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MD Gadakh
 P.G. Student Agronomy,
 Department of Agronomy,
 Mahatma Phule Krishi
 Vidyapith Rahuri, Maharashtra,
 India

KB Navale
 Assistant Professor, Department
 of Agronomy, Mahatma Phule
 Krishi Vidyapith Rahuri
 Maharashtra, India

AG Durgude
 Analytical Chemist,
 Micronutrient Research Scheme,
 Department of Soil Science and
 Agricultural Chemistry,
 Mahatma Phule Krishi
 Vidyapith Rahuri, Maharashtra,
 India

AV Solanke
 Head Department of Agronomy,
 MPKV, Rahuri Article is Based
 On M.Sc. Agri Thesis of First
 Author Submitted to M.P.K.V.,
 Rahuri, Maharashtra, India

Correspondence
MD Gadakh
 P.G. Student Agronomy,
 Department of Agronomy,
 Mahatma Phule Krishi
 Vidyapith Rahuri, Maharashtra,
 India

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Standardization of optimum seed rate and yield maximization in soybean under different land configurations and sowing technique

MD Gadakh, KB Navale, AG Durgude and AV Solanke

Abstract

A field experiment entitled “Standardization of optimum seed rate and yield maximization in soybean under different land configurations and sowing techniques” was undertaken during *khariif*, 2018 at Post Graduate Instructional Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment was laid out in randomized block design with three replications. The soil was loamy in texture, low in available nitrogen (197.5 kg ha^{-1}), medium in available phosphorous (18.4 kg ha^{-1}) and very high in potassium (480 kg ha^{-1}). The soil was moderately alkaline in reaction (pH 8.26). The experiment comprised of eight treatments T₁- Preparation of ridges and furrows at 45 cm distance and sowing at one side (45cm x 10cm), T₂- Preparation of ridges and furrows at 45cm distance and sowing at both side (22.5cm x 10cm), T₃- Preparation of ridges and furrows at 60cm distance and sowing at one side (60cm x 10cm), T₄- Preparation of ridges and furrows at 60cm distance and sowing at both side (30cm x 10cm), T₅- Preparation of ridges and furrows at 90cm distance and sowing at both side (45cm x 10cm), T₆- Preparation of BBF [90 cm top and 120cm base] and sowing at 22.5 cm distance (22.5cm x 10cm), T₇- Preparation of BBF [90 cm top and 120 cm base] and sowing at 30 cm distance (30cm x 10cm), T₈- Flat bed (45cm x 10 cm).

The growth parameters *viz* plant height (75.57 cm) significantly recorded highest at harvest on 45 cm ridges and furrows sowing at both side (22.5cm x 10cm) with seed rate 67 kg ha^{-1} . Number of compound leaves (29.80) at 90 DAS, number of branches plant⁻¹ (6.27) at 90 DAS and dry matter plant⁻¹ (40 g) at harvest and nodulation count at flowering stage (52.07) were significantly recorded highest on 60 cm ridges and furrows sowing at one side (60 cm x 10cm) with seed rate 28.1 kg ha^{-1} .

Significantly the highest grain yield (30.60 q ha^{-1}), straw yield (38.86 q ha^{-1}) were recorded on 60 cm ridges and furrows sowing at two side (30 cm x 10cm) with seed rate 51.4 kg ha^{-1} . Significantly maximum uptake in N ($120.79 \text{ kg ha}^{-1}$), P (18.83 kg ha^{-1}) and K (98.60 kg ha^{-1}) by soybean was observed on preparation of ridges and furrows at 60cm distance and sowing at two sides (30cm x 10cm). Whereas minimum uptake in N (89.18 kg ha^{-1}), P (14.40 kg ha^{-1}) and K (75.39 kg ha^{-1}) by soybean was observed on flat bed (45 cm x 10 cm).

Keywords: Land configuration and sowing techniques, nutrient uptake and soybean yield

Introduction

Soybean [*Glycine max* (L) Merill] is an important legume crop belonging to the family Leguminosae. Soybean is diploid species having chromosomes number $2n=40$. The origin of soybean is china. It is annual leguminous herbaceous plant. Soybean is cheapest and richest source of protein (38 to 42%) except methionine and cysteine and about 20% oil. It has established its recognition as both pulses and oilseed crop. It supplies most of the nutritional constituents essential for human health. Hence, soybean is known as wonder crop or golden bean or miracle bean. It is rich source of Vitamin A, B and D. The biological value of the soybean protein is good as meat and fish protein (Quayam *et al.* 1985) [5]. Soybean protein contains all the essential amino acids vital for human diet.

