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Symbiotic Traits and Yield of Different Genotypes of Soybean as Affected by Basal Doses of Inputs in Vertisol

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ABSTRACT

The experiment was conducted near research farm of Krishi Vigyan Kendra Sehore, (M.P) during kharif season of 2008-09 with Genotypes (10) viz. T_1 (Bragg), T_2 (JS 93-05), T_3 (RKS 24) T_4 (NRC 37), T_5 (MOUS 158), T_6 (JS 97-62) T_7 (NRC 7), T_8 (JS 7546), T_9 (JS 9560) T_{10} (JS 335). The result showed that the genotypes response on pre-harvest studies viz. plant height, number of branches, number of leaves, dry weight per plant, nodule number, dry weight of nodule were found significant. The JS 335 per formed the best for the nodulating ability (nodulation traits) followed by Bragg. Genotype JS 335 per formed the best for the post harvest parameters viz. pods per plant, seed yield per plant, seed index, seed yield (kg/ha), and harvest index were found significant among genotypes. It was followed by Bragg.

Key word: *Genotypes, Pre harvest studies, Post harvest studies.*

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] has been becoming the miracle crop of 21st century. It is an oilseed crop mainly grown in *kharif* season. It contains about 20% oil and 40% higher quality protein. Soybean protein is rich in valuable amino acid, lycine (5%) for which most of the cereals are deficient. In addition, it contains a good amount of vitamin c. It also improves the soil fertility by fixing atmospheric nitrogen at the rate of 65-115 kg/ha[1] with symbiosis of *Rhizobium japonicum* micro-organism. the different yield attributes viz. number of branches per plant, number of pods per plant, 100-seed weight were significantly higher with the application of recommended rates of NPK (20:60:40) which was at par with 50 kg N+1 t neem cake per hectare. However, number of grains per pod was not influenced by various treatments of inorganic and organic nutrients. Maximum grain yield was obtained with the application of 25 kg N+5 t FYM per hectare.

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The grain protein content of soybean was highest (39.67%) with the application of 50 kg N+1 t neem cake per hectare while oil content of soybean grain was highest (20.38%) with the application of 5 t FYM per hectare[4] and N_{50} + N_{50} FYM gave comparably better results and 75% RDF applied with *Rhizobium*, PSB and FYM at 5 t ha^{-1} played, a significant role in increasing yield the treatment have FYM @ 5 t per ha +V. C. @ 2.5 t per ha +V. W. @ 10 per cent+50 per cent NPK gave maximum nodule number (49 and 53/plant), highest nodule dry weight (384 and 372 mg/plant) and plant dry weights (30.33 and 40.33 g/plant)[2,3]. Among the different growth characters the yield contributing traits and varietal adaptability and stability for nodulating ability in native rhizospheric conditions are the important factors in newly developed varieties for high and sustainable productivity.

MATERIAL AND METHODS

The field experiment was carried out during kharif season 2008 and 2009 at the farmer field near RAK college of Agriculture, Sehore (m.p.) The field Soil was clay-loam having Ph 7.07, electrical conductivity 0.36 dSm-¹,organic carbon 0.41 kg^{-1} available N, P_2O_5 and K_2O 247.5,15.62 and 480 kg ha^{-1} . The total rainfall was 688 mm. The treatment Comprised ten soybean genotypes (Bragg, JS-9305, RKS-24, NRC-37, MOUS-158, JS-9752, NRC-7, JS-7546, JS-9560 and JS-335). Which were laid out in a randomised block design with three replication.

The soybean genotypes were sown on 26 June 2008 and 10 July 2009 @ 80 kg seed/ha in rows 40 cm apart. An uniform dose of 20 kg N ,60 kg P_2O_5 and 20 kg K_2O were applied through urea , single super phosphate and murate of potash . The crop was grown as per recommended package of practices. The crop was harvested on last week of September in both the years. The seed protein was determined by micro– kjeldahl distillation apparatus. The N- Content in seed was multiplies by 6.25 to obtain the protein content.

RESULT AND DISCUSSION

The highest plant height (cm) i.e. 85.12 cm was observed at maturity of the crop in the genotypes, JS 335. It was found significantly superior to the rest of the genotypes. The result showed that the plant height varied among different varieties were also observed by Mondal *et al.*[12].

