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Agronomic evaluation of high density pigeonpea cultivar LRG 470 for verticals under rainfed conditions of Andhra Pradesh

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Abstract
A field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh during *Kharif* for three continuous years in the same field i.e., from 2019-20 to 2021-22 to evaluate the agronomic suitability of pigeonpea cv. LRG-470 to high density planting in verticals under rainfed conditions of Andhra Pradesh. The soils of the experimental field were low in available nitrogen, medium in P_2O_5, high in K_2O, low in organic matter and neutral to slightly alkaline in reaction. The experiment was laid out in split plot design with three spacings *viz*., 120x20, 90x20 and 60x20 cm as main plot treatments and three fertilizer levels *viz*., 100, 125 and 150 % RDF as sub-plot treatments and each treatment was randomly allocated and replicated thrice. The three years pooled data indicated that the pigeonpea cv. LRG-470 was highly suitable for high density planting at a spacing of 90x20 cm (55,555 plants ha^{-1}) with 100 % RDF due to its erect and less branching habit and given significantly better yield of 1988 $kgha^{-1}$ as compared to 120x20 cm (1368 kg ha^{-1} with 41,666 plants ha^{-1}) and 60x20 cm (1449 kg ha^{-1} with 83,333 plants ha^{-1}) row spacing sat RDF. Further, 46.2 and 37.2 per cent yield increment was noticed over wider spacing (120x20 cm) with the cultivar LRG-470.

Keywords: Agronomic, Plant height, Pigeonpea, Rhizobium, rainfed conditions, LRG 470

Introduction
Pigeonpea (*Cajanus cajan*) popularly known as redgram, arhar or tur belongs to family Fabaceae. Its dhal (seeds) consumed on a large scale in South Asia and is a major source of protein for the population of Indian sub-continent. Globally, arhar is grown in an area of 56.16 lakh hectares with a production of 44.25 lakh tonnes and productivity of 788.1 kg/ha (FAO STAT, 2019). India ranks first in redgram production globally with 38.8 lakh tonnes cultivated under 48.24 lakh hectares with productivity of 804 kg/hectare in 2020-21 (agricoop.nic.in). In India, redgram takes second position in total pulse production after bengalgram. Karnataka ranks first in production (9.47 lakh tonnes), followed by Maharashtra (8.34 lakh tonnes), Gujarat (3.07 lakh tonnes) and Uttar Pradesh (2.72 lakh tonnes). Andhra Pradesh produced1.16 lakh tonnes in an area of 2.33 lakh hectares with 496 kg/hectare productivity during 2020-21. (Third Advance Estimates, DES-AP). The low production in Andhra Pradesh may be due to cultivation of spreading genotypes which occupy more space (180 x 20 cm) and there by facilitate less plant population per ha (27,777 plants/ha). Further, existing spreading genotypes have limitation for attending certain inter cultural operations like spraying of plant protection chemicals and herbicides because of their bushy nature coupled with tallness. Identification of erect genotypes with modified plant architecture and considerable pod number facilitates to increase plant population per unit area there by increase the yield. Pigeonpea is capable of ameliorating poor soil fertility conditions, by virtue of its ability to fix atmospheric nitrogen through symbiotic association with Rhizobium. Among the different agronomic factors, spacing plays an important role in augmenting potentially maximum production of pigeonpea. These findings can also be helpful to suggest the pigeonpea as an intercrop with different crops and cropping sequences in addition to the high density planting in Krishna zone. Keeping the above facts in view the present investigation was initiated.

Material and Methods
A field experiment was conducted at Regional Agricultural Research Station, Lam located at Guntur (Latitude: 160181, Longitude: 800291, Altitude: 33 M.A.M.S.L).

The climate is sub-tropical with a mean annual rainfall of 933.7 mm. The soil of the experimental field was clay loam in texture, neutral to slightly alkaline in reaction (pH 7.8 to 8.2). Low in available N (204 kg ha^{-1}), high in P_2O_5 (97kg ha^{-1}) and K_2O (887 kg ha^{-1}) and medium in organic carbon (0.51%). The experiment was conducted for three successive *kharif* seasons of 2019-20, 2020-21 and 2021-22 in Krishna agro-climatic zone of Andhra Pradesh. The pigeonpea cv. LRG 470 was tested for its suitability for high density planting in vertisols with different RDF. Design adopted was split plot, three row spacings (120x20, 90x20 and 60x20 cm) were taken as main plots treatments and fertilizer doses100%, 125% and 150 % RDF (RDF=20N+50 P+0 KKg ha^{-1}) were taken as sub-plot treatments, each treatment was allocated randomly and replicated thrice. Data collected during the experimentation was statistically analyzed by using variance technique as suggested by Gomez and Gomez (1984) [5]. Statistical significance was tested by applying F-test at 5% level of probability and critical difference (CD) was calculated for those parameters.

Results and Discussion

Plant height, Number of branches plant^{-1} and Number of seeds pod^{-1}

Variation in yield attributing characters *viz*., plant height, number of branches plant^{-1} and number seeds pod^{-1} of pigeonpea cv. LRG-470 due to spacing and fertilizers was studied and results were depicted in table 1&1a. In case of spacing and fertilzers, there was no significance in plant height, number of branches plant^{-1} and number seeds pod^{-1}but numerically highest values were observed with planting of pigeonpea cv.LRG-470at 90x20cmin combination with 100% RDFand interaction effect also found to be non-significant among the spacing and fertilizers. This might be due to indeterminating growth behavior of the pigeonpea cultivar. These finding were similar to that of Devaraj (2020) [1] and Kaur Kuljit and Saini (2018) [2].

