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Effect of various plant spacing and nutrient level on yield, economic and available nutrient of *kharif* soybean [*Glycine max* (L.) Merrill]

M.W.Rathod, A.K.Gore and S.K.Nayak
Department of Agronomy
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402 (M.S.)

ABSTRACT
The field experiment was conducted during the *kharif* season of year 2015 at the experimental farm of AICRP on Soybean, VNMKV, Parbhani (MS). To find out the effect of plant spacing's and different fertilizer levels on soybean. The experiment was laid out in Split Plot Design with five plant spacing's viz., S1 30 x 7.5 cm, S2 45 x 05 cm, S3 30 x 10 cm, S4 30 x 15 cm and S5 30 x 30 cm in main plot and three fertilizer levels viz., F1 – 100% of RDF, F2 – 125 % of RDF and F3 – 150 % RDF in sub plot along with three replication .The result of experiment shown that, among the different plant spacing's tested, 45 cm x 5 cm recorded more of yield, economics and available nutrient of soybean than other plant spacing's. In case of application of fertilizer level 150% RDF recorded higher value of yield, economics and available nutrient of soybean.
Keywords: Fertilizer, spacing's, soybean, recommended dose of fertilizer.

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INTRODUCTION

Soybean has been accredited as principal food crop since long time that produces 2-3 times more high quality protein yield per hectare than other pulses and cholesterol free oil. It is preferred especially by vegetarians on account of its richness in protein, fat, carbohydrates, mineral salts and vitamins. The protein of meat, fish, eggs and pulses are acid producing while that of soybean are alkalizing in their effects which makes it a desirable constituent of human diet (Kale, 1985).

Soybean is an excellent health food and contains 40% quality protein, 23% carbohydrates and 20% cholesterol free oil. Soybean protein is rich in valuable amino acid, lysine (5%) which is deficient in most of the cereals. It also contains 60% polyunsaturated fatty acid (52.8% linolenic acid + 7.2% linoleic acid). Soybean is generally processed for its oil, protein and lecithin as a whole bean or partially/ fully defatted cake meal. Enriching cereal flour with soybean improves its nutritive quality and soya flour can also be used in making baked products (chapattis, biscuits, bun and cakes). Thus, it is a multipurpose crop used for making soya milk, soya paneer, soya yogurt, soya ice-cream etc. Soya flour, soya fortified foods stuffs and biscuits have good acceptability among the people because of economical and nutritional advantages. Moreover, it is widely used in oil production in India.

Fertilizer is an important input for successful crop production. Inorganic fertilizers are used to supply essential nutrients for better growth. Inorganic fertilizers are sources of mineral elements, which plants require for effective growth and development. Planting density is an important determinant of seed yield and it plays an important role in modulating the environmental factors related to growth and development of the crop. The planting geometry and plant population have not yet been established for *kharif* seed crop and newly released cultivars with their seed size or test weight. Planting soybean in rows ensures easy intercultural operations and helps to attain in higher yield. The row spacing recommended for soybean in *kharif* season is 40 cm (BARI, 2005) and it is 45 cm and 30 cm for regular *kharif* season crop in Maharashtra. However, the relevant research finding in this line for different cultivars is highly scarce. More scientific efforts are needed to increase the productivity of soybean per unit area, and per unit time with optimum row spacing. It is necessary to maintain optimum plant population to get high productivity. Therefore, it is necessary to study behavior of soybean cultivars under various row spacing.

The effect of different row spacing on yield performance of soybean cultivars might help determining variety specific row spacing to obtain high yield.
Hence, the present investigation was carried to study effect of various plant spacing and nutrient level on growth and yield of *kharif* soybean [*Glycine max* (L.) Merrill]".

