

## Effect of fertilizer levels on pigeonpea and greengram intercropping systems

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**Abstract:** Field experiments were conducted at Tamil Nadu Agricultural University, Coimbatore for two years during *kharif* seasons of 1997-98 and 1998-99 to evolve suitable system of sowing pigeonpea and greengram in intercropping system and to fix optimum dose of fertilizer to pigeonpea + greengram intercropping system. Growing of pigeonpea applied with full recommended dose of fertilizer in paired rows with greengram applied with either 1/3<sup>rd</sup> (5:10 kg NP/ha) or 1/6<sup>th</sup> (2.5:5 kg NP/ha) of recommended fertilizer was found to be the best intercropping system.

**Key words :** Pigeonpea, Greengram, Intercropping, Fertilizer levels.

### Introduction

Growing pigeonpea as a pure crop is not economically viable due to its low productivity and longer duration. Intercrops have several advantages such as risk distribution, better utilization of labour, better quality product with higher productivity and income. Moreover pigeonpea is slow growing in nature during the early stages and so allows weed dominance. However here is a greater scope for intercropping with greengram, blackgram, cowpea, soybean, gingelly and maize. Intercropping with short duration pulses (greengram and blackgram) and oilseeds (gingelly) in pigeonpea enhances total productivity besides the benefits of suppressing weeds and spreading the risk involved (Sarma *et al.* 1995). Rao and Mishra (1989) stated that growing two legumes together helped in increasing productivity as well as achieving higher LER. Saxena *et al.* (1998) reported that a crop combination of 25 per cent pigeonpea and 75 per cent groundnut resulted in the highest LER of 1.27. Arokiaraj and Kannappan (1995) found that the LER was high in intercropping systems of pigeonpea indicating the yield advantage over pure crop of pigeonpea.

When crops are intercropped by increasing the overall density, nutritional deficiency is likely to occur. Hence judicious application of fertilizers coupled with plant population is essential to achieve higher benefits especially under intercropping systems like pigeonpea with greengram. Uniform planting of pigeonpea at

60 cm spacing intercropped with greengram at optimum population with recommended dose of fertilizers (30 kg N + 60kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> to pigeonpea and 20 kg N+ 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> to greengram) gave higher grain yield of pigeonpea and greengram. Based on the above aspects an experiment was taken up to find out optimum dose of fertilizers and suitable system of sowing pigeonpea with greengram.

### Materials and Methods

The experiments were conducted at Tamil Nadu Agricultural University, Coimbatore for two years during *kharif* seasons of 1997-98 and 1998-99. The experimental site is located at 11°N latitude and 77°E longitude at an altitude of 426.7 m above sea level. The soil of the experimental field is clay loam in texture, classified under Typic haplustalf. The fertility status of the soil is classified as low in available N (220 kg ha<sup>-1</sup>), medium in available in P (12.4 kg ha<sup>-1</sup>) and high in available K (694 kg ha<sup>-1</sup>). The experiment consisted of 11 treatment combinations with four replications in Randomised Block Design. The treatments included T<sub>1</sub> - Pure greengram + Recommended dose (15:30 NP), T<sub>2</sub> - Pure pigeonpea + Recommended dose (25:50 NP), T<sub>3</sub> - Pigeonpea in paired rows (25:50 NP) + Greengram (5:10 NP), T<sub>4</sub> - Pigeonpea in paired rows (25:50 NP) + Greengram (2.5:5 NP), T<sub>5</sub> - Pigeonpea in paired rows (25:50 NP) + Greengram (No fertilizer), T<sub>6</sub> - Pigeonpea in mixed cropping (25:50 NP) + Greengram (10:20 NP), T<sub>7</sub> - Pigeonpea in mixed cropping

**Table 1.** Influence of pigeonpea + greengram intercropping system on the growth, yield, yield components and economics (Kharif, 1997-98)

