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Telangana, India**Corresponding Author:****C Sudha Rani**Principal Scientist (Agronomy),
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Telangana, India*International Journal of Chemical Studies***Effect of different intercrops on growth and yield of pigeonpea in a paired row planting system****C Sudha Rani, C Sudhakar and K Sandya Rani**DOI: <https://doi.org/10.22271/chemi.2020.v8.i4y.9965>**Abstract**

The field experiment was conducted at Agricultural Research Station, Tandur, Professor Jayashankar Telangana State Agricultural University (PJTSAU) on medium black soil under rainfed condition during *kharif*, 2017 and 2018. The experiment was laid out in a randomized block design (RBD) with 3 replications. The experiment consists of six treatments (intercrops) which were sown in a paired row planting of Pigeonpea 1. Pigeonpea+Greengram, 2. Pigeonpea+Blackgram, 3. Pigeonpea+Clusterbean, 4. Pigeonpea+Bhendi, 5. Pigeonpea+Brinjal and 6. Sole Pigeonpea. Pigeonpea crop significantly recorded more number of pods per plant and highest seed yield (1777 kg ha⁻¹) in sole Pigeonpea followed by Pigeonpea+Clusterbean intercrop system. Among all the intercrops, Bhendi recorded highest yield (41,706 kg ha⁻¹), net returns (Rs.1,58,532 ha⁻¹) and B:C (3.17) ratio. Highest Pigeonpea equivalent yields (42,919 kg ha⁻¹), gross returns (Rs.2,81,310 ha⁻¹), net returns (Rs.2,18,810 ha⁻¹) and B:C ratio (3.50) were recorded in Pigeonpea+Bhendi intercropping system.

Keywords: Intercrops, paired row planting, pigeonpea**Introduction**

Due to vagaries of monsoon it is better to raise more than one crop in a unit area. In such situations paired row system is the best option. In a paired row planting system wide spacing that is available between the any two sets of paired rows can be utilized for growing profitable intercrops. Therefore, two adjacent-rows of the base crops are paired to reduce the inter row space to create some space between pairs of base crop rows but wide enough to minimize undue competition among plants of the base crop (Sivaraman and Palaniappan, 1996) [8]. Several experiments conducted all over India clearly showed that paired row planting of sorghum gave similar yield as normal spaced planting (Palaniappan *et al.* 1975) [6]. Development of a feasible and economically viable intercropping system largely depends on the adaptation of planting pattern and selection of compatible crops. The choice of compatible crops for an intercropping system can vary depending on growth habit, land, solar radiation, water and fertilizer utilization. The initial slow growth rate and deep root system of Pigeonpea offers good scope for intercropping with fast growing early maturing and shallow rooted crops. Several short duration crops mainly Greengram, Blackgram, Soybean, Groundnut, Maize, Sorghum, Pearl millet and Vegetables could be grown as intercrop in long duration Pigeonpea for increasing the overall productivity and in maintaining soil fertility. In order to find best profitable intercrop in a paired row system the present trial was proposed.

Material and Methods

The field experiment was conducted at Agricultural Research Station, Tandur, Professor Jayashankar Telangana State Agricultural University (PJTSAU) on medium black soil under rainfed condition during *kharif*, 2017 and 2018. The soil of the experimental site was having P^H 8.2, with low available nitrogen (190.0 kg ha⁻¹), medium in available P (16.60 kg ha⁻¹) and high in available K (330.40 kg ha⁻¹) in all the years. The experiment was laid out in a randomized block design (RBD) with 3 replications. The details of the treatments includes, 1. Pigeonpea+Greengram, 2. Pigeonpea+Blackgram, 3. Pigeonpea+Clusterbean, 4. Pigeonpea+Bhendi, 5. Pigeonpea+Brinjal and 6. Sole Pigeonpea. In paired row system Pigeonpea was sown at 3.6 m spacing between pairs and 45 cm with in pair and plant to plant spacing in each row is 30 cm was followed. Pigeonpea variety 'TDRG-4 (Hanuma)',

Greengram variety 'WGG-42, Blackgram variety 'PU 31, Clusterbean variety 'Pusa Mousami, Bhendi variety 'Pusa Sarani' and Brinjal variety 'Pusa Kranti' were used. The entire quantity of recommended dose of fertilizer for Pigeonpea (20:50:0 kg N:P₂O₅:K₂O ha⁻¹) and 2/3rd of recommended dose of fertilizer for Greengram (13.2:33:0 kg N:P₂O₅:K₂O ha⁻¹), Blackgram (13.2:33:0 kg N:P₂O₅:K₂O ha⁻¹), Clusterbean (19.8:40.9:40.9 kg N:P₂O₅:K₂O ha⁻¹), Bhendi (79.2:33:33 kg N:P₂O₅:K₂O ha⁻¹) and Brinjal (66:39.6:39.6 kg N:P₂O₅:K₂O ha⁻¹) in the form of urea, diammonium phosphate (DAP) and muriate of potash were applied at the time of sowing. The gross plot size was 10.8 x 5.0 m. Observations on five random plants from each plot were recorded. Net plot

yields were used for calculating yield per hectare. The gross returns are worked out based on the prevailing market rate of Pigeonpea seed, Greengram and Blackgram @ Rs.60 per kg and Vegetables @ Rs. 5 per kg. The results were analyzed using Fisher's method of analysis of variance was used for analysis and interpretation of the data (Panse and Sukhatme, 1967) [7]. The level of significance used in F and t tests was P=0.05. Critical differences were calculated wherever F tests were significant. Pigeonpea equivalent yield (PEY) was calculated by converting the yield of intercrops into PEY on the basis of prevailing market prices during the year by using the following formula.

