

## Influence of planting geometry and variety on seed yield and related parameters in soybean (*Glycine max*)

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### ABSTRACT

A field experiment was conducted during *kharif* seasons of 1994 and 1995 at Pune, to study the influence of planting geometry and variety on seed yield and related parameters in soybean [*Glycine max* (L.) Merr.]. Pooled data revealed that planting geometry had significant effects on seed yield and other attributes except for days to flowering and oil content (%). Varieties also showed significant differences for all the attributes except for seed and oil yields. Planting geometry of 45 cm × 15 cm recorded significantly more nodes/plant, branches/plant, pods/plant, seeds/plant and 100-seed weight than rest of the planting geometries except planting geometry of 30 cm × 15 cm for branches/plant and 100-seed weight. Planting geometry of 30 cm × 10 cm gave significantly highest seed and oil yields over rest of the planting geometries except 45 cm × 5 cm.

**Key words :** Soybean, Planting geometry, Variety, Yield

Soybean [*Glycine max* (L.) Merr.] is the third important oilseed crop in India, next to groundnut and rapeseed-mustard. As soybean fetches better market price due to establishment of large number of soybean oil-extraction plants, area under soybean is increasing rapidly in Maharashtra state as also in India. However, the productivity in India is very low (920 kg/ha) compared to that of the world average of 2,022 kg/ha (FAO, Rome 1995). The optimum number of plants/unit area is one of the important parameters in increasing the crop productivity. The optimum plant density with proper geometry of planting is dependent on variety, its growth habit and agro-climatic con-

ditions. Review of literature about planting density and its geometry in soybean is meagre in India. Hence an experiment was conducted to determine the influence of planting geometry and variety on seed yield and related parameters in soybean.

### MATERIALS AND METHODS

The field experiment was conducted during *kharif* seasons of 1994 and 1995 at Agharkar Research Institute's experimental farm at Hol, Pune, under protective irrigations. There were 18 treatments comprising 6 planting geometry (30 × 5, 30 × 10, 30 × 15, 45 × 5, 45 × 10 and 45 × 15 cm) as main plot and varieties ('MACS 13', 'MACS

57' and 'MACS 124') as subplot treatments replicated thrice in a split-plot design. Net plot size was 4 m × 2.4 m and 4 m × 2.7 m for 30 and 45 cm row spacing, respectively. Crop was sown on 14 July 1994 and 25 July 1995. The soil was vertisol with pH 8.26 and 8.32 and contained organic carbon 0.55 and 0.57%, available N 398 and 392 kg/ha, P<sub>2</sub>O<sub>5</sub> 24.6 and 22.4 kg/ha and K<sub>2</sub>O 672 and 627 kg/ha during first and second year of experimentation respectively. A fertilizer dose of 20 kg N, 80 kg P<sub>2</sub>O<sub>5</sub> and 40 kg K<sub>2</sub>O/ha was applied before sowing. Seeds were treated first with carbendazin @ 2.5 g/kg seed and later with *Bradyrhizobium japonicum* culture. The rainfall during the cropping season (June to October) was 320 mm in 1994 and 620 mm in 1995. All interculture operations were carried out to raise a good crop. Oil content was estimated on Oxford NMR 4000 Analyzer and oil yield (kg/ha) was computed by multiplying it with seed yield (kg/ha) and dividing by 100.

## RESULTS AND DISCUSSION

### *Effect of planting geometry*

Planting geometry did not affect days to flowering significantly however, significantly early maturity was induced in 30 cm × 5 cm planting geometry (Table 1). Plants grew significantly taller than other geometries probably due to highest plant density (0.67 million plants/ha) resulting in severe competition for space, light, etc. Planting pattern of 45 cm × 15 cm recorded the least height, due to ample availability of moisture, nutrients, space and light. As a result of low plant density, there was significant increase in branches/plant, nodes/plant, pods/plant and seeds/plant in 45 cm × 15 cm

plant geometry. Chandel *et al.* (1987), Halvankar *et al.* (1993) and Jadhav *et al.* (1994) also reported higher values for pods/plant, branches/plant and seeds/plant at lower plant density than at higher one. Though 45 cm × 15 cm planting pattern recorded the highest seeds/pod, it was at par with rest of the planting geometries except 30 cm × 5 cm. The planting geometry of 30 cm × 10 cm accumulated significantly more dry matter than rest of the planting geometries except 45 cm × 5 cm.

