P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(2): 1421-1424

© 2020 IJCS

Received: 10-01-2020

Accepted: 12-02-2020

RN PalviP.G. Student (Agronomy),
RCSM College of Agriculture,
Kolhapur, Maharashtra, India**DK Kathamale**Associate Professor of
Agronomy, RCSM College of
Agriculture, Kolhapur,
Maharashtra, India**JB Patil**Assistant Professor of
Agronomy, RCSM College of
Agriculture, Kolhapur,
Maharashtra, India**MJ Patil**College Librarian, RCSM College
of Agriculture, Kolhapur,
Maharashtra, India**Corresponding Author:****JB Patil**Assistant Professor of
Agronomy, RCSM College of
Agriculture, Kolhapur,
Maharashtra, India

Effect of plant spacing and number of seeds dibble⁻¹ on growth, yield and economics of soybean (*Glycine max* L. Merrill)

RN Palvi, DK Kathamale, JB Patil and MJ PatilDOI: <https://doi.org/10.22271/chemi.2020.v8.i2v.8963>

Abstract

A field experiment entitled, "Optimization of seed rate and spacing of soybean (*Glycine max*. L. Merrill) during *kharif* season" was conducted at PG Research Farm, Agronomy Section, RCSM College of Agriculture, Kolhapur (Maharashtra) during *kharif* 2018. The treatments consisting of four plant spacings viz., 30 x 5 cm², 30 x 10 cm², 45 x 5 cm² and 45 x 10 cm² and three seed rates viz., D₁ (One seed dibble⁻¹), D₂ (Two seeds dibble⁻¹) and D₃ (Three seeds dibble⁻¹). The results revealed that the sowing of soybean at 45 x 10 cm² plant spacing recorded higher mean of growth parameters (except plant height) over plant spacings 30 x 5 cm² and 30 x 10 cm², however, on par with plant spacing 45 x 5 cm². The plant spacing 30 x 5 cm² produced higher plant height due to competition among plants for space, solar radiation and nutrients. The plant spacing 45 x 5 cm² produced highest seed yield (26.46 q ha⁻¹) and stover yield (39.20 q ha⁻¹) it was followed by plant spacing 45 x 10 cm² seed yield (24.83 q ha⁻¹) and stover yield (38.79 q ha⁻¹). Sowing of one seed dibble⁻¹ recorded significantly higher growth parameters (except plant height) over rest of the treatments. Sowing of three seeds dibble⁻¹ recorded higher plant height due to competition among plants for space, solar radiation and nutrients. The various yield attributing characters were higher in sowing of two seeds dibble⁻¹ and it was followed by one seed dibble⁻¹. Sowing of two seeds dibble⁻¹ produced highest seed yield (26.90 q ha⁻¹) and stover yield (40.46 q ha⁻¹) and it was followed by one seed dibble⁻¹ with produced seed yield (25.53 q ha⁻¹) and stover yield (38.70 q ha⁻¹).

Keywords: Plant Spacings and No. of seeds per dibble, Soybean, Grain, Yield

Introduction

Soybean (*Glycine max* (L.) Merrill) is known as leguminous crop and belongs to family leguminosae. It has Eastern Asian origin. Soybean was cultivated in China from 3000 B. C. It is the miracle crop and has witnessed phenomenal growth in production, processing and trade in last few years in India and has revolutionized the rural economy and improved socio economic status of farmers. Soybean cultivation has placed India on the world map in recent past. Soybean has not only gained the vital importance in Indian agriculture, but also plays an important role in oil economy of India. Among the various factors spacing is one of the important factor which ultimately affected nutrients uptake, growth and yield of plant. The increase or decrease of row spacing and plant population has definite pattern in relation to the yield. Farmers in the western Maharashtra especially in Kolhapur different where, soybean is followed by sugarcane under irrigated condition prefer dibbling soybean on ridges and furrow method. Under such situation row to row spacing varies and number of seeds dibbled hill⁻¹ also varies from 1 to 4 seeds hill⁻¹ where very high seed rate are used. More scientific effort needed to increase the productivity of soybean per unit area, and per unit time with optimum plant population. It is necessary to maintain optimum plant population to get higher productivity. Therefore, the present investigation was undertaken to study Optimization of seed rate and spacing of soybean (*Glycine max*. L. Merrill) during *kharif* season.