Effect of different treatment at maturity (2007-08)

Treatment	Genotypes	Maturity			
		Plant height (cm)	No. of Branches	Leaf per Plant	Dry weight /plant
T_1	Bragg.	77.89	4.66	3.02	23.06
T_2	JS-9305	59.78	4.77	3.02	21.89
T_3	RKS-24	60.34	4.33	3.13	21.50
T_4	NRC-37	62.23	4.44	2.91	21.39
T_5	MOUS-158	65.45	4.44	3.24	22.39
T_6	JS-9752	77.23	5.11	2.68	22.74
T_7	NRC-7	57.67	4.88	2.79	20.61
T_8	JS-7546	71.01	4.77	2.91	22.67
T_9	JS-9560	63.78	3.99	2.90	20.56
T_{10}	JS-335	85.12	4.66	3.13	23.95
SEm±		1.9	0.28	0.30	0.61
CD %		5.51	0.83	0.43	1.77

At harvest (maturity) stage the maximum number of branches/plant (5.11) was recorded in the genotype JS 9752 (T_6), which was found to be at par with each other. The results are in confirmation with the result of Rahman *et al.*[13].

At maturity stage the genotype MOUS 158 proved to be best in terms of number of leaves per plant, with the maximum number of leaves (3.24). It was closely followed by the genotype JS 335 (3.13) and RKS 24 (3.13). The least

number of leaves per plant were recorded under the genotype JS 9752 (2.68)

The maximum dry weight per plant was noted in JS 335 at all the stages and the maximum was noticed in JS 335 (23.95), Bragg (23.06) JS-9752 (22.74) at maturity which was remained at par with each other. It was recorded lowest in JS 9305 (21.89) &in JS 9560 (20.56) at maturity The results are in confirmation with the result of Rahman *et al.*[13].

Effect of different treatment on no. of root nodules and dry weight of root nodules per plant

Treatment	Genotypes	No. of root nodules per plant (60 DAS)	Dry weight of root nodules (mg) (60 DAS)	Yield per plot (kg)	
				Seed	Straw
T_1	Bragg.	90.72	173.02	1.34	1.52
T_2	JS-9305	96.93	150.06	1.02	1.24
T_3	RKS-24	98.54	168.84	1.19	1.36
T_4	NRC-37	87.15	150.03	1.19	1.36
T_5	MOUS-158	96.40	173.32	1.11	1.33
T_6	JS-9752	97.93	164.16	1.26	1.48
T_7	NRC-7	104.84	149.74	0.98	1.21
T_8	JS-7546	92.81	172.78	1.24	1.48
T_9	JS-9560	99.77	172.71	0.92	1.14
T_{10}	JS-335	110.71	186.63	1.45	1.69
S Em±		4.39	2.5	0.03	0.04
CD %		12.68	7.23	0.10	0.12

The maximum number of nodules/plant (110.71) were recorded under the genotype JS 335, which was significantly superior to all the other genotypes except NRC 7 (104.84). Which was found to be at par JS 335 (T_{10}) The minimum number of root nodules was recorded under the genotype NRC 37 (87.15).

The dry weight of root nodules per plant recorded a significant variation the highest value of dry weight of root nodules per plant was recorded under the genotype JS 335 (186.63). The minimum dry weight of nodules was noticed in NRC 7 (149.74) which was closely followed by JS 9305 (150.06) and NRC 37 (150.03). It was followed by the genotype JS 9752 (164.16) The result are in closely conformity, Patel and Singh, Rehman *et al*.[13] Vyas and Khandwe[11].

Effect of different treatment on pods per plant, seed per plant, seed yield per plant and seed index (Mean of two years)

Treatment	Genotypes	Pods/plant	Seed/pod	Seed yield/plant (g)	Seed index
T_1	Bragg.	64.77	3.25	11.89	10.69
T_2	JS-9305	56.33	3.09	11.33	10.19
T_3	RKS-24	53.39	3.09	11.66	10.02
T_4	NRC-37	55.77	3.09	10.33	9.35
T_5	MOUS-158	62.00	3.02	12.11	9.85
T_6	JS-9752	63.77	3.22	12.44	10.35
T_7	NRC-7	50.55	3.12	10.22	10.19
T_8	JS-7546	58.88	3.09	10.11	9.69
T_9	JS-9560	52.88	2.99	11.11	10.19
T_{10}	JS-335	66.00	3.35	12.55	10.85
S Em±		2.52	0.88	0.68	1.66
CD %		7.28	0.25	1.98	0.47

It is obviously reflect the fact from these data that the sowing of soybean was done properly and uniformly in each treatment using healthy and viable seed of different genotypes to maintain the better germination, emergence and crop stand. Thus, the crop stand remained almost uniformly sufficient under all the treatment. The maximum population of native rhizobia at maturity was found under JS 335 followed by JS 9560 and JS 9752 in experimental soil which indicated in increased nitrogen fixation in the soil. It might ascribed due to the increased nodulation traits in the soil due to different genotypes.

