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Evaluate the Performance of Pigeon Pea (*Cajanus cajan*) as Influenced by Varieties and Plant Geometry in Rain fed Condition

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A B S T R A C T

A field experiment was conducted during *kharif 2015* at Krishi Vigyan Kendra, Ganiwan, Chitrakoot district of Bundelkhand region of Uttar Pradesh on silty loam soil to assess the effect of varieties and plant geometries on rain fed Pigeon pea crop. Treatments comprised of 3 levels each of variety (UPAS 120, Bahar 777, ICPL 88039) and planting geometries (Uniform 50 cm routs, paired row 40/60 cm, uniform 60 rows). Results revealed that varieties did not differed significantly from each other in growth, yield attributes, yield and economic parameters only with one exception of number of pods/plant which was found maximum of 68.03 pods / plant in UPAS-120. However, numerically UPAS-120 produced highest of 981.00 kg/ha seed yield and earned maximum net return of Rs. 25494/ha with 2.34 B: C ratio, other two varieties Bahar 777 and ICPL 88039 produced 923.50 and 928.46 kg/ha seed yield and earned Rs. 23279 and 23155 /ha not return with 2.22 and 2.20 B:C ratio, respectively. Among plant geometries, uniform 60 cm rows planting attained highest values of growth and yield attributes, thus produced significantly highest of 1164.30 kg/ha seed yield and earned maximum of Rs. 33336/ha net return with 2.74 B:C ratio. Other plant geometries of uniform 50 cm rows and paired rows 40/60 cm produced 805.92 and 862.73 kg/ha seed yield and earned Rs. 18182 and 20410/ha net return with 1.95 and 2.07 B: C ratio, respectively. Thus, uniform 60 cm rows planting produced 44.5 and 35.0 of higher seed yield and earned 83.3 and 63.3% higher net return than uniform 50 cm rows and paired row 40/60 cm planting, respectively.

Introduction

Pigeon pea (*Cajanus cajan)* is an important pulse crop of rain fed agriculture because of its ability to produce economic yield under limited moisture conditions. It occupies the second position among pulses in India only after chick pea. The release of new short duration harvest index through better utilization of monsoon rains during both vegetative and reproductive phases. These genotypes after great promise for introduction of Pigeon pea in new as well as in existing cropping systems. Maintenance of optimum plant population per unit area in proper geometry is an important test in rain fed crops

like Pigeon pea to exploit the yield potential of any genotype. Short duration Pigeon pea varieties are in general short statured with different compactness. Thus, those may require different plant geometry for proper development of individual plant on which yield depends. Though such short duration Pigeon pea genotypes have higher yield potential, their achievable yields are comparatively poor. To achieve their yield potential in a given environment, proper selection of most suitable variety and maintenance of optimum plant stand per unit area in proper geometry is necessary. With this view, the present study was carried out in Chitrakoot district of Uttar Pradesh.

Materials and Methods

A field experiment was carried out during *kharif,* 2015 on rain fed Pigeon pea at Tulsi Krishi Vigyan Kendra, Ganiwan, Chitrakoot (U P). The soil of experimental field was silty loam in texture, slightly alkaline in reaction (7.6 pH) and having 0.29% organic carbon, 10.48 kg/ha available P_2O_5 and 206 kg/ha available K_2O. The treatments comprised 9 combinations of 3 varieties viz. UPAS-120, Bahar-777, ICPL-88039 and 3 plant geometry viz. Uniform rows at 50 cm spacing, paired rows at 40 / 60 cm spacing and uniform rows at 60 cm spacing plant spacing within row was maintained uniform 10 cm in all treatment plots by thinning extra plants at the crop stage of 20 days after sowing.

