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Research Article

SYSTEM INTENSIFICATION FOR SOYBEAN PRODUCTIVITY AUGMENTATION UNDER RIDGE FURROW PLANTING

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Abstract: The field experiment was conducted in field at Regional Research Centre, Amravati during kharif season in 2018-19. The experiment was conducted in split plot design with three replications, two varieties of soybean JS 20-34 and RVS 24 in main plot and four land configurations of spacing under ridges furrow planting 45 x 5 cm, 45 x 10 cm, 45 x 20 cm and 45 x 30 cm) in sub-plot. The observation on dry matter was recorded at 30 DAS, 60 DAS and at harvest, CGR and RGR on 30-60 DAS and 60 DAS-at harvest. The observation on Yield attributes *viz*., branches per plant, pods per plant, seed index, seed yield kg/ha, straw yield kg/ha and harvest index were recorded at the time of harvesting. Highest no. of pods per plant was recorded in JS 20-34. The crop geometry was observed highest pods plant-1 in 45 x 30 cm followed by 45 x 20, 45 x 10 and lowest in 45 x 5 cm spacing. This may be due to less competition amongst the plant, maximum aeration and sunlight. Seed index was recorded no significant difference in varieties and crop geometry. Soybean was recorded significantly higher seed yield and straw yield in variety JS 20-34. No significant differences found in crop geometry but higher seed yield was observed in 45 x 10cm spacing. The lowest cost of cultivation was noticed in variety RVS 24 while highest GMR, NMR and B:C ratio was observed with JS 20-34. In respect of different plant geometry, lowest COC was observed with 45 x 30 cm spacing while highest GMR, NMR and B:C ratio was recorded with 45 x 10 cm spacing.

Keywords: *Crop geometry, Ridge and furrow system, Soybean*

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Introduction

The flat-land cultivation system is popular in Vidarbha region of Maharashtra. At present for extensively cultivation of kharif crop like soybean which faces the problem of water logging and poor aeration thereby affecting crop productivity adversely. Among all legumes, soybean is most sensitive to soil moisture. The loss in yield can be minimized if optimum amount of water is stored in soil. Water logging adversely affects the growth of crops, primarily due to reduced oxygen supply to the roots. The small change through land configuration in flat field conditions may help in improving the productivity of kharif crops. Using light machinery like bund former and desi hal with minor modifications may improve the physical conditions and drain ability. It is assumed that land treatments will help to improve the physical conditions, root development, nodules development and overall crop productivity in vertisols. Jadhav, *et al*., (2012) [1] reported that yield contributing character *viz*., number of pods plant-1, seed yield weight (g) plant1, 100 seed weight (g), seed yield (q ha^{-1}), straw yield (q ha^{-1}) and harvest index (%) also found higher in broad bed furrow followed by ridges and furrow system. Apart from soil related properties, the seed rate played a crucial role in optimizing crop productivity. Over seed rate not only enhanced the cost but also cause non-poding in plant due to insect attack, shrinking seed size and reduced crop productivity. Reduced seed rate may help in maintaining optimum plant population. Different varieties of soybean are sensitive to change in environment condition where the crop is being planted. Appropriate variety is necessary for obtaining high yield and quality of soybean. The optimum plant density for higher yield may differ from variety to variety and location to location. The productivity of soybean can be increased by selecting suitable variety. The varieties with higher harvest index resulted in higher seed yield. The present investigation is undertaken with suitable variety and its interaction with land configuration; seed rate also sustain the yield of soybean crop which is occupied highest area under cultivation in Vidarbha.

Materials and Methods

The field experiment was conducted in field at Regional Research Centre, Amravati during kharif season in 2018-19. The topography of experiment site was fairly uniform, leveled and have medium black soil in texture having pH 7.52, organic carbon 0.42%. bulk density 1.46 g cm3 and available N, P2O5, K2O: 210.88, 18.23, 345.05 kg ha^{-1} respectively. The experiment was conducted in split plot design with three replications, two varieties of soybean JS 20-34 and RVS 24 in main plot and four land configurations of spacing under ridges furrow planting45 x 5 cm, 45 x 10 cm, 45 x 20 cm and 45 x 30 cm in sub-plot. After seed bed preparation, sowing of Soybean was done by dibbling. The net plot size was 5.0 m x 2.7 m. Crop was sown in third week of June and harvest in last week of September. Five plants were taken for recording growth parameters. The seed yield was taken plot wise and converted into kg ha^{-1}. The observation on dry matter was recorded at 30 DAS, 60 DAS and at harvest, CGR and RGR on 30-60 DAS and 60 DAS-at harvest. The observation on Yield attributes *viz*., branches per plant, pods per plant, seed index, seed yield kg/ha, straw yield kg/ha and harvest index were recorded at the time of harvesting.