Variation in pods per plant may be correlated with the number of branches. Significant effect of variety on pods per plant was also reported by, Rahman *et al.*[13] and Mondal *et al.*[12] Wider row spacing given the sufficient space of individual plant for better reproductive growth and increase the pod bearing ability because easily provide essential plant nutrients in this row spacing. Similar results were reported by Mondal *et al.*[12].

The highest value of pods per plant was recorded under the genotype JS 335 (66.00). The minimum pods/plant was noticed in NRC-7(50.55) The genotype JS 335 was significantly superior over all the other genotypes with the maximum number of seeds per pod (3.35 pod^{-1}). But it was found to be at par with the genotype Bragg (3.25 pod^{-1}) and JS 9752 (3.22 pod^{-1}). The variation in seeds per pod among varieties may be accounted for varietals inheritance. Similar results were reported by Parmar and Nema and Thakur and Vyas[7].

The genotype JS 335 recorded the maximum seed index (10.85), which was significantly superior over all the other genotypes except Bragg (10.69) and JS 9752 (10.35).

The significant variation in the per plant seed yield of soybean due to the effect of different genotypes. The various genotypes significantly affected the seed yield per plant. The highest value of seed yield per plant was recorded under the genotype JS 335 (12.55gm). The minimum seed yield of nodules was noticed in JS 7546 (10.11gm).

The seed and straw yield per plot were significantly influenced by different genotypes of soybean. The maximum seed yield per plot (1.45 kg) and straw yield per plot (1.69 kg) were recorded in JS 335, respectively followed by Bragg (1.34 kg) and 1.52 kg seed and straw yields, respectively. The minimum seed yield /plot (0.92 kg) was noticed in JS 9560 followed by 0.98 kg in NRC-7. The minimum straw yield/plot was noted in JS 9560 (1.14 kg) followed by NRC 7 (1.21 kg).

The significantly increase in growth characters clearly revealed the response of different genotypes and recommended doses of nutrients which might have accelerated the hydrogenase enzyme activity in the plant system and hence, the such effect. These results are in close conformity with the results of Soni and Vyas[6], Mandloi *et al.*[10], Islam *et al.*[9], Thakur and Vyas[7] and Patidar *et al.*[8]. grain and straw yields exerted a significant difference due to cultivation of different genotypes of soybean in medium black soil. Perusal of the data revealed that genotype JS 335, produced the maximum seed yield (2434.00 kg/ha), which was significantly superior over the other genotypes. It was followed by the genotype Bragg (2243.33 kg/ha). In the case of straw yield, the same trend was recorded as in case of seed yield. The lowest grain and straw yield was recorded under the genotype NRC 7 (1648.00 kg/ha) and 2026.67 kg/ha, respectively.

Effect of different treatment on seed yield per hectare, straw yield per hectare and harvest index (Mean of two years)

Treatment	Genotypes	Seed yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T_1	Bragg.	2243.33	2546.67	46.83
T_2	JS-9305	1709.00	2071.67	45.20
T_3	RKS-24	1980.00	2210.00	47.25
T_4	NRC-37	1987.00	2273.33	46.64
T_5	MOUS-158	1862.00	2223.33	45.58
T_6	JS-9752	2106.33	2463.33	46.09
T_7	NRC-7	1648.00	2026.67	44.85
T_8	JS-7546	2082.67	2483.33	45.61
T_9	JS-9560	1536.67	1906.67	44.63
T_{10}	JS-335	2434.00	2823.33	46.30
S Em±		58.25	72.88	0.37
CD %		168.21	210.48	1.07

The variation in grain yield kg/ha in varieties may be due to maximum number of root nodules per plant, pods per plant, grain yield per plant and better seed index. These favourable phenomenons resulted in highest yield. The finding on variation in grain yield of different varieties is in agreement with the result reported by Mondal *et al.*[12] and Vyas *et al.*[5].

The harvest index is significantly influenced by the various genotypes. The maximum and significantly superior harvest index (47.25 %) was reported in the genotype RKS 24.

Although, it was found to be at par with the genotypes viz. RKS 24, NRC 37 & JS 335 under the study. The minimum Harvest index (44.63 %) was found under the genotype JS 9560.

The highest yield in JS 335 may be attributed due to the highest number of branches per plant, number of leaves per plant, dry weight per plant and grain yield per plant. This favorable morphological phenomenon in this genotype resulted in significantly highest yield. The results are in agreement with the results reported by Karmakar and Bhatnagar, Parmar and Nema, Islam *et al.*[9], Thakur and Vyas[7] and Patidar *et al.*[8].

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