The experiment was laid out in split plot design with main plots to varieties and sub plots to plant geometries replicated thrice sowing of pigeon pea varieties seed was done behind country plough in furrows as per treatment @ 20 kg/ha in all plots on 06th July, 2015. An uniform dose of 20 kg N+50 Kg P_2O_5+20 kg K_2O/ha was applied through Di-ammonium phosphate and muriate of potash fertilizers, respectively in whole experimental

area as deep furrows placement with the help of a funnel attached with country plough used for seed sowing. Other than treatments, the experimental crop was raised with recommended package of practices. The crop was harvested at about 90% pods maturity. In its life cycle, experimental crop received a total of 853.65 mm well distributed rainfall. The observations were recorded on final plant stand at harvest, growth characters, yield attributes and crop yields at final stage of crop harvest, while root studies were done at the crop stage of 90 days after sowing. Economics of pigeon pea cultivation was also worked out under different treatment considering the prevailing market prices of different inputs and yield products. All data were analysed statistically in split-plot design as prescribed by Panse and Sukhatme (1957).

Results and Discussion

Growth characters

None of the growth characters studies affected significantly by different Pigeon pea varieties (Table 1). All varieties remained at par with each other. Among plant geometries, paired row 40/60 cm planting being at par with uniform 50 cm rows planting maintained significantly more plant stand per unit area than uniform 60 cm rows planting. The reduction in plant stand under wider row spacing of 60 cm might be attributed to lesser number of rows per unit area because plant spacing within row was maintained similar in all plant geometries. Number of branches/plant was recorded significantly maximum under uniform 60 cm rows planting. It might be the effect of spacing between crop rows where wider space provided favourable environment to crop plants for producing branches profusely and vice-versa. It is in agreement to the findings of Kumawat *et al.* (2013).

Root length was measured significantly deeper under paired row planting whereas root spread was found significantly more under uniform 60 cm rows planting. It might be attributed to underground root competition for their development where horizontal lesser space in paired planting forced the roots to penetrate deeper in the soil while in wider rows planting lateral spread of roots was more because of sufficient available space. Number of nodules/plant and dry weight of root nodules/plant were recorded significantly highest under uniform 60 cm rows planting and lowest under uniform 50 cm rows planting which might be attributed to more root spread under wider rows planting. These results are in accordance to the findings of Ahlawat and Saraf (1982).

Days to phonological stages

These were influenced significantly by both treatment factors of varieties and plant geometries (Table 1).

Among varieties, UPAS-120 took significantly minimum number of days to flowering, padding and maturity while maximum numbers of days were taken by ICPL-88039 for all stages by the margin of about 10 days. It might be due to genetic makeup of different genotypes which depends on utilization of growing degree days by a variety denotes its longer period to phonological stages and vice-versa.

These results support the findings of Mishra and Chand (2009). In case of plant geometries, uniform 60 cm rows planting took maximum number of days while minimum numbers of days were recorded under paired rows planting for flowering, padding and maturity. It might be attributed to vegetative growth of crop plants which was more under uniform 60 cm rows planting, thus reproductive phase delayed.

Yield attributes and yield

Different Pigeon pea varieties under test could not differ significantly from each other in all yields attributes (Table 1) and yield (Table 2) only with one exception of number of pods/plant which was recorded significantly more in variety UPAS-120 than other two varieties (Table 1). However, variety UPAS-120 produced considerably higher seed yield/ha (5.7 and 6.2%) than other two varieties which might be attributed to number of pods/plant as reflected in seed weight/plant also. Better performance of variety UPAS-120 in this regard has also been reported by Tripathi and Chauhan (1990). The effect of plant geometries was found significant on number of pods/plant, seed weight/plant, harvest index (Table 1), seed yield and stick + Stover yield/ha (Table 2). All these characters of Pigeon pea were significantly maximized under uniform 60 cm rows planting. It was followed by paired row planting while uniform 50 cm rows planting recorded lowest values of above mentioned yield attributes and yields. The plant geometry of uniform 60 cm rows produced significantly highest of 1164 kg/ha seed yield which was found 358 kg and 302 kg/ha or 44.5 and 35.0 per cent higher than the seed yields obtained under uniform 50 cm rows and paired row planting geometries, respectively. Such higher seed yield might be attributed to number of pods/plant, seed weight/ plant and harvest index. Stick + Stover yield also produced almost in similar manner to seed yield under different plant geometries. These results are in close conformity to those of Kumar *et al.* (2003) and Kumawat *et al.,* (2013).

Economics

None of the economic parameters was influenced significantly by Pigeon pea varieties (Table 2).