Materials and methods

An experiment to study Optimization of seed rate and spacing of soybean (*Glycine max*. L. Merrill) during *kharif* season was conducted at PG Research Farm, Agronomy Section, RCSM College of Agriculture, Kolhapur during *kharif* 2018. The soil of the experimental plot was clayey in texture, low in available nitrogen (207.20 kg ha⁻¹), medium in available

phosphorus (28.75 kg ha⁻¹) and high in available potassium (287.05 kg ha⁻¹). The soil was slightly alkaline in reaction (pH 7.75). The field experiment was laid out in split plot design with three replications and 12 treatment combinations consist of four plant spacings viz., 30 x 5 cm², 30 x 10 cm², 45 x 5 cm² and 45 x 10 cm², and three seed rates viz., D₁ (One seed dibble⁻¹), D₂ (Two seeds dibble⁻¹) and D₃ (Three seeds dibble⁻¹). The plot size was 5.40 m x 4.50 m and 4.50 m x 3.60 m as the gross and net plot, respectively. The soybean Cv. KDS 344 (Phule Agrani) seeds were treated with biofertilizer *Rhizobium japonicum* and PSB @ 250 g 10 kg⁻¹ seed. Sowing was done with the help of marker at a distance of 45 cm and 30 cm between the rows and 5 and 10 cm spacing between the plants as per treatments. The seed was sown at 5 cm depth by dibbling. The fertilizer was applied as a basal application by using urea, single super phosphate (SSP) and muriate of potash (MOP) as sources for nitrogen, phosphorus and potash respectively.

Results and discussion

I) Effect on growth parameters

The growth attributes were influenced significantly due to different plant spacings. Plant spacing 45 x 10 cm² recorded significantly higher growth attributes viz., plant spread plant⁻¹ (cm), number of branches plant⁻¹, number of functional leaves plant⁻¹, leaf area plant⁻¹ (dm²), dry matter plant⁻¹ (g) throughout the crop growth period and it was followed by plant spacing 45 x 5 cm² due to more availability of space for aeration, radiation, expansion and less competition for available nutrients, moisture and sunlight. The plant height was significantly higher in plant spacing 30 x 5 cm² due to competition among plants for space, nutrients and sunlight. Increasing plant density of soybean increases plant height of soybean has been reported by Kang, *et al.*, (1998) [5]. These results are in accordance with Qayyum *et al.*, (1983) [10], Goyal *et al.*, (2008) and khazi *et al.*, (2013) [6].

The growth attributes were influenced significantly due to sowing of different number of seeds dibble⁻¹. Sowing of one seed dibble⁻¹ recorded higher growth parameters (except plant height) viz., plant spread plant⁻¹ (cm), number of branches plant⁻¹, number of functional leaves plant⁻¹, leaf area plant⁻¹ (dm²), dry matter plant⁻¹ (g) was mainly due to availability of adequate nutrients, space and sunlight and it was superior over two seeds dibble⁻¹ and three seeds dibble⁻¹. The plant height was significantly higher in sowing of three seeds dibble⁻¹ due to competition amongst plants for sunlight and nutrients.

II) Effect on yield attributes and yield

The plant spacing 45 x 10 cm² recorded significantly higher yield attributes viz., number of pods plant⁻¹, weight of pods plant⁻¹, number of seeds pod⁻¹, weight of seeds plant⁻¹ and 100 seed weight and it was significantly superior over plant spacings 30 x 5 cm² and 30 x 10 cm² however, on par with plant spacing 45 x 5 cm².

