

Effect of spacing on hybrid seed yield of pigeonpea hybrid COPH2 (*Cajanus cajan* L. Millsp)

K. PARAMESWARI, K. VANANGAMUDI AND S. KAVITHA

Dept. of Seed Science and Tech., Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu

Abstract: Field experiments conducted during Sep. 2000 and July 2001 with the parental lines of COPH 2 pigeonpea hybrid revealed that seed yield attributes were not influenced by different spacings. However, the plants spaced at 45 x 20 cm spacing (44446 plants ha⁻¹) recorded significantly higher seed yield of 728 kg ha⁻¹ in September sown crop, which was 7.69 per cent increase over July sown crop. The resultant seed showed nonsignificant differences in seed quality.

Keywords: Pigeonpea hybrid, Spacing, Seed yield and quality

Introduction

The optimum plant population per unit area is an important non monetary input to decide the maximum productivity of the seed crop. Closer spacing due to competitive effect resulted in lesser yield in soybean (Kacha *et al.* 1990). Seed crop may require specific spacing level which may or may not be the same as commercial crops. For obtaining higher seed yield and quality seed, suitable spacing should be maintained. Influence of spacing on seed yield has been observed by many researchers. In pigeonpea, hybrid is developed by utilizing genetic male sterility system, since, half of the male fertile plants are uprooted from the female parents before anthesis in the seed production plot. Hence, information on maintenance of optimum plant population per unit area needs investigation.

Materials and Methods

Two field trials were conducted at the Eastern block of Tamil Nadu Agricultural University, Coimbatore during September, 2000 (S₁) and July, 2001 (S₂) with nine spacings viz. 45 x 20 cm, 60 x 20 cm, 75 x 20 cm, 45 x 40 cm, 60 x 40 cm, 75 x 40 cm, 45 x 60 cm, 60 x 60 cm and 75 x 60 cm. A planting ratio of 4:1 could be adopted and the experiment was laid out in RBD with four replications. The recommended agronomic package of practices for seed crop were followed during the entire growth period. Observations on plant height (cm) and number of branches on 60, 90 and 120 days after sowing (DAS), number of seeds and seed yield plant⁻¹ were

recorded in five randomly tagged plants. The days to first and 50% flowering was also recorded. The seed yield ha⁻¹ was worked out. In the resultant seeds, 100 seed weight (g), germination (%), vigour index (Abdul-Baki and Anderson, 1973), drymatter production (mg 10 seedlings⁻¹) and protein content (%) were evaluated. The collected data were analysed statistically by adopting the procedure described by Panse and Sukhatme (1978).