Treatment	Pod number plant <sup>-1</sup>		No seeds pods <sup>-1</sup>		100 seed weight (g)		Grain yield (kg ha <sup>-1</sup> )		Grain equivalent yield (kg ha <sup>-1</sup> )	BC ratio
	GG	PP	GG	PP	GG	PP	GG	PP		
T <sub>1</sub>	18.75	-	12.50	-	3.43	-	639	-	639	1.64
T <sub>2</sub>	-	47.5	-	3.45	-	7.73	-	605	756	1.50
T <sub>3</sub>	16.25	35.5	11.50	3.08	3.28	7.65	542	565	1248	2.50
T <sub>4</sub>	17.25	50.5	12.00	3.63	3.30	7.93	585	611	1349	2.60
T <sub>5</sub>	15.00	62.8	11.25	3.80	3.25	7.95	458	622	1237	2.48
T <sub>6</sub>	14.25	21.5	11.00	2.63	3.20	7.15	445	429	981	1.81
T <sub>7</sub>	20.75	23.5	13.25	2.68	3.50	7.20	648	463	1228	2.35
T <sub>8</sub>	18.25	26.3	12.25	3.00	3.35	7.30	631	478	1229	2.50
T <sub>9</sub>	11.00	27.3	10.00	3.00	3.00	7.40	381	521	1033	2.12
T <sub>10</sub>	13.00	32.3	10.50	3.03	3.15	7.50	419	540	1094	2.37
T <sub>11</sub>	11.75	39.5	9.75	3.25	3.08	7.68	368	580	1094	2.45
SEd	1.89	4.59	1.29	0.13	0.11	0.17	34.7	15.8	-	-
CD	3.89	9.41	2.64	0.26	0.23	0.34	71.2	32.4	-	-

**Table 2.** Influence of pigeonpea + greengram intercropping system on the growth, yield, yield components and economics (Kharif, 1998-99)

Treatment	Pod number plant <sup>-1</sup>		No seeds pods <sup>-1</sup>		100 seed weight (g)		Grain yield (kg ha <sup>-1</sup> )		Grain equivalent yield (kg ha <sup>-1</sup> )	BC ratio
	GP	PP	GG	PP	GG	PP	GG	PP		
T <sub>1</sub>	46.8	-	13.2	-	3.60	-	675	-	675	1.73
T <sub>2</sub>	-	69.3	-	4.00	-	7.98	-	750	937	1.86
T <sub>3</sub>	43.0	60.0	12.7	3.70	3.50	7.90	625	681	1476	2.95
T <sub>4</sub>	39.5	52.5	12.2	3.55	3.45	7.83	575	645	1382	2.66
T <sub>5</sub>	36.3	49.3	10.7	3.40	3.30	7.60	518	621	1294	2.60
T <sub>6</sub>	33.8	46.3	10.7	3.25	3.25	7.43	513	594	1255	2.30
T <sub>7</sub>	28.3	42.0	10.2	3.00	3.05	7.30	454	555	1147	2.20
T <sub>8</sub>	23.5	36.8	9.75	2.80	3.00	7.05	403	520	1053	2.11
T <sub>9</sub>	35.0	47.5	11.7	3.35	3.43	7.55	560	610	1325	2.73
T <sub>10</sub>	30.5	45.0	10.5	3.10	3.20	7.35	506	575	1225	2.66
T <sub>11</sub>	26.0	38.5	10.2	2.85	3.10	7.15	461	482	1063	2.44
SEd	2.07	2.47	0.89	0.14	0.14	0.14	10.8	12.4	-	-
CD	4.25	5.05	1.83	0.28	0.28	0.28	22.3	25.4	-	-

GG - Greengram

PP - Pigeonpea

(25:50 NP) + Greengram (5:10 NP), T<sub>8</sub> - Pigeonpea in mixed cropping (25:50 NP) + Greengram (No fertilizer), T<sub>9</sub> - Pigeonpea in uniform row (12.5:25 NP) + Greengram (10:20 NP), T<sub>10</sub> - Pigeonpea in uniform row (12.5:25 NP) +

Greengram (5:10 NP), T<sub>11</sub> - Pigeonpea in uniform row (12.5 : 25 NP) + Greengram (No fertilizer). The entire dose of fertilizers viz. N and P was applied basally.

## Results and Discussion

During *kharif*, 1997-98 among the treatments tried, growing of pigeonpea in paired rows with full recommended dose of fertilizers with greengram ( $T_3$ ) in the interspaces recorded more height, more number of pods/plant, higher number of seeds/pod, 100 seed weight leading to higher grain yield. This treatment is comparable with growing of pigeonpea in paired rows with full recommended dose (25:50 NP) + greengram 2.5:5 NP ( $T_4$ ) and growing of pigeonpea as sole crop with full recommended dose ( $T_2$ ). However during *Kharif* 1998-99, growing pigeonpea as sole crop recorded significantly higher plant height, yield attributes and yield. Similar trend was observed in sole greengram also (Table 2). Similarly Velayutham *et al.* (2000) recorded significantly higher grain yield of 1101 kg ha<sup>-1</sup> under sole cropping of redgram indicating that all the intercrops had competitive effect on redgram. Growing pigeonpea or greengram as sole crop was not economical.

