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Production Potential of Pigeon Pea [*Cajanus cajan* (L.) Millsp.] as Influenced by Crop Geometry and Plant Growth Regulators

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ABSTRACT

Background: Pigeonpea being highly branching and indeterminate growth habit responds very well to crop geometry. Hence to achieve potential yields, it is important to maintain optimum plant population which can effectively utilize available moisture, nutrients and solar radiation. The plant growth regulators are also known to enhance the source sink relationship and stimulate the translocation of photo assimilates, thereby increase the productivity.

Methods: A field experiment was conducted at experimental farm of Agronomy Department, V.N.M.K.V., Parbhani during *kharif* season of 2018 and 2019. The experiment was laid out in split plot design with four main plot treatments comprised of four crop geometries as 90 cm × 20 cm, 120 cm × 20 cm 60-120 cm × 20 cm and 75-150 cm × 20 cm and sub plot treatments were five treatments on foliar application of plant growth regulators *i.e.* NAA @ 40 ppm, Mepiquat chloride @ 50 g *a.i.* ha^{-1}, Brassinosteroids @ 0.1 ppm, Chlormequat Chloride @ 75 g *a.i* ha^{-1} and control.

Result: The crop geometry of 120 cm × 20 cm and 75-150 cm x 20 cm recorded higher values of all yield parameters followed by crop geometry of 60-120 cm × 20 cm. While the seed, straw and biological yield of pigeonpea as well as highest net realization of Rs. 72072 ha^{-1} was obtained with crop geometry of 60-120 cm × 20 cm followed by 90 cm × 20 cm. Among the plant growth regulators foliar application of Brassinosteroids @ 0.1 ppm (G_3) tended to recorded higher yield parameters, seed yield and fertility coefficient of pigeonpea as well as highest net realization followed by foliar application of NAA @ 40 ppm.

Key words: Crop geometry, Pigeonpea, Plant growth regulators, Productivity.

INTRODUCTION

Seed yield is product of plant populations and the single plant yield. Maximum yield in a particular cultivars and environment can be obtained at the density where competition between the plants is low. This will be attained at an optimum plant density, which not only utilizes light, moisture and nutrients in more efficient way but also avoids excessive competition among the plants. The yield potential of pigeonpea can be realized through efficient utilization of solar radiation and mitigating terminal drought for which canopy size and shape play very important role.

Major physiological constraints limiting pigeonpea yield are flower and fruit drop. Microclimate coupled with physiological process may include internal hormonal imbalance and may result in abscission of flowers and immature pods and drastic reduction in yield of pigeon pea.

Plant growth regulators have the capacity to stimulate and inhibit physiological processes, which directly or indirectly might affect crop yield and quality. Plant growth regulators are known to improve physiological efficiency including photosynthetic ability of plant and also enhance the source sink relationship and stimulate the translocation of photo assimilates, thereby increase the productivity. Several studies on different crops have shown that the exogenous application of GA_3, an important GAs can enhance the productivity of crops influencing the vital physiological processes (Bora and Sarma, 2006).

Apropose to the physio-morphological characteristics of pigeon pea, there is need for scientific manipulation by synchronizing plant growth through growth regulating chemicals, which can check the excessive vegetative growth, thereby creating proper balance between source and sink for enhanced crop yield and standardize the plant density to exploit yield potential. Considering these points the present investigation was carried out at experimental farm, Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani with objectives to stabilize yield through proper planting geometry and use of plant growth regulators.

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MATERIALS AND METHODS

The field experiments were conducted at research farm of Agronomy department, Vasantrao Naik Marathwada Krishi Vidyapeeth and Parbhani (MS) during *kharif* season of 2018 and 2019. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction having low in organic carbon, medium in available nitrogen and phosphorus, but marginally high in available potassium.