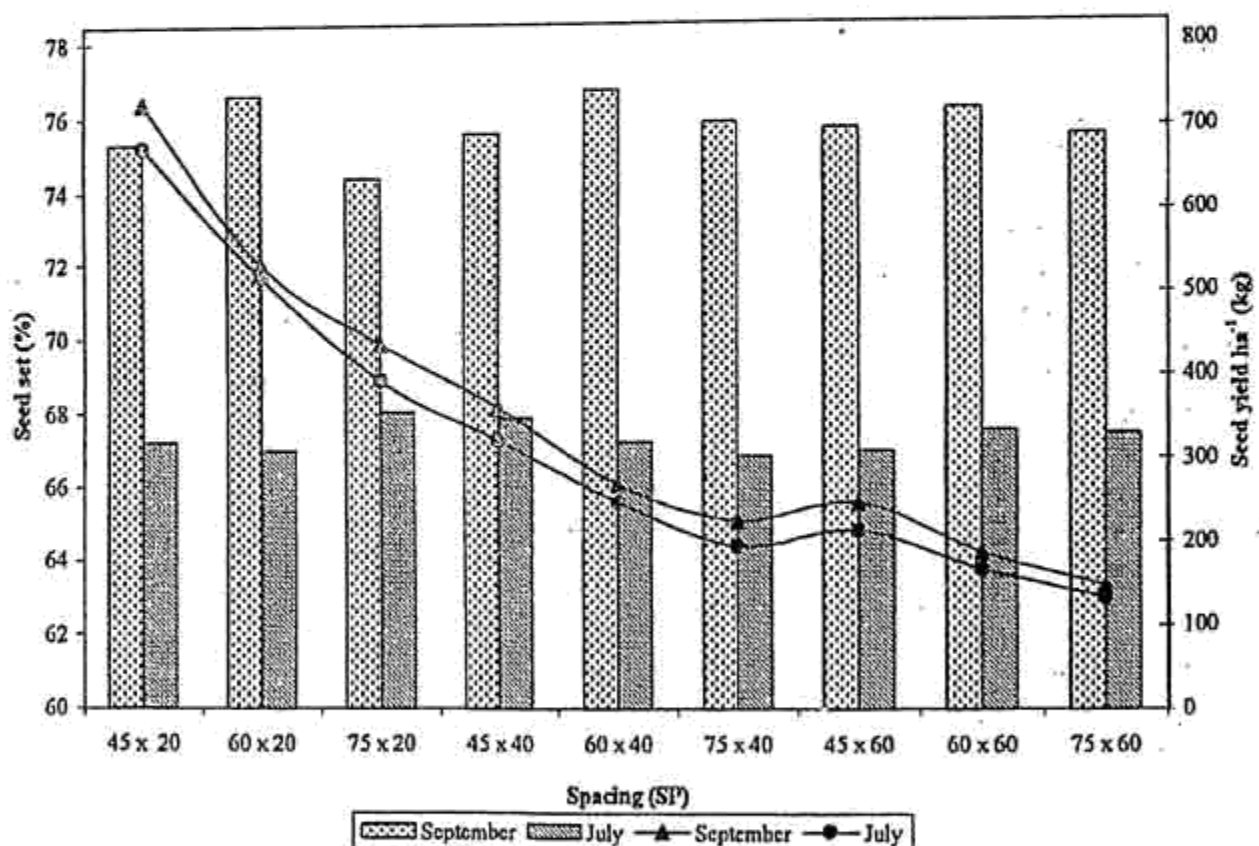
Results and Discussion

In the present study, during the flowering stage and before anthesis, based on the pollen colour *i.e.* plant with yellow fertile pollen in female parent were uprooted. The percentage of plants uprooted was around 59 per cent. The mean plant population in September and July was 44446 (45 x 20 cm), 33320 (60 x 20 cm), 26548 (75 x 20 cm), 22163 (45 x 40cm), 16554 (60 x 40 cm), 13240 (75 x 40 cm), 14738 (45 x 60 cm), 11036 (60 x 60 cm) and 8786 (75 x 60 cm) per hectare (Table 1).

The spacing of the crop significantly influenced the plant height and number of branches at 60, 90 and 120 DAS (days after sowing) in both seasons. The 45 x 20 cm spacing with a plant population of 44446 plants ha⁻¹ recorded the highest plant height (67.8 and 53.1 cm) and least number of branches (6 and 4) at 60 DAS in both September and July sown crop (Table 2). There was a gradual increase with respect to plant height and number

Table 1. Plant population (Number of plants ha⁻¹) in different spacing

Spacing (cm)	September, 2000	July, 2001	Mean
45 x 20	44446	44446	44446
60 x 20	33325	33317	33320
75 x 20	26550	26545	26548
45 x 40	22164	22162	22163
60 x 40	16552	16557	16554
75 x 40	13240	13240	13240
45 x 60	14740	14737	14738
60 x 60	10992	11079	11036
75 x 60	8790	8781	8786

Fig.1. Effect of spacing on seed set and seed yield ha⁻¹ in hybrid seed production of COPH 2 pigeonpea

of branches were observed due to plant spacing from 45 x 20 cm to 75 x 60 cm in both seasons. A similar trend for plant height and number of branches was also noticed at different growth stages *viz.* 90 and 120 DAS.