$$\text{PEY} = \text{Yield of Pigeonpea in intercropping system (kg ha}^{-1}\text{)} + \frac{\text{Yield of intercrops (kg ha}^{-1}\text{)} \times \text{Market price of intercrops (kg ha}^{-1}\text{)}}{\text{Market price of Pigeonpea (kg ha}^{-1}\text{)}}$$

Results and Discussion

Performance of Pigeonpea

Pooled results (2 years) of Pigeonpea paired row planting system with different intercrops revealed that the Pigeonpea plant height, number of primary branches plant⁻¹, number of secondary branches plant⁻¹ and test weight were not differed significantly but the number of pods plant⁻¹ and seed yield differed significantly (Table No. 1 & 2).

Maximum plant height (152.1 cm) was recorded in sole Pigeonpea plot, more number of primary branches per plant (2.88) was recorded in Pigeonpea+Clusterbean intercrop system, and more number of secondary branches plant⁻¹ (14.7) and maximum test weight (9.82 g) were recorded in Pigeonpea+Blackgram intercrop system. Pigeonpea recorded significantly maximum number of pods per plant of was in sole Pigeonpea plot (253) followed by Pigeonpea+Clusterbean intercrop (211), Pigeonpea+Blackgram intercrop (189), Pigeonpea+Greengram intercrop (156), Pigeonpea+Bhendi intercrop (152) and Pigeonpea+Brinjal intercrop (132). The highest Pigeonpea seed yield (1777 kg ha⁻¹) was recorded in sole Pigeonpea. Pigeonpea+Clusterbean intercrop system (1447 kg ha⁻¹) recorded highest Pigeonpea seed yield followed by Pigeonpea+Blackgram intercrop system (1273 kg ha⁻¹) and lowest in Pigeonpea+Greengram intercrop system (1067 kg ha⁻¹). This might be due to greater availability of space per plant and translocation of more photosynthates from source to sink as a result of lesser competition for intercepted light accumulation leading to more number of pods per plant that resulted in higher yields. The results are in agreement with the findings of Meena *et al.* (2015), Waghmare *et al.* (2016) and Swathi *et al.* (2017).

Information regarding economics of Pigeonpea was depicted in Table No. 3. The highest net returns (Rs. 84,120 ha⁻¹) was received in sole Pigeonpea plot followed by Pigeonpea+Clusterbean intercrop system (Rs. 64,320 ha⁻¹) and Pigeonpea+Bhendi intercrop system (Rs. 60,280 ha⁻¹) and lowest was recorded in Pigeonpea+Greengram intercrop

system (Rs. 41,520 ha⁻¹). The highest B:C ratio was recorded in Pigeonpea+Bhendi intercrop system (4.82) followed by in sole Pigeonpea plot (3.74); Pigeonpea+Clusterbean intercrop system (2.86), Pigeonpea+Blackgram intercrop system (2.39), Pigeonpea+Greengram intercrop system (1.85) and Pigeonpea+Brinjal intercrop system (1.72). This is in conformity with the findings of Tiwari *et al.* (2016) [12], Arjun Sharma and Guled (2011) [1] and Mallikarjun *et al.* 2018 [4].

Performance of intercrops in Pigeonpea

Among all the intercrops, Bhendi recorded highest yield of 41,706 kg ha⁻¹ followed by Clusterbean yield of 33,391 kg ha⁻¹, Brinjal yield of 27,506 kg ha⁻¹, Blackgram yield of 737 kg ha⁻¹ and Greengram yield of 586 kg ha⁻¹. Highest net returns were recorded in Bhendi crop (Rs.1,58,532 ha⁻¹) followed by Clusterbean (Rs.1,26,953 ha⁻¹) whereas lowest net returns were recorded in Greengram intercrop (Rs.1,02,529 ha⁻¹). The highest B:C (3.17) ratio was recorded in Clusterbean and Bhendi intercrops followed by Brinjal (2.93), Blackgram (2.11) and Greengram (1.21) (Table No. 4). The results are in conformity with the findings of Sujatha and Babalad, 2018 [10].

System productivity and economics

Paired row planting of Pigeonpea with different intercrops, the system productivity, gross returns, net returns and B:C ratio were presented in Table No. 5. Among all the treatments, Paired row planting of Pigeonpea+Bhendi intercrop system recorded highest Pigeonpea equivalent yields (42,919 kg ha⁻¹), gross returns (Rs.2,81,310 ha⁻¹), net returns (Rs.2,18,810 ha⁻¹) and B:C ratio (3.50). This was attributed due to additional yield of the component crop and their better performance in paired row planting of Pigeonpea with better market prices. These results confirm the findings of Kumawat *et al.* (2013) [2], Srichandan and Mangaraj (2015) [9] and Lingaraju *et al.* (2018) [3].