The experiment was laid out in split plot design and replicated thrice. Treatments consisted of twenty treatment combinations comprising four crop geometries as 90 cm × 20 cm, 120 cm × 20 cm 60-120 cm × 20 cm and 75-150 cm × 20 cm in main plot and five treatments on foliar application of plant growth regulators *i.e*. NAA @ 40 ppm, Mepiquat chloride @ 50 g a.i ha^{-1}, Brassinosteroids @ 0.1 ppm, Chlormequat Chloride @ 75 g a.i ha^{-1} and control in sub plot.

The rainfall received was 781.4 mm and 928.9 mm during year 2018 and 2019 respectively, which was favorable for vegetative and reproductive growth of crop. Sowing was accomplished on 26th June 2018 and 28th June 2019 during first and second year respectively. Periodical observations on growth and yield of pigeonpea were recorded and statistically analyzed to evaluate the effect of different treatments. The fertility co-efficient of pigeonpea was arrived from relationship between the number of flowers and the number of pods produced per plant and the results were expressed in terms of percentage (Sumathi *et al*., 2016).

RESULTS AND DISCUSSION

The data related to yield attributes along with the seed, straw, biological yield, fertility coefficient and economic aspect of pigeonpea as influenced by crop geometry and foliar application of plant growth regulators are critically interpreted and results are presented below.

Yield attributes of pigeonpea as influenced by different treatments

Effect of crop geometry

Persual of data from Table 1 revealed that, crop geometry significantly influenced the yield attributes of pigeonpea. Number of pods $plant^{-1}$ were significantly highest under crop geometry of 120 cm × 20 cm (S_2) and was found at par with crop geometry of 75-150 cm x 20 cm (S_4) followed by 60-120 cm x 20 cm (S_2) and significantly superior over crop geometry of 90cmx20cm (S_1). Similar variation was observed in case of mean weight of pods $plant^{-1}$, number of pod clusters per plant, seed yield per plant. This might have resulted due to reduced competition for light, aeration, nutrients and moisture under wider spacing. Mula *et al.* (2010) also reported that individual plants of pigeonpea at wider spacing showed significant positive traits over closer spacing.

Seed index of pigeonpea *i.e.* 100 seed weight, number of pods $cluster^{-1}$, number of seeds pod^{-1} and mean pod length of pigeonpea were not influenced significantly by different crop geometries, however crop geometry of 120 cm × 20 cm (S_2) and 75-150 cm × 20 cm (S_4) recorded numerically higher values. Favourable influence on physiological processes and build up of photosynthates due to adequate availability of moisture and nutrients throughout the growing season may be the reason behind this. Similar kinds of findings have been reported by Waghmare *et al.* (2016).

Effect of foliar application of plant growth regulators

Yield contributing parameters (Table 2) of pigeonpea were influenced due to foliar application of plant growth regulators. Foliar application of Brassinosteroids @ 0.1 ppm (G3) and foliar application of NAA @ 40 ppm (G_1) produced higher mean number of pods $plant^{-1}$, weight of pods (g), number of pod clusters $plant^{-1}$, seed yield $plant^{-1}$ (g) and was found significantly superior over rest of the treatments. Further foliar application of NAA @ 40 ppm (G_1) was followed by foliar application of Mepiquat chloride @ 50 g a.i ha^{-1} during both the years. This may be attributed due to reason that, plant growth regulators in general, increase the number of flowers, also reduced flower and pod drop to some extent as reported by Ramesh and Thirumuguran (2001). The results are in line with the results reported by Reddy *et al.,* (2004), Chandewar *et al.* (2016).

Interaction effect

It was observed that interaction between crop geometry 75-150 cm × 20 cm (S_4) with foliar application of Brassinosteroids @ 0.1 ppm (G3) recorded higher seed yield $plant^{-1}$ (48.42 g), it was at par with interaction between crop geometry 60-120 cm × 20 cm (S_3) with foliar application of Brassinosteroids @ 0.1 ppm (G3) and interaction between crop geometry 60-120 cm × 20cm (S_3) with foliar application of NAA @ 40 ppm (G_1) during the first year of experimentation (Table 4).