Increased plant height under 45 x 20 cm might be attributed to competition between

the plants for light and space which in turn produced lean and lanky plants. Consequently, lanky plants would produce lesser number of branches. This result is in good agreement with the findings of Trivedi and Vyas (2000) in chickpea and Deshmukh and Bhoi (2000) in groundnut.

Table 2. Effect of spacing on plant height and number of branches at 60, 90 and 120 DAS in hybrid seed production of COPH 2 pigeonpea

Spacing (SP) (cm)	Plant height at 60 DAS (cm)			Plant height at 90 DAS (cm)			Plant height at 120 DAS (cm)			No. of branches at 60 DAS			No. of branches at 90 DAS			No. of branches at 120 DAS		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
45 x 20	67.8	53.1	60.5	85.3	70.6	78.0	118.3	99.8	109.1	6	4	5	7	6	7	8	7	8
60 x 20	65.2	51.6	58.4	84.0	69.1	76.6	116.9	98.8	107.9	6	4	5	7	6	7	9	8	9
75 x 20	64.8	50.2	57.5	83.7	68.7	76.2	116.0	98.4	107.2	6	5	6	8	7	8	9	8	9
45 x 40	64.0	49.7	57.3	83.5	68.1	75.8	115.7	98.0	106.9	6	5	6	8	7	8	9	8	9
60 x 40	63.7	49.0	56.4	83.0	67.8	75.4	115.2	98.0	106.6	7	5	6	9	7	8	10	8	9
75 x 40	63.6	49.0	56.3	82.7	67.3	75.0	114.6	97.7	106.2	7	6	6	9	8	9	10	9	9
45 x 60	63.0	48.7	56.0	82.3	67.0	74.7	114.0	97.4	105.7	7	6	6	10	8	9	11	9	10
60 x 60	63.0	48.4	55.7	82.0	66.8	74.4	114.0	97.1	105.6	7	6	6	10	8	9	11	9	10
75 x 60	63.0	48.1	55.6	81.7	66.8	74.3	114.0	97.0	105.5	7	6	6	10	8	9	11	9	10
Mean	64.3	49.8		83.1	68.0		115.4	98.0		7	5		9	7		10	8	

OD 0.486 0.303 0.743 0.371 0.165 0.536 0.576 0.271 0.851 0.011 0.004 0.015 0.010 0.002 0.013 0.012 0.004 0.017 (P=0.05)

S₁ - September, 2000; S₂ - July, 2001

Table 3. Effect of spacing on days to first and 50 per cent flowering and number of pods and seeds plant⁻¹ in hybrid seed production of COPH 2 pigeonpea

Spacing (SP)	Days to first flowering			Days to 50% flowering			Number of pods plant ⁻¹			Number of seeds plant ⁻¹		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
45 x 20	57	58	58	68	70	69	60.2	53.3	56.8	162.7	146.3	154.3
60 x 20	58	57	58	70	68	69	62.3	53.5	57.9	167.3	148.6	158.0
75 x 20	58	57	58	69	68	69	62.0	53.3	58.7	169.5	148.5	159.0
45 x 40	56	58	57	67	69	68	63.0	55.7	59.4	169.6	151.2	160.4
60 x 40	57	56	57	70	68	69	63.3	55.5	59.4	171.8	152.8	162.3
75 x 40	58	56	57	70	67	69	63.5	56.3	59.9	173.3	152.3	162.8
45 x 60	55	58	57	68	66	67	64.3	56.6	60.5	173.0	155.0	164.0
60 x 60	56	57	57	66	70	68	64.6	56.8	60.7	174.1	155.2	164.7
75 x 60	58	55	57	68	68	68	64.0	56.8	60.4	174.3	155.3	164.8
Mean	57	57		68	68		63.0	55.3	60.4	170.6	151.7	

