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Effect of row spacing and intercropping in pigeon pea under *rainfed* condition of South Gujarat

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Abstract
A field experiment was conducted during 2016-17, 2017-18 and 2018-19 to study row spacing and intercropping in pigeon pea *var*. Vaishali under *rainfed* condition of South Gujarat. There were total eight treatments comprising of sole pigeonpea with 120 and 150 cm row spacing, sole greengram and sole soybean, intercropping with greengram and soybean in pigeaonpea with 1:2 and 1:3 ratio. The experiment was laid out in RBD with four replications. The type of soil was medium black and no sever pest and disease incidence were observed on sorghum during the experiment. According to pooled results of three consecutive years the treatment T_7 [pigeonpea (120 cm) + soybean (1:2)] gave significantly higher pigeonpea equivalent yield (1222 kg/ha) and was found at par with only T_5 treatment [pigeonpea (120 cm) + greengram (1:2)] (1150 kg/ha). The data revealed that maximum net returns (Rs. 44106/ha) and B:C ratio (1.51) were obtained in pigeonpea (120 cm) intercropped with soybean in the ratio of 1:2 followed pigeonpea (120 cm) + greengram (1:2).

Keywords: Pigeonpea, intercropping, crop equivalent yield, row spacing

Introduction
Pigeonpea [*Cajanus cajan* (L.) Millsp.] is one of the protein rich legumes of the semi-arid tropics grown predominantly under *rainfed* conditions. It is grown throughout the tropical and sub-tropical regions of the world, between 30^0 N and 35^0 S latitudes. However, major area under pigeonpea in India is lying between 14^0 and 28^0 N latitudes. Pigeonpea is one of the important pulses of India and 91 per cent of the world's pigeonpea is produced in India.

Small/marginal farm holder's productivity is constrained under *rainfed* condition has numerous of limitations *viz*., biophysical, economic and social in nature, for which legume intercropping suits better in present era. The additive series of intercropping seems appropriate since it reflects the actual cropping system; a fixed density of main crop is grown with various densities of intercrop. In this experiment, we have tried the same under *rainfed* condition with pigeonpea as main crop and greengram and soybean as intercrops with different two densities and two different row saplings. One of the objectives under this study was also to test, two different row spacings of pigeonpea.

Pigeonpea, like other pulses is considered as subsidiary crop. It is often grown on marginal lands and is usually intercropped with other pulses or planted on bunds. As a crop of secondary importance in many of these systems, it receives little or no purchased high cost inputs. However, in recent years, farmers in some areas are growing pigeonpea as a sole crop and the crop is increasingly gaining status as a cash crop.

The main subject of intercropping is to augment total productivity per unit area and time, besides judicious and equitable utilization of land resources and farming inputs including labours (Marer *et al*., 2007) [1]. Richards (1983) [2] also summarized intercropping as to minimize soil erosion (especially if fast growing and slower-maturing varieties are planted together) with lesser spread of pests and diseases, increase the use of available resources and minimized risks of crop failure. Cropping systems based approach of agricultural research, received little attention, except some considerations for utilizing the beneficial effects of growing crops of dissimilar nature in mixed/ intercropping (Aiyer, 1949) [4] or sequential cropping and role of legumes in green manuring (Singh, 1972) [3]. Keeping all these in view this experiment was framed.

Material and Methods
The field experiment was conducted during 2016-17, 2017-18 and 2018-19 at NARP farm, Navsari Agricultural University, campus Bharuch to study the row spacing and intercropping in pigeon pea *var*. Vaishali under *rainfed* condition of South Gujarat.

The soil of the experimental field was medium black having medium to poor drainage, medium in available nitrogen (256 kg/ha) and available phosphorus (25.8 kg/ha) with high potassium (381 kg/ha).

Total eight treatments comprising of sole pigeonpea sole at 120 cm row spacing, sole pigeonpea at 150 cm row spacing, sole greengram, sole soybean, pigeonpea (120 cm) + greengram (1:2), pigeonpea (150 cm) + greengram (1:3), pigeonpea (120 cm) + soybean (1:2) and pigeonpea (150 cm) + soybean (1:3). The experiment was laid out in factorial RBD with three replications. The full dose of fertilizers was applied according to the treatments manually before sowing the seeds *i.e.* for sole cropping as per crop and for intercropping treatments RDF of pigeonpea was applied. All the recommended cultural practices and plant protection measures were followed throughout the experimental periods.