Yield studies

Data pertaining to seed yield, straw yield, biological yield and harvest index of pigeonpea during 2018 and 2019 as influenced by different crop geometry and foliar application of plant growth regulators are presented in Table 2.

Effect of crop geometry

Different crop geometries had significant influence on pigeonpea yield. The crop geometry 60-120 cm × 20 cm (S_3) produced significantly higher seed yield (1661, 1982 and 1821 kg ha^{-1}) over crop geometry of 120 cm × 20 cm (S_2) and crop geometry 75-150 cm × 20cm (S_4), but it was found at par with crop geometry 90 cm × 20 cm (S_1). The per cent increase in seed yield of pigeonpea recorded with crop geometry 60-120 cm × 20 cm (S_3) over 120 cm × 20 cm (S_2) was 22.85 per cent, on pooled basis. Similar kind of trend was observed for straw and biological yield as well as for harvest index of pigeonpea. The probable reason behind this might be that, though it showed lower seed weight per plant, pods per plant as a result of intra row competition, the total grain yield was increased at closer spacing as the lower per plant yield was compensated by higher plant population per unit area. Also suitable planting geometry with 60-120 cm × 20 cm (S_3) helped in optimum and efficient utilization of the available resources which ultimately enhanced the growth and yield. The higher seed and straw yield of pigeonpea ultimately resulted in higher biological

Table 1: Yield attributes of pigeonpea as influenced by different treatments during 2018 and 2019.

Treatments	No. of pods per plant		Weight of pods plant^{-1}		Number of pod clusters plant^{-1}		Number of seeds pod^{-1}		Pod length (cm)		Seed yield plant^{-1} (g)		Seed index (g)	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Main plot: Crop geometry														
S_1: 90 cm × 20 cm	117.61	135.72	49.34	53.87	35.09	37.17	3.05	3.36	5.04	5.44	31.23	37.39	10.31	10.70
S_2: 120 cm × 20 cm	153.87	173.65	57.63	64.79	41.05	46.03	3.32	3.45	5.01	5.66	38.05	45.87	10.70	10.80
S_3: 60-120 cm × 20 cm	124.32	138.85	46.63	51.42	35.28	43.22	3.16	3.21	5.02	5.59	34.48	40.50	10.10	10.43
S_4: 75-150 cm × 20 cm	132.83	159.43	52.87	55.03	37.67	43.83	3.21	3.32	5.19	5.64	38.00	44.30	9.67	11.10
S.E.(m)±	3.92	6.26	1.00	1.75	1.21	1.34	0.14	0.12	0.12	0.078	1.09	1.49	0.30	0.29
C.D. at 5%	13.58	21.67	3.47	6.04	4.17	4.64	NS	NS	NS	NS	3.79	5.17	NS	NS
Sub Plot (Growth regulators): (02 sprays at bud initiation and flowering)														
G_1: NAA @ 40 ppm	135.39	172.95	55.01	66.45	37.11	45.42	3.17	3.36	5.29	5.65	39.89	45.57	10.69	11.12
G_2: Mepiquat chloride @ 50 g a.i ha^{-1}	124.75	159.96	52.67	53.53	35.36	42.58	3.14	3.40	5.00	5.46	34.16	41.11	9.98	10.45
G_3: Brassinosteroids @ 0.1 ppm	161.74	179.81	56.46	64.83	42.64	47.75	3.30	3.46	5.18	5.84	42.48	47.80	10.29	11.37
G_4: Chlormequat Chloride @ 75 g a.i ha^{-1}	122.38	136.60	48.65	51.77	36.69	41.93	3.32	3.30	4.97	5.38	32.15	40.60	9.83	10.54
G_5: Control	116.54	110.23	43.45	43.45	34.56	35.13	2.97	3.25	5.01	5.57	28.22	35.00	10.19	10.29
S.E.(m)±	4.56	5.01	0.83	1.15	1.28	1.54	0.16	0.13	0.11	0.13	0.77	1.62	0.33	0.31
C.D. at 5%	13.15	14.43	2.41	3.31	3.69	4.43	NS	NS	NS	NS	2.24	4.69	NS	NS
S X F Interaction														
S.E.(m)±	8.40	10.02	1.67	2.30	2.56	3.07	0.32	0.26	0.23	0.25	1.55	3.25	0.66	0.61
C.D. at 5%	NS	NS	NS	6.63	NS	NS	NS	NS	NS	NS	4.48	NS	NS	NS
General Mean	132.15	151.91	51.23	56.20	37.27	42.56	3.18	3.35	5.07	5.58	35.38	42.01	10.20	10.75