MATERIALS AND METHODS

A field experiment was conducted during 2015-16 at All India Coordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS), India. Parbhani located at 19^0 16' N latitude and 96^0 41' East longitudes and has sub – tropical climatic conditions. Parbhani is grouped under assured rainfall zone. The normal rainfall of this region is around 954.9 mm, precipitating mostly between mid June–mid November. The average maximum and minimum temperature recorded 31.2^0 C and 22.6^0 C, respectively. The soil of experimental field was clayey in texture, low in nitrogen (177 Kg ha^{-1}), medium in phosphorus (18 Kg ha^{-1}),), rich in potash (380 Kg ha^{-1}), low in organic carbon content 0.22 % and the soil pH 8.5. The experiment was laid out in split plot design during *kharif* with fifteen treatments and three replications with randomization. The fifteen treatment combination comprise of five plant spacings viz., S1 30 x 7.5 cm, S2 45 x 05 cm, S3 30 x 10 cm , S4 30 x 15 cm and S5 30 x 30 cm as main plot and three fertilizer levels viz., F1 – 100% of RDF, F2 – 125 % of RDF and F3 – 150 % RDF as sub plot . The gross and net plot sizes were 6.0 m x 5.4 m and 5.1 m x 4.5 m respectively. The soybean variety was used MAUS-612 (Genotype) was procured from AICRP on soybean, VNMKV Parbhani. Only bold and healthy seeds were used for sowing, it was early to harvest and non shattering effect. The seeds were treated with thirum 80 WP @ 3 g / kg seed for controlling seed borne diseases. Sowing was done by dibbling on 15 July 2015 object of dibbling was to maintain fairly uniform plant population in each row. The sowing was done by dibbling with 2 seed per hill and fertilizer application was done at the time of sowing as per treatment.
Biometric observations and plant characters as an indicator of crop growth viz., plant height, number of leaves, leaf area, number of branches, and total dry matter per selected plant from net plot were recorded at 15 days interval from 30 days onwards till to harvest of the crop. The post harvest biometric observation of yield attributes and yield was taken after the harvesting of crop. The harvest index was calculated by the following formula

$$\text{Harvest index} = \frac{\text{Economical yield}}{\text{Biological yield}} \times 100$$

RESULTS AND DISCUSSION

Effect of plant spacings

Yield

The seed yield (2115 kg ha^{-1}**)**, straw yield (5018 kg ha^{-1}**)**, biological yield (kg ha^{-1}**)**, and harvest index (42.14 %) were maximum in plant spacing of 45 x 05 cm (S_2) than other treatment followed by plant spacing 30 x 7.5 cm (S_1) was best in respect of seed, straw yield, biological yield (kg ha^{-1}**)**, and harvest index (%) viz. 1890 kg ha^{-1}, 2714 kg ha^{-1}, 4604 kg ha^{-1} and 41.05 % respectively (Table 1). This is might due to better space available responsible for better growth attributes (leaf area, dry matter, no. of branches) and less competition among the plant for nutrient and water. Similar result was observed by Rajput *et al.* (1985).

Economics

The highest cost of cultivation (Rs. ha^{-1}), Gross monetary returns (Rs. ha^{-1}), Net monetary returns (Rs. ha^{-1}), and B:C ratio was observed in plant spacing of 45 x 05 cm (S_2) viz. 33,338 Rs. ha^{-1}, 76,140 Rs. ha^{-1}, 42,802 Rs. ha^{-1} and 2.28 respectively followed by 30 x 7.5 cm (S_1). Similar result was observed by Hossain *et al.* (2011).

Available nutrient

The final available NPK was maximum in plant spacing of 30 x 30 cm (S_5) viz. 258 kg ha^{-1}, 24.49 kg ha^{-1} and 465 kg ha^{-1} respectively and followed by Plant spacing 30 x 15 cm (S_4), 30 x 10 cm (S_3), 45 x 05 cm (S_2) and 30 x 7.5 cm (S_1) respectively.

Effect of fertilizer levels:

Yield

The application of fertilizer level of 150% of RDF (F_3) recorded higher seed yield (1605 kg ha^{-1}**)** of soybean and it were found to be statically at par with the fertilizer level of 125% of RDF (1542 kg ha^{-1}**)**,(F_2).where as higher straw yield (2471 kg ha^{-1}**)**, and biological yield (3931 kg ha^{-1}**)**, was found in

application in 100 % RDF than other treatment. Highest harvest index found in 150% RDF (41.05%).Wood *et al*. (1993), Shinde *et al.,* (2015). Samia *et al.,* (2012) found similar results.

Economic

In case of economic parameter gross monetary, net monetary returns and benefit cost ratio were highest due to levels of fertilizer 150% of RDF (F_3). This is due to higher cost of cultivation in 150 % RDF (F_3) and higher yield increase the net monetary return. Lower cost of cultivation, net monetary returns and benefit cost ratio was observed in lower fertilizer levels. Singh *et al.,*(2000) reported similar result

Available nutrient

The available NPK was significantly increased with increase level of fertilizer. The significantly higher available NPK content was observed in 150% RDF it was at par with 125% RDF and significant over 100% RDF. The higher available nutrient may be due to more nutrient supply and availability of nutrient till harvesting of crop.

