

Production potential and profitability in pigeonpea (*Cajanus cajan*) + groundnut (*Arachis hypogaea*) intercropping system*

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Pigeonpea [*Cajanus cajan* (L.) Millsp.], is a widely-spaced initially slow growing crop, offers good potential for intercropping of short- statured crops under rainfed conditions. Pigeonpea + groundnut (*Arachis hypogaea* L.) intercropping is getting popularized in central India in rainfed areas where probability of crop failure is generally high due to frequent occurrence of aberrant weather conditions.

Consequently under such a situation intercropping can be more profitable and dependable than sole cropping. Intercropping system increases the total productivity in addition to stability in production. Selection of compatible genotype of the component crops and their appropriate planting pattern avoid interspecific and intraspecific competition for resources and thereby give higher productivity. Hence a field experiment was conducted to find out the most compatible genotype and appropriate spatial arrangement for pigeonpea+ groundnut intercropping under rainfed conditions.

*Short note

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The field experiment was conducted during 1995-97 at

Table 1 Seed yield, pigeonpea equivalent-yield and net return in pigeonpea + groundnut intercropping

Treatment	Pooled seed-yield (kg/ha)		Pigeonpea-equivalent yield (kg/ha)	Net return (Rs/ha)	Benefit:cost ratio
	Pigeonpea	Groundnut			
<i>Sole cropping</i>					
Pigeonpea					
'Pusa 9'	2 594		2 594	29 430	4.00
'Bahar'	2 135		2 135	22 818	3.08
Groundnut					
'Chitra'		1 802	1 274	5 500	0.55
'Kaushal'		1 537	1 122	7 636	0.76
<i>Intercropping</i>					
'Pusa 9' + 'Chitra'					
1:5	1 204	1 305	2 130	21 152	2.22
2:5	1 867	1 151	2 691	29 635	3.22
'Pusa 9' + 'Kaushal'					
1:5	1 204	1 192	2 033	19 733	2.07
2:5	1 455	877	2 068	20 707	2.27
'Bahar' + 'Chitra'					
1:5	1 212	1 368	2 175	21 768	2.29
2:5	1 359	1 174	2 193	22 298	2.45
'Bahar' + 'Kaushal'					
1:5	1 061	1 092	1 827	16 503	1.73
2:5	1 404	1 015	2 127	21 435	2.35
CD ($P=0.05$)			372		

Table 2 Competition function and economic indices in pigeonpea + groundnut intercropping

Intercropping	LER	ATER	CRp	CRg	Kp	Kg	K	Ap	Ag	MAI	IER
<i>'Pusa 9' + 'Chitra'</i>											
1:5	1.19	0.83	2.36	0.42	3.53	0.64	2.26	1.29	-1.29	3357	0.71
2:5	1.36	1.04	2.06	0.48	2.95	1.54	4.54	1.08	-1.08	5728	1.01
<i>'Pusa 9' + 'Kaushal'</i>											
1:5	1.21	0.94	2.29	0.42	3.23	0.81	2.2	1.26	-1.26	3425	0.67
2:5	1.11	0.84	1.89	0.52	1.42	1.10	1.57	0.75	-0.75	2052	0.70
<i>'Bahar' + 'Chitra'</i>											
1:5	1.32	0.95	2.78	0.36	5.58	0.74	4.13	1.74	-1.74	5270	0.95
2:5	1.29	0.97	1.78	0.55	2.80	1.16	3.25	0.82	-0.82	5013	0.98
<i>'Bharat' + 'Kaushal'</i>											
1:5	1.19	0.84	2.70	0.37	3.82	0.57	2.18	1.50	-1.50	2635	0.74
2:5	1.30	0.98	1.88	0.53	2.58	1.32	3.40	0.82	-0.82	4947	0.94

*LER, Land-equivalent ratio; ATER, area time equivalent ratio; CR, competitive ratio; K, relative crowding coefficient; A; aggressivity; p, pigeonpea; g, groundnut; MAI, monetary advantage index; IER, income-equivalent ratio

research farm of the Institute involving intercropping of 2 diverse growing genotypes each of pigeonpea ('Bahar' compact and 'Pusa 9' semi-spreading) and groundnut ('Chitra' semi-spreading and 'Kaushal' bunch type) under 1:5 and 2:5 row arrangement (pigeonpea : groundnut) in replacement system. The sole stands of all the genotypes were also maintained. Randomized block design with 3 replications was adopted. The soil was sandy loam, low in organic carbon (0.28%) and available nitrogen (185 kg/ha) and medium in available P (17.5 kg/ha) and exchangeable potassium (265 kg/ha). Planting of pigeonpea and groundnut was done on 3 July and 17 July in 1995 and 1996 in 60 cm and 45 cm apart rows respectively. The plant-to-plant distance was maintained at 20 cm. Recommended fertilizers, viz 20, 26.4 and 20 kg N, P and S/ha to sole pigeonpea and 20, 26.4, 16 and 20 kg N, P, K and S/ha to sole groundnut, were applied. In intercropping the crops received fertilizers on the basis of proportionate area under each crop. The crop duration for pigeonpea and groundnut was 275 and 140 days respectively. Land-equivalent ratio, competition ratio, relative crowding coefficient, aggressivity and monetary advantage index, income-equivalent ratio and area time-equivalent ratio were calculated.