yield with the crop geometry of 60-120cm x 20 cm followed by crop geometry of 90 cm × 20 cm (S_1). These findings are in line with earlier findings of Saritha *et al.* (2012) and Nagaraj and Murali (2018).

The crop geometry 60-120 cm x 20 cm (S_3) recorded the highest harvest index (27.73 and 28.47) in pigeonpea, it was followed by crop geometry of 75-150 cm x 20 cm (S_4). This might be due to optimum utilization of resources which led to enhanced economic yield. These results correlate with the findings of Pramod *et al*. (2010) and Waghmare *et.al* (2016).

Effect of foliar application of plant growth regulators

The data presented in Table 2 indicated that the foliar application of Brassinosteroids @ 0.1 ppm (G3) recorded higher seed yield, it was at par with foliar application of NAA @ 40 ppm (G_1) and significantly superior over other treatments, during both the years of experimentation and in pooled analysis. The magnitude of increase in seed yield recorded under the foliar application Brassinosteroids @ 0.1 ppm (G_3) over control (G_5) on pooled basis was 36 percent. The maximum grain yield recorded by Brassinosteroids might be due to better growth, enhanced pod number, pod clusters, pod weight and seed yield per plant. These results also correlate with findings reported by Ramesh and Ramprasad (2013), Sumathi *et al*. (2016).

The straw yield and biological yield (Table 2) was influenced significantly due to plant growth regulator treatments during both the years. It was observed that, during both the years of study and in pooled analysis foliar application of NAA @ 40 ppm (G_1) and the foliar application of Brassinosteroids @ 0.1 ppm (G_3) recorded higher straw yield ha^{-1} and were significantly superior over other treatments. The increase in straw yield of pigeonpea with foliar application of Brassinosteroids and foliar application of NAA was mainly attributed to enhanced growth and yield which ultimately led to increase in dry matter. These results are parallel with the findings of Upadhyay (2002). It was observed from Table 2 that the foliar application of Brassinosteroids @ 0.1 ppm (G_3) and Mepiquat chloride @ 50 g a.i ha^{-1} recorded higher values of harvest index in pigeonpea. While during second year of investigation application of Chlormequat Chloride @ 75 g a.i ha^{-1}(G_4) recorded higher values of harvest index. This increased harvest index might be due to the reduction in excess vegetative growth along with increased mobilization of metabolites from source to reproductive sink and conservation of biomass into yield. These findings are in line with the findings of Kalyankar *et al.* (2008).

Economics and fertility co-efficient studies

Data on the economics pertaining to the gross monetary returns, net monetary returns, benefit cost ratio (B:C ratio) and fertility co-efficient of pigeonpea under various treatments are furnished in Table 3.

Effect of crop geometry

The data regarding economic returns of pigeonpea as influenced by treatments indicated that, crop geometry of 60-120 cm × 20 cm (S_3) recorded the highest gross monetary returns (‘94003, 122570 ha^{-1} and ‘108280), net monetary returns (‘58502, ‘85641, ‘72072), and benefit cost ratio (2.64, 3.31 and 2.97) during 2018, 2019 and pooled means respectively, while it was at par with the crop geometry of 90cmx20cm (S_1) and significantly superior over rest of the crop geometry. This higher gross and net returns with the closer crop geometry may be due to the increased yield per unit area along with the optimum and efficient utilization of the available resources. This ultimately reflected in enhanced gross and net returns. These results co insides with the findings reported by Ravikumar *et al*. (2013) and Kittur and Guggari (2017). Among the different crop geometry, highest fertility co-efficient of pigeonpea was recorded with crop geometry of 120 cm × 20 cm (S_2), it was at par with the crop geometry of 75-150 cm × 20 cm (S_4) and crop geometry of 60-120 cm × 20 cm (S_3) during first year of study while during second year the differences in fertility co-efficient of pigeonpea were found nonsignificant among the crop geometry.