OD SP NS SPS NS S NS SPS NS S NS SPS NS SPS NS SPS NS (P=0.05)

S₁ - September, 2000; S₂ - July, 2001

Table 4. Effect of spacing on pod set and seed yield plant⁻¹ in hybrid seed production of COPH 2 pigeonpea

Spacing (SP)	Pod set (%)			Seed yield plant ⁻¹ (g)		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean
45 x 20	21.57 (27.67)	18.95 (25.81)	20.26 (26.75)	16.37	15.21	15.79
60 x 20	22.18 (28.10)	19.26 (26.03)	20.72 (27.08)	16.02	15.13	15.58
75 x 20	21.31 (27.49)	18.87 (25.75)	20.09 (26.03)	16.48	14.73	15.63
45 x 40	22.01 (27.98)	19.05 (25.88)	20.53 (26.94)	16.33	14.56	15.45
60 x 40	21.01 (27.28)	19.87 (26.47)	20.44 (26.88)	16.27	14.98	15.63
75 x 40	21.18 (27.40)	20.00 (26.57)	20.59 (26.97)	17.00	14.68	15.84
45 x 60	22.00 (27.97)	19.56 (26.25)	21.59 (27.69)	16.78	14.48	15.63
60 x 60	21.68 (27.65)	19.73 (26.37)	20.71 (27.07)	17.21	15.05	16.13
75 x 60	21.47 (27.60)	19.22 (26.00)	20.35 (26.81)	16.56	15.13	15.85
Mean	21.60 (27.69)	19.39 (26.13)		16.56	14.88	

CD (P=0.05)	SP NS	S 2.573	SPS NS	SP NS	S 0.643	SPS NS
-------------	----------	------------	-----------	----------	------------	-----------

(Figures in parentheses indicate arcsine values)
 S₁ - September, 2000; S₂ - July, 2001

Fig.2. Effect of spacing on hundred seed weight and germination of resultant seeds of pigeonpea hybrid COPH 2