REFERENCES

1. Hossain M.M. (2011). Effect of Plant Density on Growth, Yield Components of two Soybean varieties under Equidistant Planting Arrangement. *Asian J. of Plant Scie.***10** (5)278-286.
2. Samia O.Y., Wigdan M., Ali A. and Mariod A.A. (2012). Effect of Urea, NPK and Compost on Growth and Yield of Soybean (*Glycine max* L.), in Semi-Arid Region of Sudan. *International Scholarly Research Network ISRN Agronomy* Volume 2012.
3. Shinde R.N., Karanjikar P.N. And Gokhale D.N. (2015). Effect of different levels fertilizer and micronutrients on growth, yield and quality of soybean. *Journal Crop and Weed*, **11**(1):213-15.
4. Singh S.P. and Bansal K.M. (2000). Response of soybean to nitrogen its application time and sulphur. *Indian J. Agric. Sci*., **70**(1):34-36.
5. Wood C.W., Torbert H.A. and Weaver D.B. (1993). Nitrogen Fertilizer Effects on Soybean Growth, Yield, and Seed Composition *J. Prod. Agric.*, **6**(3) 89-93.
6. Rajput M.J., Tunio S. and Rajput F.K. (1985). Effect of row and plant spacing on yield and yield component in soybean. Field crop Abstr., 38 (7): 400.

Table 1: Seed yield straw yield, biological yield and harvest index of soybean as influenced by different treatments.

Treatment	Seed yield (kg ha^{-1})	Straw Yield (kg ha^{-1})	Biological Yield (kg ha^{-1})	Harvest Index (%)
Plant spacing				
S_1-30 cm x 7.5 cm	1890	2714	4604	41.05
S_2-45 cm x 05 cm	2115	2903	5018	42.14
S_3-30 cm x 10 cm	1745	2514	4259	40.97
S_4-30 cm x 15 cm	1181	1873	3054	38.67
S_5-30 cm x 30 cm	743	1546	2289	32.45
SE m±	76.09	113	172	0.83
CD at 5 %	229	339	516	1.66
Level of fertilizer (NPK kg ha^{-1})				
F_1-100 % of RDF	1460	2471	3931	37.14
F_2-125 % of RDF	1542	2239	3781	40.78
F_3-150 % of RDF	1605	2304	3909	41.05
SE ±	134.62	43.12	58.66	0.40
CD at 5 %	403.44	129.38	175.98	1.22
Interaction (S x F)				
SE ±	353.29	215.12	294.35	1.01
CD at 5 %	NS	NS	NS	NS
General mean	1535	2320	3855	39.28

Table 2: Mean gross monetary returns (₹ ha^{-1}), Net monetary returns (₹ ha^{-1}), Cost of cultivation ₹ ha^{-1} and benefit : cost ratio as influenced by different treatments

Treatment	Cost of cultivation ₹ ha^{-1}	Gross Monetary Returns ₹ ha^{-1}	Net Monetary Returns ₹ ha^{-1}	B:C Ratio
Plant spacing				
S_1-30 cm x 7.5 cm	33338	68040	34702	2.04
S_2-45 cm x 05 cm	33338	76140	42802	2.28
S_3-30 cm x 10 cm	32444	62820	30376	1.93
S_4-30 cm x 15 cm	31550	42516	10966	1.34
S_5-30 cm x 30 cm	30657	26748	-3909	0.87
SE m±	-	2740.26	2739.55	-
CD at 5 %	-	8111	8109	-
Level of fertilizer (NPK kg ha^{-1})				
F_1-100 % of RDF	31312	52560	21248	1.67
F_2-125 % of RDF	32265	55512	23247	1.72
F_3-150 % of RDF	33217	57780	24563	1.73
SE ±	-	765.36	445.98	-
CD at 5 %	-	2273	1327	-
Interaction (S x F)				
SE ±	-	1873.32	1667.26	-
CD at 5 %	-	NS	NS	-
General mean	32265.12	55264.5	23976.62	1.69

Table 3: Available NPK status in soil as influenced by different treatments.

Treatments	Available N (Kg ha^{-1})		Available P (Kg ha^{-1})		Available K (Kg ha^{-1})	
	Initial	Final	Initial	Final	Initial	Final
Plant spacing						
S_1-30 cm x 7.5 cm	177	218	18	17.93	380	393
S_2-45 cm x 05 cm	177	224	18	18.71	380	403
S_3-30 cm x 10 cm	177	236	18	20.56	380	426
S_4-30 cm x 15 cm	177	244	18	21.52	380	443
S_5-30 cm x 30 cm	177	258	18	24.49	380	465
SE m±	-	12.75	-	1.32	-	14.78
CD at 5 %	-	38.21	-	3.96	-	44.38
Level of fertilizer (NPK kg ha^{-1})						
F_1-100%of RDF	177	210	18	16.50	380	390
F_2-125%of RDF	177	240	18	19.82	380	429
F_3-150%of RDF	177	253	18	23.71	380	460
SE m±	-	13.12	-	1.55	-	14.97
CD at 5 %	-	39.38	-	4.68	-	44.81
Interaction (S x F)						
SE m ±	-	9.22	-	1.10	-	9.94
CD at 5 %	-	NS	-	NS	-	NS
General mean		235.37		20.40		426.12

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