Effect of foliar application of plant growth regulators

During both the years of study as well as in pooled results, foliar application of Brassinosteroids @ 0.1 ppm (G_3) recorded higher gross and net monetary returns in pigeonpea, it was followed by foliar application of NAA @ 40 ppm and both of these treatments were significantly superior over rest of the treatments. Similar trend was recorded for benefit : cost ratio during 2018, 2019 and pooled results (Table 3). The higher net returns and benefit: cost ratio was on account of the higher seed yield recorded with application of Brassinosteroids @ 0.1 ppm (G_3). These findings are in close conformity with those reported by Kashid *et al.* (2010) and Jadhav *et al*. 2017.

It was observed that, among the different plant growth regulator treatments, foliar application of Brassinosteroids @ 0.1 ppm (G_3) recorded the highest fertility co-efficient of pigeonpea, over other treatments (Table 2) and was followed by foliar application of NAA @ 40 ppm (G_1). This might be attributed to the reason that, these plant growth regulators increases the source activity during pod filling stage and thus diverts the assimilates for pod (sink) development. The present results correlate to the findings reported by Sumathi *et al*. (2016).

Interaction effect

The interaction effect between treatments on seed, straw, biological yield, gross monetary returns and net monetary returns of pigeonpea was found to be significant during both the years as well as pooled data. It was observed from the data (Table 4 and 5) that maximum seed, straw and biological yield, gross monetary returns and net monetary returns were recorded with the interaction between crop geometry 60-120 cm × 20 cm (S_3) with foliar application of Brassinosteroids @ 0.1 ppm (G_3), it was at par with

Table 2: Mean seed, straw biological yield (kg ha^{-1}) and harvest index of pigeonpea as influenced by different treatments during 2018, 2019 and pooled mean.

Treatments	Seed yield (kg ha^{-1})			Straw yield (kg ha^{-1})			Biological yield (kg ha^{-1})			Harvest Index		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Mean
Main plot:Crop geometry												
S_1: 90 cm X20cm	1466	1782	1624	4088	4996	4542	5554	6779	6166	26.40	26.46	26.44
S_2: 120 cm x20cm	1239	1572	1405	3620	4075	3848	4859	5713	5286	25.56	27.68	26.63
S_3: 60-120 cm x20cm	1661	1982	1821	4338	5100	4719	5998	7082	6540	27.73	28.47	28.10
S_4: 75-150 cm x20cm	1281	1361	1321	3425	3540	3482	4706	4901	4803	27.22	28.17	27.70
S.E.(m)±	57.52	72.37	64.02	134.51	152.25	112.29	188.78	109.53	106.52	0.33	1.67	
C.D. at 5%	199.02	254.74	221.52	465.05	526.87	395.26	664.29	385.54	374.95	1.16	NS	
Sub plot (Plant growth regulators)(02 sprays at bud initiation and flowering)												
G_1: NAA @ 40 ppm	1630	1847	1739	4755	4983	4869	6385	6829	6607	25.56	27.16	26.36
G_2: Mepiquat chloride @ 50 g a.i ha^{-1}	1384	1596	1490	3644	4480	4062	5029	6075	5552	27.57	26.43	27.00
G_3: Brassinosteroids @ 0.1 %	1742	2018	1880	4606	5553	5080	6348	7571	6959	27.42	26.91	27.17
G_4: Chlormequat Chloride @ 75 g a.i ha^{-1}	1212	1583	1397	3243	3830	3537	4456	5413	4935	27.13	29.52	28.33
G_5: Control	1089	1328	1208	3089	3293	3191	4179	4704	4441	26.06	28.43	27.25
S.E.(m)±	34.97	79.55	59.62	104.86	158.98	79.97	132.24	142.49	88.07	0.40	1.54	
C.D. at 5%	96.78	220.18	152.03	290.21	439.99	221.34	365.98	394.35	240.98	1.17	NS	
S X F Interaction												
S.E.(m)±	69.94	159.12	112.44	209.73	317.96	159.96	264.48	284.99	174.15	0.81	3.09	
C.D. at 5%	193.56	440.36	309.21	580.43	879.97	442.68	731.97	788.71	481.96	NS	NS	
General mean	1412	1674	1543	3868	4428	4148	5279	6119	5699	26.75	27.69	