Oil content (%) did not differ significantly among the planting geometries. These results are in conformity with those of Chandel *et al.* (1987). However, except for 45 cm × 5 cm planting geometry, 30 cm × 10 cm recorded significantly highest oil yield/ha because of the highest seed yield.

The seed yield was significantly influenced by planting geometry. The planting pattern of 30 cm × 10 cm recorded the highest seed yield (3,529 kg/ha) being at par with 45 cm × 5 cm (3,391 kg/ha) and was significantly higher than other planting geometries. This might be due to better geometric arrangement resulting in more photosynthesis and better absorption of soil moisture and nutrients and consequently resulting in the highest seed yield. Similar results are also reported by Jadhav *et al.* (1994). The lowest seed yield was observed in 45 cm × 15 cm followed by 45 cm × 10 cm planting geometry. In the planting geometry of 30 cm × 10 cm (0.3333 million plants/ha) and 45 cm × 5 cm (0.4444 million plants/ha) low values for important yield attributes like branches/plant, pods/plant and seeds/plant should have resulted in low seed yield but this was not so due to the compensation of

**Table 1.** Growth, yield attributes, quality and yield of soybean varieties as influenced by various treatments (pooled data of 2 years)

Treatment	Plant density (million plants/ha)	Days to		Plant height (cm)	Pods/ plant	Nodes/ plant	Branches/ plant	Seeds/ plant	Seeds/ pod	100- seed weight (g)	Oil content (%)	Oil yield (kg/ha)	Dry matter yield (kg/ha)	Seed yield (kg/ha)
		Flow- ering	Matu- rity											
<i>Planting geometry (cm)</i>														
30 × 5	0.6667	44.11	91.94	58.98	27.78	13.43	3.02	47.16	1.72	12.27	17.64	571	6,870	3,239
30 × 10	0.3333	43.44	93.56	51.42	47.01	14.87	5.02	83.43	1.78	12.56	17.64	623	7,816	3,529
30 × 15	0.2222	43.78	93.22	48.98	69.53	14.87	6.67	122.89	1.76	12.89	17.75	574	7,078	3,234
45 × 5	0.4444	43.67	93.00	54.17	36.67	13.63	4.09	67.30	1.80	12.43	17.66	599	7,735	3,391
45 × 10	0.2222	43.94	94.17	49.34	61.86	14.77	6.32	116.89	1.84	12.56	17.82	543	6,862	3,048
45 × 15	0.1481	43.56	94.61	46.31	85.10	15.41	6.82	154.60	1.84	13.09	17.80	522	6,654	2,932
CD (P = 0.05)		NS	0.89	1.89	2.91	0.39	0.31	5.07	0.08	0.33	NS	42	463	237
<i>Variety</i>														
'MACS 13'		45.31	97.36	39.07	49.19	14.12	5.43	87.46	1.75	12.95	17.67	579	7,871	3,277
'MACS 57'		41.56	87.61	52.60	61.06	12.48	5.37	105.17	1.73	10.88	18.02	578	6,699	3,191
'MACS 124'		44.39	95.28	62.92	53.72	16.89	5.18	103.51	1.89	14.08	17.39	560	6,937	3,219
CD (P = 0.05)		0.54	0.51	1.18	2.17	0.30	0.20	1.82	0.06	0.19	0.52	NS	152	NS

higher number of plants in these planting geometries.

#### **Effect of variety**

Varieties differed considerably with respect to days to flowering and maturity. 'MACS 57' was the most early flowering and maturing variety, whereas flowering and maturity were significantly delayed in 'MACS 13'. Variety 'MACS 124' was the tallest among 3 varieties and had significantly more nodes/plant, seeds/pod and 100-seed weight than 'MACS 13' and 'MACS 57'. 'MACS 57' had also significantly more nodes/plant than 'MACS 13', however, later variety exhibited significantly heavier test weight than earlier variety and both the varieties were at par with each other in respect to branches/plant and seeds/pod. Oil content (%) was significantly more in 'MACS 57' than in 'MACS 124'. The estimated oil yield (kg/ha), however, was at par with each other because of relatively more seed yield of later variety. The differences for seed yield among the varieties were observed to be statistically nonsignificant.

The effect of interaction between plant-

ing geometry and variety for oil and seed yield was found to be non-significant. It was concluded that seed yield is significantly influenced by planting geometry. Soybean varieties, viz. 'MACS 13', 'MACS 57' and 'MACS 124' may be planted at either 30 cm × 10 cm or 45 cm × 5 cm planting geometry for getting maximum seed and oil yield.

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