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Effect of Plant Geometry on the Growth, Yield and Economics of *Rabi* - Pigeonpea (*Cajanus cajan (L.) Millsp*)

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ABSTRACT: *A field experiment was conducted during the* rabi *season of 2011-2012 at Tamil Nadu Agricultural University, Coimbatore to study the response of Co (Rg) 7 pigeonpea at* rabi *season with different planting geometry. The results revealed that closer spacing of 45 x 30 cm with population of 74,074 plants ha^{-1} recorded maximum plant height and significantly higher grain yield of 1059 kg ha^{-1}. However number of branches per plant, stem girth and yield attributes like number of pods per plant were higher in wider spacing of 90 x 45 cm with the population of 24,691 plants ha^{-1}. This study indicates that Co (Rg) 7 pigeonpea has better response to closer spacing of 45 x 30 cm at* rabi *season and higher B:C ratio.*

Key words: *Pigeonpea, Co (Rg) 7, Planting geometry*

INTRODUCTION

Pigeonpea *(Cajanus cajan (L.)* Millsp.) is the second most important pulse crop cultivated in the semi-arid tropics of India. It occupies an area of 3.53 m. ha with an annual production of 2.46 m. t (FAO STAT., 2010). The productivity of pigeonpea in India is 723 kg ha^{-1}. The availability of new short duration and extra-short duration cultivars with wide adaptation and hybrids makes it possible to grow pigeonpea as a sole crop and also in rotation with winter crops in the area where pigeonpea is not traditionally cultivated. Pulses are grown under irrigated condition either as intercrop , mixed crop or sole crop during *adi pattam* (June-July) and *purattasi pattam* (September- October) and as sole crop during chitrai pattam (February-March) in different parts of Tamilnadu. *Rabi* pigeonpea could be successfully extended and introduced in areas where winter temperatures are mild. Pigeonpea as a *rabi* crop can be introduced in the lands vacated by *kharif* maize, rice, millets, etc. To take advantages of north east monsoon in Tamil Nadu during September – November, *rabi* pigeonpea can be sown early in September. Pigeonpea at relatively high population densities could have considerable potential as a winter crop in peninsular India (Narayanan and Sheldrake, 1979). Among the different agronomic practices, date of sowing, crop geometry (row to row spacing, plant geometry) and plant population for a particular cultivar and crop management practices plays an important role in determining the yield in pigeonpea. Hence this trial was under taken to study the effect of varied plant population on short duration pigeonpea Co (Rg) 7 to realize maximum yield level under *rabi* season.

MATERIAL AND METHODS

A field experiment was conducted at Millet Breeding Station of Tamil Nadu Agricultural University, Coimbatore during *Rabi* 2011-2012 under rainfed condition to study the effect of plant geometry on Co (Rg) 7 redgram. The treatments were laid out in randomized block design with three replications. The experiment consists of eight treatments with four row to row spacing (45, 60, 75, 90 cm) and two plant to plant spacing (30, 45 cm). The soil is clay loam with pH of 8.17. Observation was recorded in five randomly tagged plants.

RESULT AND DISCUSSION

Growth Parameters

Planting geometry had significantly influenced the growth parameter viz., plant height, number of branches, stem girth and dry matter production. The maximum plant height (128.7cm) was recorded in

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closer spacing of 45 x 30 cm. The increase in plant height at closer spacing was because of increased inter plant competition for light, while less space available for growth of each plant. The increased plant height leads to smaller and thinner stalks leading to lesser dry matter per plant at closer spacing. These findings are in agreement with Mahajan *et al.* (1997).

At wider spacing of 90 x 45 cm, plants tend to develop more number of branches per plant (8.5) it may be attributed to better spread and canopy width as a result of increased availability of space for each plant. But in narrow row spacing of 45 x 30 cm recorded lower number of branches (7.1) per plant. The decrease in the number of branches at closer spacing may be due to decreased space plant per plant and severe interplant competition. Similar finding was reported by Srinivasan *et al.* (1997).

Wider spacing of 90 x 45 cm recorded higher stem diameter (3.74 cm). Stem diameter increased sharply with the low plant population whereas, it showed a linear response to increased plant population. This may be due to photosynthate supply to stem was reduced under higher plant population. This result in close conformity with finding of Singh and Kush (1980).

The total dry matter production (3499 kg ha^{-1}) was higher in closer spacing because of increased population density of 74074 plants ha^{-1} when compared with wider spacing of 24,691 plants ha^{-1}.