In India, soybean is mainly grown in Madhya Pradesh, Maharashtra and Rajasthan which together contributes 92 to 93 percent of area and production. In India, soybean is grown on an average of 10.96 M ha area with production of 13.46 million metric tons having 1228 kg ha⁻¹ average productivity and 1120 kg ha⁻¹ average yield. In state wise contribution Madhya Pradesh contributes 59.17 percent that is 6.73 million metric tons from 5.24 M ha followed by Maharashtra 38.35 percent that is 4.39 million metric tons from 3.93 M ha then Rajasthan 9.44 percent that is 1.16 million metric tons from 0.93 M ha (Anonymous 2018-19).

Area under soybean crop has increase more in Marathwada and Vidarbha region. In Maharashtra estimate of soybean production 38.35 percent i.e. 4.39 million metric tons from 3.93 M ha with productivity 925 kg ha⁻¹. (Anonymous 2018-19).

Land configuration decides the effectiveness of the crop management practices regarding application of nutrient, irrigation, weed management, etc. Major land configuration practices includes raised bed preparation, rides and furrows, broad bed furrows, etc. The general farmer's practice sowing over flat bed without any proper land configuration, leading to less significant growth and development of crops and in turn lesser yields.(Deshmukh *et al.* 2016) [3]. Therefore the present investigation was carried out to know about the suitable land configuration for proper growth and development of crops especially cereals

Material Methodology

A field experiment entitled Standardization of optimum seed rate and yield maximization in soybean under different land configurations and sowing techniques was undertaken during *kharij*, 2018 at Post Graduate Instructional Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment comprised of eight treatments of T₁-Preparation of ridges and furrows at 45cm distance and sowing at one side(45cm x 10cm), T₂-Preparation of ridges and furrows at 45cm distance and sowing at both side(22.5cm x 10cm), T₃-Preparation of ridges and furrows at 60cm distance and sowing at one side(60cm x 10cm), T₄-Preparation of ridges and furrows at 60cm distance and sowing at both side(30cm x 10cm), T₅-Preparation of ridges and furrows at 90cm distance and sowing at both side(45cm x 10cm), T₆-Preparation of BBF [90 cm top and 120cm base] and sowing at 22.5 cm distance(22.5cm x 10cm).

T₇- Preparation of BBF[90 cm top and 120 cm base]and sowing at 30 cm distance(30cm x10cm), T₈- Flat bed (45cm x 10 cm). The experiment was laid out in randomized block design with three replications. The soil was loamy in texture, low in available nitrogen (197.5 kg ha⁻¹), medium in available phosphorous (18.4 kg ha⁻¹) and vary high in potassium (480 kg ha⁻¹). The soil was moderately alkaline in reaction (pH 8.26).

Results and Discussion

Growth Contributing Characters

The data in respect of plant height, number of compound leaves, number of branches per plant, dry matter per plant and nodulation count of soybean as influenced by different treatments are presented in table 1.

The plant height was significantly highest (75.57 cm) in treatment T₂[Preparation of ridges and furrows at 45cm

distance and sowing at both side(22.5cm x 10cm)] over all the treatments except T₆(75.40 cm) which was at par. Number of compound leaves per plant were significantly increased (29.80) in treatment T₃ over all the treatments except T₅ (29.70) and T₁ (29.47) which were at par. Number of branches per plant of soybean was found significantly higher (6.27) over all the treatments except treatment T₅ (6.25) and T₁ (5.93) which were at par. Similar results were also reported by Paul and Shinde (2016) [4].

In respect of dry matter of soybean per plant was found significantly increased (40 g) in treatment T₃ over all treatments except treatment T₅ (39.30 g) and T₁ (38.90 g) which were at par. The nodulation count was also found significantly higher (52.07) over all treatments except treatment T₅ (51.73) and T₁ (50.47) which were at par.

In general treatment T₃- preparation of ridges and furrows at 60cm distance and sowing at one side (60cm x 10cm) was found to be superior in respect of increased in growth characters of soybean this may be due to better availability of sunlight, soil moisture, nutrients, and other environmental factors except plant height observed highest in T₂- preparation of ridges and furrows at 45cm distance and sowing at both side (22.5cm x 10cm)

Yield characters

The grain and straw yield of soybean as influenced by different land configuration and sowing techniques are presented in table 2.

The grain yield of soybean was significantly recorded higher (30.60 q ha⁻¹) in treatment T₄ -Preparation of ridges and furrows at 60cm distance and sowing at both side(30cm x 10cm) over all the treatment except T₇(29.64 q ha⁻¹) which was at par. However the grain yield of soybean recorded lowest in treatment T₈ (23.12 q ha⁻¹).

The straw yield of soybean was significantly recorded higher (38.86 q ha⁻¹) in treatment T₄ -Preparation of ridges and furrows at 60cm distance and sowing at both side(30cm x 10cm) over all the treatment except T₇ (38.53 q ha⁻¹) which was at par. Similar results were also reported by Rajput *et al.* (1999) [6] and Abbas *et al.* (1994) [2].

Total nutrient uptake

The total nutrient uptake by soybean as influenced by different land configuration and sowing techniques are presented in table 3.