Results and Discussion

Effect of varieties and crop geometry in growth parameters of soybean

The data was showed in [Table-1]. The result revealed that significantly maximum number of branches plant-1 JS 20-34 as compared to RVS 24. The crop geometry was recorded no significant difference in number of branches plant-1. Significantly highest dry matter accumulation per plant at 60 DAS was recorded in JS 20-34 while at harvest it was observed in RVS 24. Crop geometry was recorded significantly maximum dry matter accumulation in 45 x 30 cm followed by 45 x20 cm, 45 x10 cm and lowest in 45 x 5 cm spacing. Highest CGR and RGR were observed at 30-60 DAS in JS 20-34 while at harvest it was observed in RVS 24.

Table-1 Branches plant-1, plant dry weight (g), CGR (g/m2/day), RGR (g/g/day) and rain use efficiency (kg/ha-mm) of different varieties of soybean as influenced by plant geometry under ridge furrow planting

Treatment	Branches/ Plant	Plant dry weight			CGR		RGR		RUE
		30 DAS	60 DAS	At harvest	30-60 DAS	60-at harvest	30-60 DAS	60-at harvest	
Variety									
JS 20-34	2.77	3.01	8.55	10.09	8.31	2.30	0.042	0.007	2.02
RVS 24	1.92	3.42	7.34	17.64	5.88	15.46	0.031	0.034	1.51
SEM±	0.12	0.25	0.31	0.41	0.44	0.64	--	--	--
CD (P=0.05)	0.38	NS	0.96	1.27	1.34	1.98	--	--	--
Plant geometry									
45 X 5 CM	1.90	2.72	7.58	10.09	7.29	3.76	0.041	0.011	1.80
45 X 10 CM	2.60	3.27	7.80	13.02	6.79	7.83	0.034	0.019	2.12
45 X 20 CM	2.30	3.18	9.09	15.81	8.86	10.08	0.042	0.020	1.64
45 X 30 CM	2.57	3.69	7.31	16.54	5.43	13.85	0.028	0.030	1.49
SEM±	0.09	0.17	0.28	0.56	0.32	1.04	--	--	--
CD (P=0.05)	0.28	0.52	0.87	1.73	1.00	3.19	--	--	--
Interaction									
SEM±	0.14	0.13	0.22	0.32	0.28	0.38	--	--	--
CD (P=0.05)	NS	NS	0.69	0.98	0.88	1.17	--	--	--

Table-2 Number of pods-1, test weight (g), seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) and harvest index (%) of different varieties of soybean as influenced by plant geometry under ridge furrow planting

Treatment	Pods/Plant	Seed index	Seed yield (kg/ha)	Straw yield (kg/ha)	HI (%)
A. Variety					
JS 20-34	36.97	10.65	1206	1527	44.15
RVS 24	20.42	10.29	899	1033	46.58
SEM±	1.22	0.37	50.59	56.38	--
CD (P=0.05)	3.75	NS	155.87	173.70	--
B. Cropping system					
45 X 5 cm	20.17	10.57	1074	1295	45.61
45 X 10 cm	28.23	10.34	1268	1569	44.81
45 X 20 cm	31.07	10.67	978	1181	45.60
45 X 30 cm	35.30	10.29	890	1075	45.45
SEM±	1.36	0.24	49.30	66.19	--
CD (P=0.05)	4.19	NS	151.88	203.93	--
Interaction					
SEM±	0.93	0.24	38.09	43.39	--
CD (P=0.05)	2.86	NS	NS	133.69	--

Table-3 Interaction effect of seed yield (kg ha^{-1}) on soybean varieties and crop geometry (cm) planting in ridge and furrow system

Treatment	Variety		
Plant geometry	JS 20-34	RVS 24	MEAN
45 X 5 cm	1241	907	1074
45 X 10 cm	1350	1185	1267
45 X 20 cm	1179	776	977
45 X 30 cm	1054	725	889
Mean	1206	898	
	Variety	Plant geometry	Interaction
SEM±	50.59	49.30	38.09
CD (P=0.05)	155.87	151.88	NS