Plant spacing 45 x 5 cm² recorded maximum seed yields (26.46 q ha⁻¹) and stover yield (39.20 q ha⁻¹) which was significantly superior over rest of the plant spacings however, on par with plant spacing 45 x 10 cm² which produce seed yield (24.83 q ha⁻¹) and stover yield (38.79 q ha⁻¹). Higher seed yield at highest plant population level was due to more pods per unit area. Seed yield is positively related to photosynthetically active radiation (PAR) interception (Wells *et al.*, 1993; De bruin and Pedersen, 2009) [3]. Therefore, at higher plant population more interception of PAR is expected to increase seed yield and this could be the reason for higher yield at higher plant population in the present study. Highest harvest index was recorded at plant spacing 45 x 5 cm² followed by plant spacing 45 x 10 cm² and lowest harvest index was recorded at plant spacing 30 x 5 cm². These results are in accordance with Sarmah and kalita, (1982), Balyan and Mehta (1985) [2] Goyal *et al.*, (2008), Rajput *et al.*, (1985) [11] Pople (1986) [9].

Sowing of two seeds dibble⁻¹ (26.90 q ha⁻¹) recorded the maximum seed yield, which was significantly superior over sowing three seeds dibble⁻¹ (22.35 q ha⁻¹), while it was on par with sowing of one seed dibble⁻¹ (25.53 q ha⁻¹). Sowing of two seeds dibble⁻¹ recorded maximum stover yield (40.46 q ha⁻¹), biological yield (67.36 q ha⁻¹) and harvest index which was significantly superior over sowing of three seeds dibble⁻¹ while, it was on par with sowing of one seed dibble⁻¹. Sowing of one seed dibble⁻¹ recorded significantly highest number of pods plant⁻¹, weight of pods plant⁻¹, number of seeds pod⁻¹, weight of seeds plant⁻¹ and mean 100 seed weight over rest of the treatments.

III) Effect on economics of soybean

The highest net monetary return and B:C ratio were recorded at plant spacing 45 x 5 cm² followed by plant spacing 45 x 10 cm². Plant spacing 30 x 10 cm² recorded lowest net monetary return and B:C ratio. Here the benefit cost ratio increases with increasing plant spacing. The highest net monetary return and B:C ratio recorded at sowing of one seed dibble⁻¹ followed by sowing of one seed dibble⁻¹.

Table 1: Effect of plant spacings and number of seeds dibble⁻¹ on growth parameters of soybean

Treatments	Plant height (cm)	Plant spread (cm)	No. of branches plant ⁻¹	Leaf area plant ⁻¹ (dm ²)	No. of functional leaves plant ⁻¹	Dry matter plant ⁻¹ (g)
Main Plot: Spacings						
S ₁ - 30 cm x 5 cm	66.69	42.45	4.74	111.81	46.73	35.15
S ₂ - 30 cm x 10 cm	64.87	43.76	5.30	112.21	47.99	37.90
S ₃ - 45 cm x 5 cm	61.87	45.48	5.72	119.03	49.73	41.77
S ₄ - 45 cm x 10 cm	60.23	47.30	5.90	124.72	53.14	43.71
S.Em±	1.31	0.93	0.17	2.55	1.26	1.21
C.D.at 5%	4.54	3.23	0.58	8.83	4.35	4.18
Sub Plot: No. of seeds per dibble						
D ₁ - One seed dibble ⁻¹	59.93	50.03	5.76	120.53	58.67	43.41
D ₂ - Two seeds dibble ⁻¹	62.16	43.58	5.34	117.19	46.96	39.99
D ₃ - Three seeds dibble ⁻¹	68.15	40.64	5.14	113.10	42.56	35.50
S.Em±	1.03	0.73	0.14	1.74	0.98	0.72
C.D.at 5%	3.10	2.20	0.41	5.21	2.93	2.15
Interaction (Sx D)						
S.Em±	2.07	1.47	0.2	3.48	1.96	1.44
C.D.at 5%	NS	NS	NS	NS	NS	NS
General mean	63.41	44.75	5.41	116.94	49.40	39.63