Number of pods plant^{-1}, seed and straw yield

Spacing and fertilizer management practices exerted significant influence on number of pods plant^{-1}, seed and straw yield (kgha^{-1}) of pigeonpea cv. LRG-470, it might be due to its erect and less branching habit it could be trapped more photosynthates even under high density planting and that was performed significantly better yield of 1988 kgha^{-1} at 90x20cm (55,555 plants ha^{-1}) spacing as compared to 120x20cm (41,666 plants ha^{-1}) and 60x20cm (83,333plants ha^{-1}) row spacing at RDF (Table1a). These findings were in conformation with the findings of Sultana *et al*. (2018) [3] and it might be due to erect branching habit trap the more photosynthats there by improve yield.

Table 1: Agronomic evaluation of pigeonpea cv.LRG-470 for high density planting under rainfed vertisols

Treatments	Plant height (cm)				No of branches/plant				No. of pods/plant				No. of seeds/pod			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
Main plots (Spacing)																
S_1:60x20 cm	217.7	246.1	201.9	221.7	16.8	12.8	9.9	13.2	196	180.6	263.8	213.5	3.87	3.48	3.92	3.75
S_2: 90x20 cm	219.4	246.6	203.7	223.2	20	13.1	9.2	14.1	270	239.1	303.2	270.7	4	3.53	4.03	3.85
S_3: 120x20 cm	206.7	241.7	199.4	215.9	18.3	12.9	9.1	13.4	190	185.2	256.3	210.5	3.93	3.51	3.93	4.32
S.Em+/-	10.8	10.6	7.49	11.03	1.25	0.52	0.48	0.92	24.3	10.9	18.9	17.65	0.09	0.09	0.08	0.11
CD (p = 0.05)	NS	NS	NS	NS	2.65	NS	NS	NS	72.01	42.81	42.5	52.44	NS	NS	NS	NS
CV (%)	10.65	9.17	10.5	11.39	15.76	18.69	15.3	17.26	20	11.47	14.6	15.81	5.1	6.43	5.9	6.02
Sub plots (fertilizers)																
F_1:100% RDF	212.2	256.3	201.1	223.2	19.7	13.2	9.4	10.1	236	235	206.2	225.7	3.93	3.5	3.93	3.78
F_2:125% RDF	220.1	247.8	200.3	222.7	17.2	13.1	8.8	13	206	184.4	344	244.8	3.91	3.48	3.99	4.31
F_3:150% RDF	212	230.2	203.6	215.3	17	12.8	9.1	12.9	205	180.5	279.2	221.6	3.93	3.54	3.98	3.82
S.Em+/-	7.41	13.03	1.93	6.46	0.51	0.57	0.22	1.02	9.27	11.33	11.5	12.1	0.073	0.09	0.9	0.35
CD (p = 0.05)	NS	NS	NS	NS	0.72	NS	NS	NS	28.57	34.92	35.6	33.03	NS	NS	NS	NS
CV (%)	7.34	11.29	11.6	12.31	6.5	20.71	18.3	16.89	9	11.92	8.9	10.36	4.1	5.15	6.7	5.32
Interaction (SxF)																
CD (p = 0.05)	NS	49.17	49.1	51.13	NS											

Table 1a: Agronomic evaluation of pigeonpea cv. LRG 470 for high density planting under rainfed vertisols

Treatments	Test Weight(g)				Grain Yield (kg/ha)				Straw Yield (kg/ha)			
	2019-20	2020-21	2021-22	POOLED	2019-20	2020-21	2021-22	POOLED	2019-20	2020-21	2021-22	POOLED
Main plots: Spacing (S)												
S_1:60x20 cm	11.6	11.5	11.5	11.6	1708	1680	959.2	1449	5512	5510	5922	5648
S_2: 90x20 cm	11.7	11.9	11.8	11.8	2421	2705	838.9	1988	7031	7032	5478	6514
S_3: 120x20 cm	11.9	11.7	11.8	11.8	1702	1673	727.9	1368	5503	5503	4475	5160
S.Em+/-	0.18	0.16	0.17	0.2	122	189	31.44	119	580.1	580.1	141.37	456
CD (p = 0.05)	NS	NS	NS	NS	477.1	740.5	126.74	462	1508	1508	565.93	1265
CV (%)	3.16	3.2	3.17	4.12	13.27	19.81	11.2	15	18.8	18.8	7.95	16.02
Sub plots : Fertilizer levels (F)												
F_1:100% RDF	9.2	11.8	10.5	10.6	2146	2350	824.1	1773	6194	7083	4981	6086
F_2:125% RDF	11.8	11.6	11.7	11.7	1879	1855	938.9	1558	7083	6337	6030	6483
F_3:150% RDF	11.8	11.7	11.8	11.8	1808	1853	763.0	1475	6337	6194	4863	5798
S.Em+/-	0.12	0.12	0.12	0.1	68.1	161.53	22.55	86.5	177.2	177.2	169.36	196.9
CD (p = 0.05)	NS	NS	NS	NS	194.4	497.7	69.96	263	546.1	546	527.64	611.5
CV (%)	2.4	2.17	2.19	2.3	7	16.96	10.3	13.9	6.43	6.43	9.6	10.26
Interaction (SxF)												
CD (p = 0.05)	NS											

Conclusion

The study brings to light the superior performance of

pigeonpea cv. LRG-470under high density planting at recommended dose of fertilizer (RDF) and that the three years of the experimentation it can be concluded that the pigeonpea cv. LRG-470 having the phenotypic characters of erect branching habit and its accommodation ability to with stand under high density planting (55,555 plants ha^{-1}) found to be beneficial in terms of yield compared to closer (60x20 cm) and wider (120x20 cm) row spacing in vertisols.

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