Among the intercrop combinations tried, growing pigeonpea in paired rows with full recommended dose of fertilizer in combination with greengram as intercrop which was applied with 1/3<sup>rd</sup> of recommended quantity of fertilizers *i.e.* 5:10 NP kg/ha ( $T_3$ ) registered significantly higher growth and yield attributes and yield of both pigeonpea and greengram. It was followed by the treatment ( $T_4$ ). Growing pigeonpea with

greengram as mixed cropping registered lower yields. This could be attributed mainly to higher total population of greengram and pigeonpea per unit area resulting in increased competition for growth resources, especially for moisture, nutrients and light. Similar reduction in seed yield of greengram has been reported by Bishnoi *et al.* (1987) and Dharam Singh and Singh (1992). Reduction in number of pods per plant and seed weight per plant was also reported by Hunshal and Malik (1988) in greengram intercropped with pigeonpea.

With regard to grain equivalent yield (GEY) also growing of pigeonpea in paired rows with full recommended dose of fertilizer in combination with greengram as intercrop applied with 1/6<sup>th</sup> (2.5:5 kg NP/ha) or 1/3<sup>rd</sup> (5:10 kg NP/ha) of recommended dose of fertilizer produced higher grain equivalent yield of 1349 and 1248 kg/ha respectively compared to other treatment combinations. Meyyazhagan *et al.* (1999) recorded higher crop growth, pods and pigeonpea yield and crop equivalent yield under intercropping systems with pigeonpea. During 1998-99, on comparing these two crops *viz.*, pigeonpea and greengram in terms of GEY, raising greengram as intercrop in between the paired rows of pigeonpea applied with full dose of recommended fertilizer with 1/3<sup>rd</sup> of recommended fertilizer *i.e.* 5:10 kg NP/ha to greengram was found to be advantageous with

Table 3. Pooled mean for grain yield and grain equivalent yield

Treatment	Grain yield (kg ha <sup>-1</sup> )		Grain equivalent yield (kg ha <sup>-1</sup> )
	GP	PP	
T <sub>1</sub>	657	-	657
T <sub>2</sub>	-	677	846
T <sub>3</sub>	583	623	1362
T <sub>4</sub>	580	628	1365
T <sub>5</sub>	488	621	1265
T <sub>6</sub>	479	511	1118
T <sub>7</sub>	551	509	1187
T <sub>8</sub>	517	499	1141
T <sub>9</sub>	470	565	1179
T <sub>10</sub>	462	557	1159
T <sub>11</sub>	520	531	1078

GP - Greengram

PP - Pigeonpea

higher GEY of 1476 kg ha<sup>-1</sup> (T<sub>3</sub>) compared to other treatment combinations.

From the pooled mean of grain yield of two crops it is evident growing pigeonpea in paired rows with full recommended dose of fertilizer along with greengram as intercrop applied with 1/3<sup>rd</sup> (5:10 NP kg/ha) (T<sub>3</sub>) or 1/6<sup>th</sup> (2.5:5 kg NP/ha) (T<sub>4</sub>) of recommended quantity of fertilizers registered higher grain yield of both pigeonpea and greengram. The pooled mean of grain equivalent yield of two years also showed that these two treatments T<sub>3</sub> and T<sub>4</sub> were superior to other treatments by recording higher GEY of 1362 and 1365 kg/ha respectively.

Growing pigeonpea in paired rows with full recommended dose of fertilizer in combination with greengram as intercrop applied with 1/6<sup>th</sup> of recommended quantity of fertilizers resulted in a higher BC ratio of 2.60 (T<sub>4</sub>) followed by the treatment T<sub>3</sub> (2.50) whereas raising either greengram or pigeonpea as sole crop produced a lower BC ratio of 1.64 & 1.50. During 1998-99, highest BC ratio of 2.95 was obtained by growing pigeonpea in paired rows applied with full recommended dose of fertilizer with greengram as intercrop applied with 1/3<sup>rd</sup> of recommended fertilizers i.e 5:10 kg NP/ha (T<sub>3</sub>). It was followed by the treatment (T<sub>9</sub>) which includes growing of pigeonpea in uniform rows with 12.5:25 kg NP/ha + greengram with 2/3<sup>rd</sup> (10:20 kg NP/ha) of recommended dose of fertilizers (T<sub>9</sub>) (2.73). Madhusudhan Rao *et al.* (1989) stated that the monetary advantage was highest when pigeonpea was intercropped with greengram in 1:2 row proportion at Lam, Andhra Pradesh. Whereas raising sole greengram and sole pigeonpea fetched a low BC ratio of 1.73 and 1.86 respectively.

It can be concluded that growing of pigeonpea applied with full recommended dose of fertilizer (25:50 kg NP/ha) in paired rows with greengram applied with either 5:10 kg NP/ha or 2.5:5 kg NP/ha can be recommended.

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