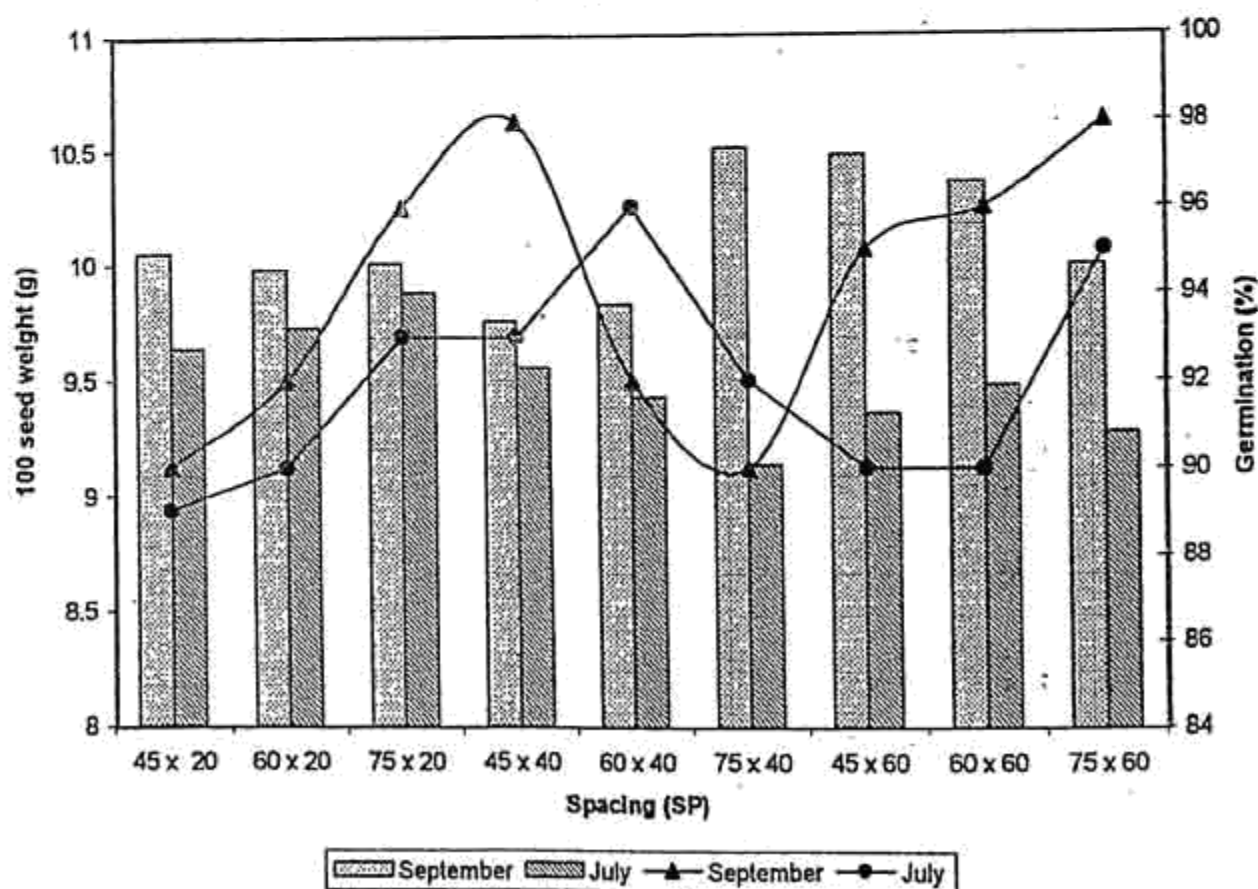


Table 5. Effect of spacing on drymatter production, vigour index and protein content of resistant seeds of pigeonpea hybrid COPH 2.

Spacing (SP)	Drymatter production (mg 10 seedlings ⁻¹)			Vigour index			Protein content (%)		
	S ₁	S ₂	Mean	S ₁	S ₂	Mean	S ₁	S ₂	Mean
45 x 20	656	608	632	3226	3176	3201	19.9 (26.49)	20.5 (26.92)	20.2 (26.71)
60 x 20	668	612	640	3189	3153	3171	20.0 (26.57)	20.3 (26.78)	20.2 (26.71)
75 x 20	650	598	624	3286	3096	3191	20.5 (26.92)	19.7 (26.35)	20.1 (26.64)
45 x 40	643	586	615	3173	3056	3115	20.0 (26.57)	20.3 (26.78)	20.2 (26.71)
60 x 40	659	595	627	3256	3132	3194	19.6 (26.28)	20.2 (26.71)	19.9 (26.49)
75 x 40	669	518	644	3269	3157	3213	20.1 (26.64)	20.0 (26.57)	20.1 (26.64)
45 x 60	648	608	628	3232	3048	3140	19.8 (26.42)	20.9 (27.20)	20.4 (26.85)
60 x 60	656	612	639	3186	3056	3121	20.6 (26.99)	20.5 (26.92)	20.6 (26.99)
75 x 60	659	591	625	3199	3077	3138	20.3 (26.78)	19.8 (26.42)	20.1 (26.64)
Mean	656	603	629	3224	3106	3172	20.1 (26.64)	20.2 (26.71)	20.2 (26.71)
CD (P=0.05)	SP	S	SPS	SP	S	SPS	SP	S	SPS
	NS	65.56	NS	NS	130.683	NS	NS	NS	NS

(Figures in parentheses indicate arcsine values)