Table 3: Mean gross and net monetary returns, benefit: cost ratio and fertility co-efficient of pigeonpea as influenced by different treatments during 2018, 2019 and pooled mean

Treatments	GMR (Rs ha^{-1})			NMR (Rs ha^{-1})			Benefit:Cost ratio			Fertility Co-efficient (%)		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Mean
Main plot:Crop geometry												
S_1: 90 cm × 20 cm	83245	110860	97052	47744	73932	60838	2.34	2.99	2.66	49.84	49.68	49.76
S_2: 120 cm × 20 cm	70498	97398	83948	35158	60633	47895	1.98	2.65	2.31	52.79	52.65	52.72
S_3: 60-120 cm × 20 cm	94003	122570	108280	58502	85641	72072	2.64	3.31	2.97	51.47	52.16	51.815
S_4: 75-150 cm × 20 cm	72613	84245	78429	37237	47444	42341	2.04	2.29	2.16	52.54	54.00	53.27
S.E.(m)±	3230	4033	3414	3230	4033	3414	0.09	0.11		0.61	0.91	
C.D. at 5%	11371	14196	12018	11371	14196	12018	0.31	0.38		2.12	NS	
Sub plot (Plant Growth regulators)(02 sprays at bud initiation and flowering)												
G_1: NAA @ 40 ppm	92797	114570	103680	57054	77403	67228	2.59	3.08	2.84	52.36	53.20	52.78
G_2: Mepiquat chloride @ 50 g a.i ha^{-1}	78416	99283	88850	41343	60784	51064	2.11	2.60	2.35	51.69	52.97	52.33
G_3: Brassinosteroids @ 0.1 %	98661	125340	112000	63147	88406	75778	2.80	3.39	3.09	53.43	54.66	54.04
G_4: Chlormequat Chloride @ 75 g a.i ha^{-1}	68674	97565	83119	32950	60416	46683	1.92	2.62	2.27	51.42	51.26	51.34
G_5: Control	61900	82072	71986	28806	47553	38180	1.87	2.30	2.08	49.39	48.51	48.95
S.E.(m)±	1965	4514	2799	1965	4514	2799	0.05	0.12		0.51	0.80	
C.D. at 5%	5438	12494	7749	5438	12494	7749	0.16	0.35		1.47	2.31	
S X F Interaction												
S.E.(m)±	3930	9029	5599.8	3930	9029	5599	0.11	0.24	0.11	1.02	1.61	
C.D. at 5%	10877	24989	15498	10877	24989	15498	0.32	NS	0.32	NS	NS	
General mean	80090	103770	91928	44660	66913	55786	2.25	2.81	2.30	51.66	52.12	

Table 4: Interaction effect of crop geometry and plant growth regulators on seed yield plant^{-1} (g) of pigeonpea during 2018 and seed, straw, biological yield (kg ha^{-1}) in pooled analysis.