The total N, P and K uptake by soybean was significantly recorded higher (120.79, 18.83, 98.60 kg ha⁻¹, respectively) in treatment T₄- preparation of ridges and furrows at 60cm distance and sowing at both side (30cm x 10cm) overall treatments, However treatment T₇ was at par in respect of total uptake of P and K.

Table 1: Effect of different land configurations and sowing techniques on growth characters of soybean

Treatment	Plant height (cm)	Number of compound leaves plant ⁻¹	Number of branches plant ⁻¹	Dry matter plant ⁻¹ (g)	Nodulation count
T ₁ -Preparation of ridges and furrows at 45cm distance and sowing at one side (45 cm x 10cm).	72.00	29.47	5.93	38.90	50.47
T ₂ -Preparation of ridges and furrows at 45cm distance and sowing at both side (22.5cm x 10cm).	75.57	28.50	5.13	36.10	48.30
T ₃ -Preparation of ridges and furrows at 60cm distance and sowing at one side (60cm x 10cm).	71.73	29.80	6.27	40.00	52.07
T ₄ - Preparation of ridges and furrows at 60cm distance and sowing at both side(30cm x 10cm).	74.73	29.10	5.27	37.00	50.00
T ₅ -Preparation of ridges and furrows at 90cm distance and sowing at both side(45cm x 10cm).	72.20	29.70	6.20	39.30	51.73
T ₆ -Preparation of BBF [90 cm top and 120cm base] and	75.40	28.33	5.07	35.00	48.13

sowing at 22.5 cm distance (22.5cm x 10cm).					
T7-Preparation of BBF[90 cm top and 120 cm base]and sowing at 30 cm distance (30cm x10cm).	72.83	28.67	5.20	36.63	49.07
T8-Flat bed(45cm x10 cm)	71.43	28.17	4.93	34.50	47.53
S.E. m (\pm)	0.17	0.18	0.23	0.38	0.51
C.D at 5%	0.53	0.54	0.71	1.17	1.57
General Mean	73.24	28.97	5.50	38.90	49.66

Table 2: Effect of different land configurations and sowing techniques on yield of soybean

Treatment	Yield (q ha ⁻¹)	
	Grain	Straw
T1-Preparation of ridges and furrows at 45cm distance and sowing at one side (45 cm x 10cm).	28.50	36.48
T2-Preparation of ridges and furrows at 45cm distance and sowing at both side (22.5cm x 10cm).	28.30	36.79
T3-Preparation of ridges and furrows at 60cm distance and sowing at one side (60cm x 10cm).	24.43	31.27
T4- Preparation of ridges and furrows at 60cm distance and sowing at both side (30cm x 10cm).	30.60	38.86
T5-Preparation of ridges and furrows at 90cm distance and sowing at both side (45cm x 10cm).	28.70	36.45
T6-Preparation of BBF [90 cm top and 120cm base] and sowing at 22.5 cm distance (22.5cm x 10cm).	27.93	36.03
T7-Preparation of BBF [90 cm top and 120 cm base] and sowing at 30 cm distance (30cm x10cm).	29.64	38.53
T8-Flat bed(45cm x10 cm)	23.12	29.36
S.E. m (\pm)	0.31	0.40
C.D at 5%	0.96	1.24
General Mean	27.65	35.47

Table 3: Nutrient uptake by grain and straw of soybean influenced by different treatment.

Treatment	Total nutrient uptake (kg ha ⁻¹)		
	Nitrogen	Phosphorus	Potassium
T1-Preparation of ridges and furrows at 45cm distance and sowing at one side (45cm x 10cm).	111.15	17.77	93.04
T2-Preparation of ridges and furrows at 45cm distance and sowing at both side (22.5cm x 10cm).	111.23	17.80	93.16
T3-Preparation of ridges and furrows at 60cm distance and sowing at one side (60cm x 10cm).	96.75	15.18	79.49
T4- Preparation of ridges and furrows at 60cm distance and sowing at both side (30cm x 10cm).	120.79	18.83	98.60
T5-Preparation of ridges and furrows at 90cm distance and sowing at both side (45cm x 10cm).	112.79	17.62	92.24
T6-Preparation of BBF [90 cm top and 120cm base] and sowing at 22.5 cm distance (22.5cm x 10cm).	111.17	17.22	90.14
T7-Preparation of BBF[90 cm top and 120 cm base]and sowing at 30 cm distance (30cm x10cm).	115.91	18.38	96.19
T8-Flat bed (45cm x10 cm)	89.18	14.40	75.39
S.Em (\pm)	0.58	0.21	1.11
C.D at 5%	1.76	0.64	3.38
General Mean	108.62	17.15	89.78

Conclusion

It is concluded that the preparation of ridges and furrows at 60cm distance and sowing at both side (30cm x 10cm) found beneficial for increase in grain, stover, yield as well as total nutrient uptake by soybean on shallow soil.

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