Table 1
Effect of Planting Geometry on Growth Parameters of Co (Rg) 7 pigeonpea during *rabi*, 2011

Treatment	*Plant height (cm)*	*No. of Branches per plant*	*Stem-girth (cm)*	*Total Drymatter production (kg ha^{-1})*
T_1 - 45 x 30 cm spacing	128.7	7.1	2.75	3499.0
T_2 - 45 x 45 cm spacing	127.0	7.1	3.01	2911.4
T_3 - 60 x 30 cm spacing	122.2	7.2	3.28	3060.8
T_4 - 60 x 45 cm spacing	121.3	7.3	3.29	2460.5
T_5 - 75 x 30 cm spacing	119.9	7.5	3.29	2781.9
T_6 - 75 x 45 cm spacing	119.8	8.0	3.33	2053.7
T_7 - 90 x 30 cm spacing	116.5	8.2	3.47	2562.6
T_8 - 90 x 45 cm spacing	116.0	8.5	3.74	1912.0
SEd	3.24	0.38	0.18	175.4
CD (P=0.05)	6.77	0.80	0.38	366.5

Physiological Character

Yield Components and Yield

Planting geometry significantly influences the yield and yield components of pigeonpea (Table 2). Wider spacing recorded higher number of pods $plant^{-1}$ than the closer spacing. The increase in number of pods $plant^{-1}$ at wider spacing was because of reduced inter plant competition for light, water and nutrient as more space was available for growth of individual plant. This result are in conformity with the findings of Mahajan *et al.* (1997) , Srinivasan *et al.* (1997) and pavan *et al.* (2009). But there was no significant influence on 100 seed weight.

Among the different spacing tried, closer spacing of 45 x 30 cm recorded significantly higher grain yield (1059 kg ha^{-1}) than the wider spacing of 90 x 45 cm. This might be due to more plant population per unit area (74,074 plants ha^{-1}) in closer spacing. These results are in accordance with Parameswari *et al.* (2003).

A significant difference in stalk yield of pigeonpea was noticed among various spacing. The highest stalk yield of 2329 kg ha^{-1} was recorded in pigeonpea at the spacing of 45 x 30 cm. Nagamani *et al.* (1995) also recorded the highest stalk yield with more number of plants per hectare.

Table 2
Effect of Planting Geometry on Yield Components and Yield of Co (Rg) 7 pigeonpea during *rabi*, 2011

Treatment	*No. of pods $plant^{-1}$*	*100 seed weight (g)*	*Grain yield (kg ha^{-1})*	*Stalk yield (kg ha^{-1})*
T_1 - 45 x 30 cm spacing	49.3	8.53	1059.0	2329.8
T_2 - 45 x 45 cm spacing	61.3	8.86	857.2	2009.6
T_3 - 60 x 30 cm spacing	52.6	8.81	914.4	2106.6
T_4 - 60 x 45 cm spacing	66.9	8.75	729.3	1714.0
T_5 - 75 x 30 cm spacing	67.1	8.77	814.6	1871.4
T_6 - 75 x 45 cm spacing	70.2	8.86	610.8	1413.7
T_7 - 90 x 30 cm spacing	74.3	8.99	745.2	1788.5
T_8 - 90 x 45 cm spacing	83.6	8.12	554.1	1347.9
SEd	4.74	0.32	46.9	110.9

Economics

Among the various spacing treatments, pigeonpea raised with closer spacing recorded higher gross return (₹ 38696 ha^{-1}), net return 20914.91 ha^{-1} and benefit cost ratio (2.18). The higher gross return, net return and B:C ratio of pigeonpea at closer spacing was mainly attributed to significantly higher grain yield may be due to higher plant population. Similar result was reported by Islam *et al.* (2008).

Table 3
Effect of Planting Geometry on Economics of Co (Rg) 7 Redgram during Rabi, 2011

Treatment	*Cost of cultivation (₹ha-1)*	*Gross return (₹ha-1)*	*Net return (₹ha-1)*	*B:C Ratio*
T1 - Co (Rg) 7 at 45 x 30 cm spacing	17781.09	38696	20914.91	2.18
T2 - Co (Rg) 7 at 45 x 45 cm spacing	17395.89	31402	14006.11	1.81
T3 - Co (Rg) 7 at 60 x 30 cm spacing	17497.29	33465	15967.71	1.91
T4 - Co (Rg) 7 at 60 x 45 cm spacing	17192.49	26715	9522.51	1.55
T5 - Co (Rg) 7 at 75 x 30 cm spacing	17314.29	29800	12485.71	1.72
T6 - Co (Rg) 7 at 75 x 45 cm spacing	17069.49	22340	5270.51	1.31
T7 - Co (Rg) 7 at 90 x 30 cm spacing	17192.49	27327	10134.51	1.59
T8 - Co (Rg) 7 at 90 x 45 cm spacing	16992.69	20334	3341.31	1.20

CONCLUSION

The result of this study indicate that during *rabi* season short duration pigeonpea Co (Rg) 7 can be grown in a closer spacing of 45 x 30 cm with a plant population of 74,074 plants ha^{-1} for achieving higher grain yield and higher profit.

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