Interaction effect on seed yield plant^{-1} (g) of pigeonpea during 2018					
			Plant growth regulators		
Crop geometry	G_1	G_2	G_3	G_4	G_5
S_1: 90 cm × 20 cm	34.78	29.43	36.48	29.33	26.12
S_2: 120 cm × 20 cm	44.28	38.27	44.86	31.46	30.12
S_3: 60-120 cm × 20 cm	39.16	35.16	40.16	29.83	28.06
S_4: 75-150 cm × 20 cm	41.35	33.80	48.42	37.99	28.59
S.E.(m)±			1.55		
C.D. at 5%			4.48		
Interaction effect on seed yield (kg ha^{-1}) of pigeonpea in pooled analysis					
Crop geometry	G_1	G_2	G_3	G_4	G_5
S_1: 90 cm x 20 cm	1842	1561	1977	1461	1279
S_2: 120 cm x 20 cm	1692	1447	1698	1216	1074
S_3 : 60-120 cm x 20 cm	2070	1830	2154	1609	1441
S_4: 75-150 cm x 20 cm	1450	1123	1690	1303	1040
S.E.(m)±			112.44		
C.D. at 5%			309.21		
Interaction effect on straw yield (kg ha^{-1}) of pigeonpea in pooled analysis					
Crop geometry	G_1	G_2	G_3	G_4	G_5
S_1: 90 cm × 20 cm	5388	4305	5561	3719	3738
S_2: 120 cm × 20 cm	4478	3367	4894	3193	2905
S_3: 60-120 cm × 20 cm	5575	5148	5534	3804	3533
S_4: 75-150 cm × 20 cm	3834	3227	4329	3432	2589
S.E.(m)±			159.96		
C.D. at 5%			442.68		
Interaction effect on biological yield (kg ha^{-1}) of pigeonpea pooled analysis					
Crop geometry	G_1	G_1	G_1	G_1	G_1
S_1: 90 cm × 20 cm	7231	5866	7539	5180	5016
S_2: 120 cm × 20 cm	6269	5015	6592	4409	4145
S_3: 60-120 cm × 20 cm	7645	6979	7688	5413	4974
S_4: 75-150 cm × 20 cm	5284	4349	6019	4735	3629
S.E.(m)±			174.15		
C.D. at 5%			481.96		

Table 5: Interaction effect of crop geometry and plant growth regulators on gross and net monetary returns (Rs ha^{-1}) of pigeonpea in pooled results.

Interaction effect on gross monetary returns (Rs ha^{-1})					
			Growth regulators		
Crop geometry	G_1	G_2	G_3	G_4	G_5
S_1: 90 cm × 20 cm	110290	93179	118370	87069	76344
S_2: 120 cm × 20 cm	95129	85983	101570	72599	64462
S_3: 60-20 cm × 20 cm	123100	109230	128240	95428	85420
S_4: 75-50 cm × 20 cm	86214	67007	99826	77381	61717
S.E.(m)±	5599				
C.D. at 5%	15498				
Interaction effect on net monetary returns (Rs ha^{-1})					
Crop geometry	G_1	G_2	G_3	G_4	G_5
S_1: 90 cm × 20 cm	73764	55321	82078	50562	42466
S_2: 120 cm × 20 cm	58762	48287	65430	36252	30746
S_3: 60-120 cm × 20 cm	86575	71372	91948	58920	51542
S_4: 75-150 cm × 20 cm	49812	29274	63654	40499	27964
S.E.(m)±	5599				
C.D. at 5%	15498				

interaction between crop geometry 60-120 cm × 20 cm (S_3) with foliar application of NAA @ 40 ppm (G_1), interaction between crop geometry 90 cm × 20 cm (S_1) with foliar application of Brassinosteroids @ 0.1 ppm (G_3) and interaction between crop geometry 90 cm × 20 cm (S_1) with foliar application of NAA @ 40 ppm (G_1).

CONCLUSION

Based on the two years findings and pooled results of present investigation, it can be concluded that, crop geometry of 60-120 cm × 20 cm or 90 cm × 20 cm for pigeonpea along with foliar application of Brassinosteroids @ 0.1 ppm, as well as the crop geometry of 60-120 cm × 20 cm along with foliar application of NAA @ 40 ppm were found to be beneficial in improving seed yield, net returns and also fertility co-efficient of pigeonpea.

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