Table 1: Effect of different intercrops on growth of Pigeonpea in a paired row planting system

Treatment	Plant height (cm)			No. of primary branches			No. secondary branches		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Pigeonpea+ Greengram	148.0	140.0	144.0	2.01	2.00	2.01	15.0	13.0	14.0
Pigeonpea+ Blackgram	136.9	136.7	136.8	1.99	2.10	2.01	14.8	14.6	14.7
Pigeonpea+ Clusterbean	139.5	137.5	138.5	2.25	2.30	2.88	12.1	11.7	11.9
Pigeonpea+ Bhendi	133.8	133.8	133.8	2.17	2.12	2.15	9.9	9.7	9.8
Pigeonpea+ Brinjal	147.7	149.7	148.7	2.23	2.34	2.29	11.0	10.7	10.85
Sole Pigeonpea	151.6	150.6	152.1	2.42	2.34	2.38	13.2	11.3	12.25
C.D (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of different intercrops on yield parameters and yield of Pigeonpea in a paired row planting system

Treatment	Number of pods plant ⁻¹			Test weight (g)			Seed yield (kg ha ⁻¹)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Pigeonpea+ Greengram	159	153	156	9.41	9.47	9.44	1006	1127	1067
Pigeonpea+ Blackgram	198	180	189	9.84	9.80	9.82	1195	1351	1273
Pigeonpea+ Clusterbean	217	205	211	9.64	9.73	9.68	1495	1399	1447
Pigeonpea+ Bhendi	157	147	152	9.36	9.37	9.37	1312	1113	1213
Pigeonpea+ Brinjal	137	127	132	9.44	9.36	9.40	1210	1280	1245
Sole Pigeonpea	266	241	253	9.38	9.41	9.39	1920	1634	1777
C.D (p=0.05)	38.4	41	39.7	NS	NS	NS	314	314	315

Table 3: Effect of different intercrops on economics of Pigeonpea in a paired row planting system

Treatment	Gross return (Rs. ha ⁻¹)			Net returns (Rs. ha ⁻¹)			Benefit cost ratio		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Pigeonpea+ Greengram	60360	67620	64020	37860	45120	41520	1.68	2.01	1.85
Pigeonpea+ Blackgram	71700	81060	76380	49200	58560	53880	2.19	2.60	2.39
Pigeonpea+ Clusterbean	89700	83940	86820	67200	61440	64320	2.99	2.73	2.86
Pigeonpea+ Bhendi	78720	66780	72780	66220	54280	60280	5.30	4.34	4.82
Pigeonpea+ Brinjal	72600	76800	74700	45100	49300	47200	1.64	1.79	1.72
Sole Pigeonpea	115200	98040	106620	92700	75540	84120	4.12	3.36	3.74

Table 4: Yield and economic of intercrops in a Pigeonpea paired row planting system

Treatment	Intercrop yield (kg ha ⁻¹)			Gross Returns (Rs ha ⁻¹)			Net Returns (Rs ha ⁻¹)			BCR		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Pigeonpea+ Greengram	781	391	586	46864	19527	33196	31864	4527	18196	2.12	0.30	1.21
Pigeonpea+ Blackgram	983	492	737	58984	34407	46696	43984	19407	31696	2.93	1.29	2.11
Pigeonpea+ Clusterbean	35148	31633	33391	175740	158166	166953	135740	118166	126953	3.39	2.95	3.17
Pigeonpea+ Bhendi	43901	39511	41706	219507	197556	208532	169507	147556	158532	3.39	2.95	3.17
Pigeonpea+ Brinjal	28953	26058	27506	144767	130290	137529	109767	95290	102529	3.14	2.72	2.93
Sole Pigeonpea	-	-	-	-	-	-	-	-	-	-	-	-

Table 5: System productivity and economics of Pigeonpea paired row planting with different intercrops

Treatment	Pigeonpea equivalent yield (kg ha ⁻¹)			Gross return (Rs. ha ⁻¹)			Net return (Rs. ha ⁻¹)			Benefit cost ratio		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
Pigeonpea+ Greengram	1787	1518	1653	107220	91080	99180	69720	53580	61680	1.86	1.43	1.64
Pigeonpea+ Blackgram	2178	1843	2010	130680	110580	120630	93180	73080	83130	2.48	1.95	2.22
Pigeonpea+ Clusterbean	36643	33032	34838	265440	242105	253775	202940	179605	191275	3.25	2.87	3.06
Pigeonpea+ Bhendi	45213	40624	42919	298225	264335	281310	235725	201835	218810	3.77	3.23	3.50
Pigeonpea+ Brinjal	30163	27338	28751	217365	207090	212230	154865	144590	149730	2.48	2.31	2.40
Sole Pigeonpea	1920	1634	1777	115200	98040	106620	92700	75540	84120	4.12	3.36	3.74

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