Result and Discussion

Effect on growth parameters and yield attributes

The mean data on plant height of pigeonpea, greengram and soybean is depicted in Table 1. The data showed that the pigeonpea height remained between 155.35 cm to 163.80 cm during 2016-17, 151.23 cm to 160.80 cm during 2017-18 and from 158.60 cm to 176.45 cm in the year 2018-19. From the mean data it may be said that, there was no major difference in height of pigeonpea whether it is sole planted or intercropped with greengram and soybean. Same was in the case of soybean and greengram crop whether sown sole or intercropped. The plant height of greengram remained between 51.68 to 55.95 cm in 2016-17, 50.33 to 54.45 cm in 2017-18 and 59.23 to 58.60 cm in 2018-19. The plant height of soybean remained between 52.00 to 54.18 cm in 2016-17, 51.68 to 52.23 cm in 2017-18 and 58.83 to 61.75 cm in the year 2018-19.

Table 2 shows the mean data on number of branches/plant, days to 50% flowering and pods per plant of pigeonpea. The data recorded showed the mean number of branches per plant from 27.13 to 28.62 in 2016-17, 26.32 to 27.87 in 2017-18 and 27.68 to 30.58 in the year 2018-19.

While the days to 50% flowering remained from 104 to 111 days during the year 2016-17, 103 to 109 during 2017-18 and from 108 to 116 during the year 2018-19.

The data recorded in different plots of treatments regarding to pods per plant in pigeonpea crop varied from 270.23 to 284.18 during 2016-17, from 256.99 to 272.96 during 2017-18 and from 268.45 to 293.75 during 2018-19.

Effect on yield of pigeonpea and intercrops

The data pertaining to grain yields of pigeonpea, greengram and soybean along with the pigeon pea equivalent yield are given in Table 3. The data revealed that in all the three years of experimentation and pooled results, significantly higher pigeonpea equivalent yield (PEY) was obtained in pigeonpea (120 cm) intercropped with soybean in the ratio of 1:2 (T_7). However in the year 2017-18, it remained at par with all the treatments except for treatment T_3 *i.e.* sole greengram. During 2018-19, all the intercropping treatments irrespective of the intercrop and row spacing remained statistically similar in case of PEY with higher values from treatment T_7 [pigeonpea (120 cm) + soybean (1:2)].

Although in pooled results the treatment T_7 [pigeonpea (120 cm) + soybean (1:2)] gave significantly higher pigeonpea equivalent yield (1222 kg/ha) and was found at par with only T_5 treatment [pigeonpea (120 cm) + greengram (1:2)] (1150 kg/ha). Similar observations were made by Patel and Raj (2009) [7], Garud *et al.* (2018) [6] and Pradhan *et al.* (2019) [5].

Economics

The data pertaining to monetary returns as influenced by different row spacing and intercropping treatments is given in Table 4. The data revealed that maximum net returns of Rs. 44106/ha and B:C ratio (1.51) were obtained in pigeonpea (120 cm) intercropped with soybean in the ratio of 1:2 (T_7) followed by Rs. 40780/ha (1.44) obtained from T_5 treatment [pigeonpea (120 cm) + greengram (1:2)] and Rs. 37475/ha (1.38) obtained from T_1 treatment *i.e.* sole pigeon pea sole, 120 cm.

So from these results it can be concluded that, pigeonpea sown at row spacing 120 cm is beneficial over 150 cm row spacing and the monetary returns may be increased from the additive type intercropping system by adding 2 rows of soybean or greengram.

Table 1: Plant height at harvest of pigeon pea and intercrops as influenced by different treatments

Treatments	2016-17		2017-18		2018-19	
	PP	IC	PP	IC	PP	IC
T_1 sole pigeon pea at 120 cm row spacing	163.80	-	159.48	-	176.45	-
T_2 sole pigeon pea at 150 cm row spacing	155.35	-	151.23	-	171.33	-
T_3 sole greengram	-	55.95	-	54.45	-	58.60
T_4 sole soybean	-	53.10	-	51.68	-	61.48
T_5 pigeon pea (120 cm) + greengram (1:2)	165.18	55.65	160.80	54.20	168.70	57.05
T_6 pigeon pea (150 cm) + greengram (1:3)	156.55	51.68	152.38	50.33	159.15	59.23
T_7 pigeon pea (120 cm) + soybean (1:2)	164.25	52.00	159.93	52.23	167.70	61.75
T_8 pigeon pea (150 cm) + soybean (1:3)	156.03	54.18	151.90	51.88	158.60	58.83

**PP- Pigeon pea & IC- Intercrops

Table 2: Number of branches/plants, days to 50% flowering and pods per plant of pigeon pea as influenced by different treatments

Treat	Number of branches/pl			50% flowering			pods per plant		
	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
T_1	28.39	27.64	30.58	111	108	113	284.18	270.58	293.75
T_2	27.90	26.55	29.69	109	104	116	279.12	259.32	291.81
T_3	-	-	-	-	-	-			
T_4	-	-	-	-	-	-			
T_5	27.13	27.05	27.58	112	109	114	278.55	272.96	285.31
T_6	28.62	27.87	29.24	106	105	108	272.08	264.46	271.41
T_7	27.04	26.32	27.68	111	108	113	281.31	269.79	278.09
T_8	28.47	27.72	29.06	106	103	110	270.23	256.99	268.45