Table 2: Effect of plant spacings and number of seeds dibble⁻¹ on attributing characters of soybean

Treatments	No. of pods plant ⁻¹	Weight of pods plant ⁻¹ (g)	No. of seeds pod ⁻¹	Weight of seeds plant ⁻¹ (g)	100 seed weight (g)
Main Plot: Spacings					
S ₁ - 30 cm x 5 cm	46.92	23.46	2.52	18.74	11.40
S ₂ - 30 cm x 10 cm	47.90	23.96	2.59	18.27	11.90
S ₃ - 45 cm x 5 cm	48.82	25.02	2.67	20.87	12.34
S ₄ - 45 cm x 10 cm	52.07	26.93	2.78	21.20	12.49
S.Em±	1.00	0.56	0.05	0.42	0.28
C.D.at 5%	3.45	1.95	0.18	1.45	0.96
Sub Plot: No. of seeds per dibble					
D ₁ - One seed dibble ⁻¹	52.05	26.77	2.78	21.49	12.77
D ₂ - Two seeds dibble ⁻¹	49.19	25.20	2.61	19.55	12.12
D ₃ - Three seeds dibble ⁻¹	45.54	22.55	2.53	18.42	11.21
S.Em±	1.39	0.83	0.06	0.65	0.30
C.D.at 5%	4.17	2.48	0.19	1.96	0.89
Interaction (Sx D)					
S.Em±	2.78	1.66	0.13	1.31	0.73
C.D.at 5%	NS	NS	NS	NS	NS
General mean	48.93	24.84	2.64	19.77	12.03

Table 3: Effect of Plant spacings and number of seeds dibble⁻¹ on yield and harvest index of soybean

Treatments	Seed yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Harvest Index (%)
Main Plot: Spacings			
S ₁ - 30 cm x 5 cm	24.04	37.80	38.87
S ₂ - 30 cm x 10 cm	24.39	38.28	38.89
S ₃ - 45 cm x 5 cm	26.46	39.20	40.21
S ₄ - 45 cm x 10 cm	24.83	38.79	39.05
S. Em±	0.48	0.36	0.55
C. D. at 5%	1.67	1.23	1.89
Sub Plot: No. of seeds per dibble			
D ₁ - One seed dibble ⁻¹	25.53	38.70	39.48
D ₂ - Two seeds dibble ⁻¹	26.90	40.46	38.29
D ₃ - Three seeds dibble ⁻¹	23.35	37.63	37.91
S. Em±	0.46	0.86	0.78
C. D. at 5%	1.39	2.58	2.34
Interactions: S × D			
S. Em±	0.93	1.72	1.56
C. D. at 5%	NS	NS	NS
General mean	25.07	38.69	39.24

Table 4: Effect of plant spacings and number of seeds dibble on economics of soybean

Treatments	Cost of cultivation (Rs ha ⁻¹)	Gross monetary returns (Rs ha ⁻¹)	Net monetary returns (Rs ha ⁻¹)	B:C Ratio
Main Plot: Spacings				
S ₁ - 30 cm x 5 cm	37420	76414	38994	2.04
S ₂ - 30 cm x 10 cm	35890	77523	41633	2.16
S ₃ - 45 cm x 5 cm	36998	83986	46988	2.27
S ₄ - 45 cm x 10 cm	35100	78912	43812	2.24
S. Em±	-	674	346	-
C. D. at 5%	-	2332	1200	-
Sub Plot: No. of seeds per dibble				
D ₁ - One seed dibble ⁻¹	36360	81078	44718	2.22
D ₂ - Two seeds dibble ⁻¹	37630	85413	47777	2.26
D ₃ - Three seeds dibble ⁻¹	38100	74300	36200	1.95
S. Em±	-	574	388	-
C. D. at 5%	-	1721	1165	-
Interactions: S × D				
S. E m±	-	1148	777	-
C. D. at 5%	-	NS	NS	-
General mean	36785	79660	42874	2.16

Conclusion

1. Among the plant spacings sowing of soybean at 45 x 5 cm² (4,44,444 plants ha⁻¹) plant spacing recorded the highest yield of soybean.

