. Further research is being undertaken into planting date/density/genotype interaction.

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