S₁ - September, 2000; S₂ - July, 2001

The present study revealed that the yield attributes namely days to first and 50 per cent flowering, number of pods and seeds and pod and seed set were not significantly influenced by spacing in both seasons. Seed yield plant⁻¹ also did not vary with spacings (Table 3 and 4). While the seed yield ha⁻¹ was significantly influenced by different spacing in both seasons. The highest seed yield of 728 and 676 kg ha⁻¹ treatment were recorded by plants under 45 x 20 cm spacing (44446 plants ha⁻¹) in September and July sown crop, respectively (Figure 1). Further, it was observed that, as the spacing increased there was a reduction in seed yield per hectare (Table 3 and 4; Figure 1). The higher seed yield in 45 x 20 cm spaced crop was due to optimum plant population per unit area, which could not be compensated by an increase in yield attributes like plant height, number of branches, number of pods and seeds plant⁻¹ under wider spaced crop. Ahlawat *et al.* (1985) and Sarvaiya *et al.* (1993) also reported similar results in cowpea and pigeonpea, respectively. Kauthale *et al.* (1995) also found that closer spacing of 45 x 10 cm could be recommended for hybrid seed production of ICPH 8 pigeonpea. Therefore, it can be concluded that, a spacing of 45 x 20 cm could be recommended for hybrid seed production of COPH 2 pigeonpea.

Seed quality parameters namely, hundred seed weight, germination, seedling vigour and protein content remained unaffected by different spacing in both seasons (Figure 2; Table 5). The result of present study is in accordance with Srivastava *et al.* (1992) in radish, Sarvaiya *et al.* (1993) in pigeonpea, Ujinaiah *et al.* (1995) in sunflower BSHI hybrid and in cowpea Ananthi (2001). However, the quality of seeds harvested in September sown crop was superior to July sown crop. Therefore, for hybrid seed production of COPH 2 pigeonpea September sowing was found ideal.

References

- Abdul-Baki, A. A. and Anderson, J.D. (1973). Vigour determination in soybean seed by multiple criteria. *Crop Sci.* **13**: 630-633.
- Ahlawat, I.P.S., Saraf, C.S. and Singh, A. (1985). Production potential of summer and rainy season pigeonpea intercropped with cowpea and greengram. *Ind. J. Agril. Sci.* **55**: 565-569.
- Ananthi, R. (2001). Seed technological studies in cowpea (*Vigna unguiculata* L.wallp) cv. CO 5. *M.Sc.(Ag.) Thesis*, TNAU, Coimbatore.
- Deshmukh, G.N. and Bhoi, P.G. (2000). Effect of plant densities and fertilizer levels on growth and yield of groundnut. *J. Maharashtra Agric. Univ.* **24**: 298-299.
- Kacha, R.P., Madhuwadia, M.M., Patel, J.C., Tawk, D.A. and Kaneria, B.B. (1990). Response to row spacing and level of N, P fertility in soybean. *Ind. J. Agron.* **35**: 317-319.
- Kauthale, V.K., Patil, R.B. and Suryavanshi, Y.B. (1995). Effect of planting ratio and spacing on growth and yield of pigeonpea hybrid ICPH 8. *Seed Res.* **23**: 36-37.
- Panse, V.G. and Sukhatme, P.V. (1978). Statistical methods for Agricultural Workers, ICAR Pub. New Delhi.
- Sarvaiya, B.G., Patel, M.P. and Patel, H.S. (1993). Response of pigeonpea (*Cajanus cajan* L. Millsp) to row spacing, nitrogen and phosphorus. *Ind. J. Agron.* **38**: 134-135.
- Srivastava, B.K., Singh, M.P., and Jain, S.K. (1992). Effect of spacing and nitrogen levels on growth, yield and quality of seed crop of radish cv. Pusa Chetki. *Seed Res.* **20**: 85-87.
- Trivedi, K.K. and Vyas, M.D. (2000). Response of Kabuli chickpea under different dates of sowing and row spacings. *Crop Res.* **20**: 52-55.
- Ujinaiah, V.S., Shambulingappa, K.G. and Seenappa, K. (1995). Effect of different levels of nitrogen and spacing on production and quality of BSHI hybrid sunflower. *Mysore J Agric Sci.* **29**: 9-13.

(Received: February 2003; Revised: September 2003)