Table-4 Economics of different varieties of soybean as influenced by plant geometry under ridge furrow planting

Treatment	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Variety				
JS 20-34	28815	40280	11464	1.40
RVS 24	28231	29854	1623	1.06
SEM±	96.13	1677	--	--
CD (P=0.05)	296.16	5168	--	--
Plant geometry				
45 X 5 CM	28565	35776	7212	1.25
45 X 10 CM	28933	42287	13354	1.46
45 X 20 CM	28381	32566	4185	1.14
45 X 30 CM	28214	29637	1423	1.05
SEM±	93.66	1651	--	--
CD (P=0.05)	288.57	5087	--	--
Interaction				
SEM±	72.37	1264	--	--
CD (P=0.05)	NS	NS	--	--

Crop geometry was recorded highest CGR and RGR in 45 x 20 cm at 30-60 DAS while 45 x 30 cm at 60-harvest DAS. Highest rain use efficiency was recorded in JS 20-34 and found with spacing 45 x 10 cm spacing of crop geometry.

Effect of varieties and crop geometry in yield attributes and yield of soybean

The data was showed in [Table-2] and [Table-3] and [Fig-1, 2, 3, 4 and 5]. Highest number of pods plant-1was recorded in JS 20-34. The crop geometry was observed highest pods plant-1 in 45 x 30 cm followed by 45 x 20, 45 x 10 and lowest in 45 x 5 cm spacing. This may be due to less competition amongst the plant, maximum aeration and sunlight. Seed index was recorded no significant difference in varieties and crop geometry. Soybean was recorded significantly higher seed yield and straw yield in variety JS 20-34.

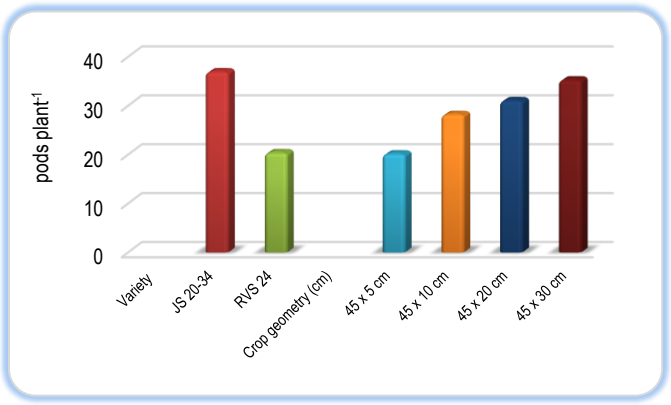

Fig-1 Number of pod plant-1of different soybean varieties as influenced by plant geometry in ridge and furrow system

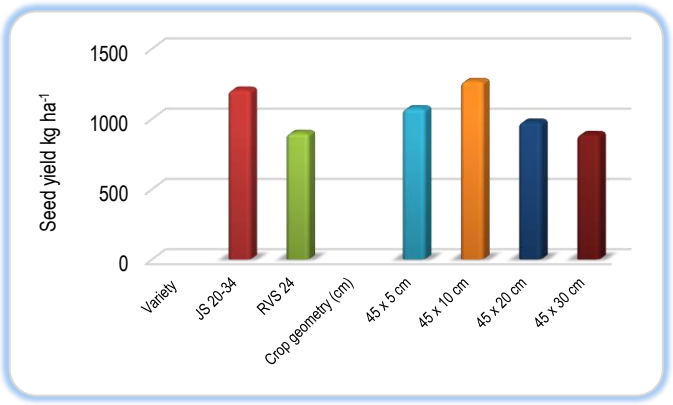

Fig-3 Seed yield (kg ha-1) of different soybean varieties as influenced by plant geometry in ridge and furrow system

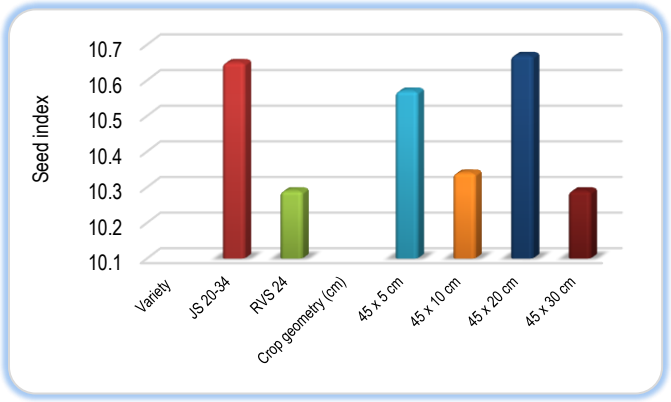

Fig-2 Seed indexof different soybean varieties as influenced by plant geometry in ridge and furrow system