2. Among number of seeds dibble⁻¹ sowing of one seed dibble⁻¹ (50 kg ha⁻¹) can be recommended for better yield of soybean.

3. Based on economics, the plant spacing 45 x 5 cm² (4,44,444 plants ha⁻¹) and sowing of one seed dibble⁻¹ (50 kg ha⁻¹) can adopted for the highest gross, net monetary return as well as B:C ratio.

References

1. Ahmad Lone, Hasan B, Singh A, Haq SA, Sofi NR. ARPN Journal of Agricultural and Biological Science ©2006-2009 Asian Research Publishing Network (ARPN), 2004.
2. Balyan JS, Mehta NK. Effect of plant population on promising varieties of soybean. Indian J. Agron. 1985; 30(3):370-373.
3. De Bruin JL, Pedersen P. New and old soybean cultivar responses to plant density and intercepted light. Crop sci. 2009; 49:2225-2232.
4. Goyal, Shashi Nawange DD, Vyas MD. Performance of Soyabean (*Glycine max* L. Merrill) Genotypes under Varying Plant Densities. Int. J. of Agri. Sci., ISSN: 0975-3710 & E-ISSN: 0975-9107. 2017; 9(6):3792-3794.
5. Kang YK, Ko MR, Cho NK, Park YM. Effect of planting date and planting density on growth and yield of soybean in cheju island. Korean J crop sci. 1998; 43:44-48.
6. Khazi GS, Narkhede WN, Garud HS. Effect of different plant densities, nutrient levels and varieties on growth, yield and yield attributing characters of soybean (*Glycinemax*.) Int. J. of Trop. Agri. © Serials Publications, ISSN: 0254-8755. 2013; 33(2), 2015.
7. Lone BA, Hassan B, Ansar-ul-haq S, Khan MM. Effect of seed rate, row spacing and fertility levels on relative economics of soybean (*Glycine max* L. Merrill) under temperate conditions. African J. of Agric. Res. 2010; 5(5):322-324.
8. Nimje PM, Agrawal V, Soni RD. Effect of planting density and improved seeding machinery on yield and economics of soybean (*Glycine max*). Indian J. of Agron. 2002; 48(4).
9. Pople PV. Studies on growth, yield and quality of soybean (*Glycine max* L. Merrill) varieties as influenced by plant population and phosphate level. M.Sc. (Agri.) dissertation submitted to M.A.U., Parbhani, 1986.
10. Qayyum SM, Liaquat ACF, Mushtaque A, Rajput MA. Effect of row spacing and fertilizer combination on the growth and yield of soybean. Tropical grain legume bulletin. 1983; 28:29-32.
11. Rajput MJ, Tunio S, Rajput FK. Effect of row and plant spacing on yield and yield component in soybean. Field crop Abstract. 1985; 38(7):400.
12. Sarmah SC, Kalita MM. "Research Notes: India: Effect of varieties and plant population on grain yield and two yield attributes of soybean," Soybean Genetics Newsletter. 1984; 11(11):
13. Singh A, Singh J. Productivity, profitability and quality of soybean (*Glycine max* L. Merrill) as influenced by sowing date and row spacing under mid- hill conditions of Himachal Pradesh. Indian J. of Agron. 2017; 62(3):371-373.
14. Wagh H, Awasarmal VB, Waghmare YM, Nayak SK. Effect of optimization in spacing and seed rate on yield attributes, yield and economics of soybean (*Glycine max* L. Merrill). OMICS Group conference. 2014; 2(4):108.