Significantly higher seed yield of pigeonpea was obtained in sole cropping which reduced considerably in intercropping primarily due to loss in area. Of the 2 pigeonpea genotypes, 'Pusa 9' gave significantly higher seed yield of 459 kg/ha showing an increase of 21.49% over the 'Bahar' in the sole cropping (Table 1). In intercropping, the yield level of both the genotypes was lower by 10.81–35.51% in 1:5 row arrangement compared with 2:5 row arrangement. 'Pusa 9' gave higher seed yield than 'Bahar' in all the combinations with pigeonpea.

The semi-spreading genotype 'Chitra' gave higher seed yield by 265 kg/ha than the bunch-type 'Kaushal' in sole cropping. In intercropping also 'Chitra' gave higher yield

than 'Kaushal' in all the combinations during both the years with either of pigeonpea genotypes, indicating its better compatibility. A spatial arrangement of 1:5 row ratio proved better for groundnut yield with a gain of 77 to 315 kg/ha over 2:5 row arrangement probably owing to more areas under groundnut and less competition for resources. Jagtap and Holkar (1998) also observed variable response of pigeonpea and soybean [*Glycine max* (L.) Merr.] genotypes in intercropping under rainfed conditions of western Madhya Pradesh.

A considerable variation in pigeonpea-equivalent yield was observed due to intercropping. The highest pigeonpea-equivalent yield (2 691 kg/ha) was observed in pigeonpea genotype 'Pusa 9'+ 'Chitra' intercropping under 2:5 row arrangement over all the treatments except yield obtained in sole crop of 'Pusa 9' which was statistically at par. The results indicate that higher population replacement of pigeonpea by intercrops is not productive. Of the 2 planting systems, 2:5 row arrangement gave a yield advantage of 18–561 kg/ha. Higher seed yield of component crops in the system resulted in significantly higher equivalent yield Prasad *et al.* (1997) also found higher equivalent yield in pigeonpea+soybean intercropping system under south-eastern Rajasthan conditions.

Intercropping systems gave 11–36% more grain than the sole cropping. The maximum land-equivalent ratio of 1.36 was recorded in 'Pusa 9' pigeonpea + 'Chitra' groundnut intercropping under 2:5 row ratio probably due to more complimentary relationship. It also had higher relative crowding coefficient and its product, indicating an advantage as well as complimentary relationship in the 2 species. Pigeonpea proved dominant component in the intercropping having positive aggressivity factor as well as higher competition ratio (Table 2). Comparatively lower values of competitive ratio and aggressivity factor in pigeonpea + groundnut intercropping under 2:5 row arrangement

indicated balanced competition between the 2 species which partially competed for different resources. The highest area time-equivalent ratio of 1.04 was recorded in 'Pusa 9'+ 'Chitra' intercropping under 2:5 row arrangement which indicated efficient use of area time by the intercrop and thereby advantage in yield.

On the basis of mean of 2 years, the highest net return was fetched by 'Pusa 9'+ 'Chitra' intercropping under 2:5 planting pattern, resulting in an advantage of Rs 7 337/ha over 'Bahar' + 'Chitra' intercropping under same planting pattern. The highest benefit : cost ratio was also recorded in same combination. Relatively higher yield of the component crops resulted in higher net return and benefit : cost ratio. The highest monetary advantage of Rs 5 728 was achieved in 'Pusa 9'+ 'Chitra' intercropping under 2:5 planting pattern owing to higher values of combined intercrops, indicating better intercropping system. The higher income-equivalent ratio of 1.01 achieved in same combination indicated its superiority to others.

SUMMARY

Pigeonpea [*Cajanus cajan* (L.) Millsp.] + groundnut (*Arachis hypogaea* L.) intercropping proved more productive and remunerative than either of the sole crops under rainfed conditions of central Uttar Pradesh. An intercropping of 'Pusa 9' pigeonpea with 'Chitra' groundnut under 2:5 row ratio gave the maximum pigeonpea-equivalent yield and also profit.

REFERENCES

- Jagtap J G and Holkar S. 1998. Evaluation of soybean (*Glycine max*) and pigeonpea (*Cajanus cajan*) lines for advantage in intercropping system. *Indian Journal of Agricultural Sciences* 68 (5) : 241-3.
- Prasad S N, Singh, Ratan and Singhal A K. 1997. Grain yield, competitive indices and water use under soybean (*Glycine max*)-based intercropping system in South-eastern Rajasthan. *Indian Journal of Agricultural Sciences* 67 (4) : 150-2.