T_1: sole pigeon pea at 120 cm row spacing; T_2: sole pigeon pea at 150 cm row spacing; T_3: sole greengram; T_4: sole soybean; T_5: pigeon pea (120 cm) + greengram (1:2); T_6: pigeon pea (150 cm) + greengram (1:3); T_7: pigeon pea (120 cm) + soybean (1:2); T_8: pigeon pea (150 cm) + soybean (1:3)

Table 3: Grain yield (kg/ha) of pigeon pea, greengram and soybean along with the pigeon pea equivalent yield (kg/ha) as influenced by different treatments.

Treat	Yield (kg/ha)											
	2016-17			2017-18			2018-19			Pooled		
	IC	PP	PEY	IC	PP	PEY	IC	PP	PEY	IC	PP	PEY
T_1	-	1005	1005	-	1164	1164	-	1062	1062	-	1077	1077
T_2	-	852	852	-	1085	1085	-	961	961	-	966	966
T_3	626	-	469	663	-	497	771	-	578	686	-	515
T_4	2045	-	1022	2259	-	1129	2146	-	1073	2150	-	1075
T_5	222	877	1045	328	933	1179	279	1018	1227	276	943	1150
T_6	431	625	948	537	690	1093	304	884	1111	424	733	1051
T_7	1137	613	1182	1223	615	1227	732	893	1259	1031	707	1222
T_8	908	393	847	1278	448	1087	786	780	1173	991	540	1036
S.Em.±			37			60			56			30
C.D. at 5%			108			177			164			85
C.V. %			8.00			11.41			10.56			10.28

T_1: sole pigeon pea at 120 cm row spacing; T_2: sole pigeon pea at 150 cm row spacing; T_3: sole greengram; T_4: sole soybean; T_5: pigeon pea (120 cm) + greengram (1:2); T_6: pigeon pea (150 cm) + greengram (1:3); T_7: pigeon pea (120 cm) + soybean (1:2); T_8: pigeon pea (150 cm) + soybean (1:3)

Table 4: Economics as influenced by different treatments.

Treatments	Fixed cost	Variable cost	Total cost of cultivation	Gross returns	Net returns	B:C ratio
T_1	25639	1500	27139	64614	37475	1.38
T_2	25639	1275	26914	57959	31046	1.15
T_3	21090	2200	23290	30889	7600	0.33
T_4	25639	4200	29839	64499	34661	1.16
T_5	25639	2600	28239	69019	40780	1.44
T_6	25639	2595	28234	63054	34820	1.23
T_7	25639	3600	29239	73344	44106	1.51
T_8	25639	3795	29434	62132	32698	1.11

**Sale price of Pigeon pea-Rs. 60/kg; Soybean-Rs. 30/kg; and Green gram-Rs. 45/kg

T_1: sole pigeon pea at 120 cm row spacing; T_2: sole pigeon pea at 150 cm row spacing; T_3: sole greengram; T_4: sole soybean; T_5: pigeon pea (120 cm) + greengram (1:2); T_6: pigeon pea (150 cm) + greengram (1:3); T_7: pigeon pea (120 cm) + soybean (1:2); T_8: pigeon pea (150 cm) + soybean (1:3)

References

1. Marer SB, Lingaraju BS, Shashidhara GB. Productivity and economics of maize and pigeonpea intercropping under *rainfed* condition in northern transitional zone of Karnataka. Karnataka Journal Agricultural Sciences. 2007; 20(1):1-3.
2. Richards P. Ecological Change and the Politics of African Land Use. Africa Studies Review. 1983; 26:1-72.
3. Singh A. Conceptual and experimental basis of cropping patterns. In: Proceedings of Symposium on cropping patterns in India held at New Delhi, 27-31 January, 1968, ICAR, New Delhi, 1972, 271-274.
4. Aiyer AKYN. Mixed cropping in India. Indian Journal of Agricultural Sciences. 1949; 19:439-543.
5. Pradhan P, Verma A, Naik RK. Effect on yield of pigeonpea due to intercropping of soybean and chickpea. Journal of Pharmacognosy and Phytochemistry. 2019; 8(1):713-718.
6. Garud HS, Asewar BV, Khazi GS, Khargkharate VK, Gadade GD. Effect of intercropping systems on pigeon pea equivalent yield under different land configuration. Journal of Pharmacognosy and Phytochemistry. 2018; 7(6):525-527.
7. Patel SU, Raj VC. Accessibility of Intercropping in *Rabi* Pigeonpea (*Cajanus Cajan* (L.) Millsp.) under South Gujarat condition. M.Sc. Thesis submitted to Navsari Agricultural University, Navsari, 2009.