Table.1 Effect of varieties and plant geometry on growth characters and yield attributes of pigeon pea

Treatments	Growth Characters						No. of days to Phonological stages			Yield attributes				
Varieties														
UPAS-120	16.78	20.85	19.19	16.45	0.636	24.79	90.67	119.67	140.67	68.03	3.34	8.72	9.96	**21.06**
Bahar-777	17.56	19.36	18.31	14.96	0.603	23.88	94.67	123.67	150.00	58.36	3.26	8.73	9.45	**20.14**
ICPL-88039	17.00	20.35	18.97	14.70	0.590	23.68	99.67	129.67	150.00	59.17	3.21	8.69	9.62	**20.40**
S.Ed. ±	0.95	0.62	0.59	0.60	0.030	0.77	0.74	0.75	1.12	1.43	0.13	0.18	0.35	**0.40**
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	2.03	2.06	3.08	3.95	NS	NS	NS	**NS**
Plant geometry														
Uniform 50 cm rows	17.55	20.07	18.72	13.33	0.542	21.13	94.33	123.67	144.33	52.35	3.33	8.76	8.16	**19.34**
Paired rows 40/60cm	18.22	21.39	17.91	15.23	0.601	23.75	91.67	121.00	141.67	57.77	3.31	8.72	8.98	**20.25**
Uniform 60 cm rows	15.56	19.11	19.84	17.55	0.686	27.47	99.00	28.33	149.67	75.44	3.18	8.66	11.90	**22.00**
S.Ed. ±	0.93	0.72	0.60	0.65	0.030	0.75	0.70	0.82	1.30	1.57	0.12	0.20	0.47	**0.34**
C.D. (P=0.05)	**2.03**	**1.57**	**1.30**	**1.42**	**0.066**	**1.63**	**1.53**	**1.78**	**2.83**	**3.41**	NS	NS	**1.02**	**0.74**

Table.2 Effect of varieties and plant geometry on yield and economics of pigeon pea cultivation

Treatments	Yield (kg/ha)		Economic parameters		
Varieties					
UPAS-120	981.00	3655.51	44.587	25.494	**2.34**
Bahar-777	923.50	3639.64	42.372	23.279	**2.22**
ICPL-88039	928.46	3588.45	42.454	23.155	**2.20**
S.Ed. ±	68.11	96.08	1.131	1.133	**0.22**
C.D. (P=0.05)	NS	NS	NS	NS	NS
Plant geometry					
Uniform 50 cm rows	805.92	3360.02	37.344	18.182	**1.95**
Paired rows 40/60cm	862.73	3396.11	39.571	20.410	**2.07**
Uniform 60 cm rows	1164.30	4127.46	52.498	33.336	**2.74**
S.Ed. ±	66.06	90.68	1.117	1.135	**0.18**
C.D. (P=0.05)	**143.90**	**197.53**	**2.434**	**2.472**	**0.39**

However, variety UPAS-120 gave numerically highest values of gross income, net return and benefit: Cost ratio. Differences between other two varieties were not found remarkable in any case. Thus, variety UPAS-120 recorded 9.52 and 10.10 per cent higher not return than Bahar-777 and ICPL-88039, respectively. It might be attributed to higher seed yield of UPAS-120 compared to other varieties. Tripathi and Chauhan (1990) also reported similar results.

Among plant geometries, uniform 60 cm row

planting recorded significantly highest values of gross income, net return and B: C ratio while other two planting geometries remained at par with each other. Thus, the uniform 60 cm rows planting gave Rs. 15154 and 12927/ha or 40.6 and 32.7 per cent more gross income, earned Rs. 15154 and 12926/ha or 83.3 and 63.3 per cent more net return with 40.5 and 32.4 percent higher B:C ratio than uniform 50 cm rows and paired row plantings, respectively. Superiority of uniform 60 cm row planting over other plant geometries might be attributed mainly to higher yields of

seed and stick + Stover. These results concede with the findings of Sharma and Rajput (1996).

The effect of varieties × plant geometries interaction was not found significant in any observation. Numerically the treatment combination of variety UPAS-120 sown in uniform 60 cm row spacing proved to be the best for higher production and profitability from rain fed Pigeon pea crop in Chitrakoot district of Bundelkhand region of Uttar Pradesh.

Acknowledgement

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