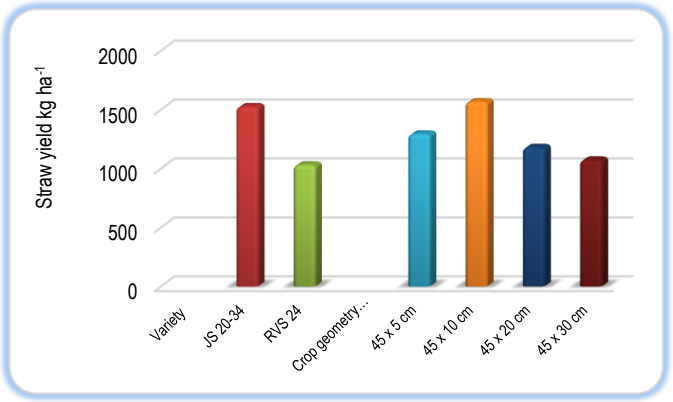

Fig-4 Straw yield (kg ha-1) of different soybean varieties as influenced by plant geometry in ridge and furrow system

No significant differences found in crop geometry but higher seed yield was observed in 45 x 10cm spacing. Significantly highest straw yield was recorded in crop geometry of 45 x 10 cm and lowest in 45 x 30 cm. Significant increase in grain yield due to land configuration treatments was also reported by Verma et al. (2020) [2]. Highest harvest index was recorded with 45 x 5 cm spacing. The Interaction effect observed in seed yield, interaction show combination of treatment variety and crop geometry was highest seed yield obtained in JS 20-34with spacing 45 x 10 cm and lowest in RVS 24 with spacing 45 x 30 cm. Singh, (2011) [3] also reported that higher seed yield at the highest plant population level due to better plant growth and higher biological yield. Relationship between plant population and seed yield (kg ha-1) was linear with performance maximum in variety and crop geometry 45×10 cm.

Economics of cultivation assessment

To examine the economic feasibility and viability of different treatment under investigation, economics of soybean production in terms of gross return, net return and net return per rupee investment were calculated for different treatments of soybean and the outcome is presented in [Table-4]. The lowest cost of cultivation was noticed in variety RVS 24 while highest GMR, NMR and B:C ratio was observed with JS 20-34. In respect of different plant geometry, lowest cost of cultivation was observed with 45 x 30 cm spacing while highest GMR, NMR and B:C ratio was recorded with the crop geometry of 45 x 10 cm spacing and lowest in the 45 x 30 cm. Similar results have been noted by Singh, *et al*., (2000) [4] and Pandya, *et al*., (2005) [5].

Application of research: The crop geometry was observed highest pods plant-1 in 45 x 30 cm followed by 45 x 20, 45 x 10 and lowest in 45 x 5 cm spacing.

Research Category: Crop geometry

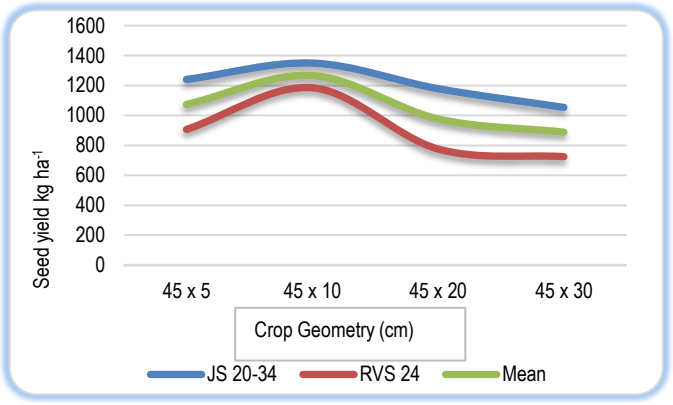

Fig-5 Interaction effect of seed yield (kg ha-1) on soybean varieties and crop geometry (cm) in ridge and furrow system

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University: Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 444104, India
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Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Regional Research Centre, Amravati, 444603

Cultivar / Variety / Breed name: Soybean

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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