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Effect of Different Fertility Levels on Periodical Growth Stages and Yield of Different Soybean Genotypes

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ABSTRACT: *The field investigation on response of soybean genotypes to different fertilizer levels was carried out at research farm, Department of Agronomy, College of Agriculture, V.N.M.K.V., Parbhani (M.S.). The experiment was laid down in split-plot design with 12 treatment combinations comprising of four varieties i.e. JS-335 (V1), MAUS – 162 (V2), MAUS – 71 (V3) and MAUS – 158 (V4) as main plot treatments and three fertilizer levels i.e. 75% RDF as 23.5:45:23.5 kg ha-1 N, P and K2O (F1), 100% RDF as 30:60:30 kg ha-1 N P2O5 and K2O. (F2) and 125 % RDF as 37.5:75:37.5 kg ha-1 N, P2O5 and K2O (F3) as subplot treatments. Variety MAUS – 158 and application of 100% RDF recorded significantly higher plant height, number of functional leaves, number of branches, leaf area as well as total dry matter per plant, seed, straw and biological yield, as compared to the rest of the varieties and fertilizer levels.*

Key Words: *Fertilizer, Genotypes, Growth, Soybean and Yield*

INTRODUCTION

In Maharashtra area under soybean cultivation during 2011-12 was 32.13 lakh hectare with an average productivity of 1243 kg per hectare. Maharashtra ranks second in terms of production of soybean after Madhya Pradesh in the country.Soybean has profitably replaced the other legumes like mung bean, black gram. Madhya Pradesh and Maharashtra states are major producers of soybean with regards to acreage and production soybean varieties selected for drought tolerance have the potential of improving agricultural productivity and hence, livelihoods if adopted by farmers (Chianu, 2006).

Fertilizers bear a direct relationship with food grain production along with a number of supporting factors like high yielding varieties (HYVs), irrigation, access to credit, enhanced total factors of productivity, the tenurial conditions, size of the product market and prices they face both for inputs and the outputs etc. Studies have shown that around 50 to 60 per cent of the enhanced food production during 1960 – 77 could be attributed to fertilizers to sustain healthy growth and plant need nutrients. In light of above, field experiment was conducted to find the effect of different levels of fertilizers on growth and yield of soybean genotypes.

MATERIALS AND METHODS

The experiment was conducted at research farm, Department of Agronomy, College of Agriculture, V.N.M.K.V., Parbhani (M.S.).The experiment was laid out in Split PlotDesign with three replications. The gross plot size was 5.4 m x 4.5 m and net plot size was 4.5 m x 3.6 m. The experiment consisted of twelve treatment combinations of four cultivars *i.e.*, JS- 335, MAUS-162, MAUS-71 and MAUS -158 in main plot and three fertilizer levels *i.e.* 75% RDF, 100% RDF, 125% RDF in sub plot. Soil of experimental site was low in available nitrogen (213 kg ha-1), medium in available phosphorus (15.6 kg ha-1), high in available potassium (574 kg ha-1) and slightly alkaline (pH 7.7) in reaction. The recommended plant protection measures for the crop were followed. The fertilizers were applied as per the treatments at the time of sowing of the crop.

RESULTS AND DISCUSSION

Plant height (cm)

The mean plant height (cm) per plant as influenced by different treatments at various stages of crop growth is presented in Table 1.

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The data presented in Table 1 indicated that the mean plant height (cm) per plant of soybean was increased continuously from emergence to the harvest of crop. The increase in plant height was slow upto 30 days, thereafter, it was very fast during 30 to 45 days and later on the rate of increase in plant height was decreased.

Effect of Varieties

The mean plant height (cm) per plant was significantly influenced by different varieties at all the growth stages of crop except 30 DAS. The variety MAUS – 162 recorded significantly highest plant height than rest of the varieties at all other growth stages of crop. Except at 60 DAS were it was at par with MAUS-71. This could be attributed to genetic makeup of variety. In general, the plant height of individual variety was directly proportional to the duration of that variety. Siddiqui *et al.* (2007) and Ruhul Amin *et al.* (2009) also reported significant differences in plant height due to different varieties.

Effect of Fertilizer Levels

Application of 125% RDF recorded highest plant height during all growth stages. This treatment was found significantly superior over 75% of RDF and it was on par with 100% of RDF during all growth stages, except at 30 DAS, where it was significantly superior over both 75% and 100% of RDF. Application 100% RDF was found to be significantly superior over application of 75% RDF during all growth stages, except at harvest stage, where both these treatments were on par with each other. Application of 75% of RDF recorded lowest plant height. The same consequence was quoted by Raut *et al.* (2003) More *et al.* (2006) on the aspects of growth characters.

Mean Number of Functional Leaves

The data on mean number of functional leaves per plant recorded at various stages of crop growth is presented in Table 2. The mean numbers of functional leaves at 30, 45, 60 and 75 DAS were 7.32, 16.70, 24.76 and 24.36, respectively.

Data present in Table 2 revealed that the mean number of functional leaves per plant increased rapidly up to 60 DAS, gradually decreased between 60 and 75 days. At harvest decrease in mean number of functional leaves was due to drying.

Varieties

Differences in respect of number of functional leaves per plant were significant at almost all the growth stages due to the dissimilar varieties under study. At all the growth stages of the crop, variety MAUS-158 was found significantly superior over the rest of the varieties in respect of number of functional leaves per plant. This might be due to genetic composition of cultivars. Ruhul Amin, *et al*. (2009) also stated significant differences in number of functional leaves and leaf area due to different varieties

Fertilizer Levels

Significant effect was obtained due to different fertilizer levels in respect of number of functional leaves per plant. The application of 125% RDF recorded maximum number of functional leaves during all the stages of crop growth, it was on par with 100% of RDF at 30, 45, 60 DAS and significantly superior over all other treatment at harvest stage. Application of 125% RDF and 100% RDF were found significantly superior over 75% of RDF during all growth stages. The treatment 75% of RDF recorded lowest number of functional leaves. The same consequence was quoted by More *et al.* (2006) on the aspects of growth characters.

Mean Leaf Area

The data on mean leaf area of soybean recorded at various growth stages of the crop are presented in Table 3.

The leaf area increased very fast from 30 to 60 DAS. Thereafter, it was decreased due to leaf senescence. The mean leaf area at 30, 45, 60 and 75 DAS was 388, 1345, 1491 and 1214 cm^2, respectively

Varieties

The data presented in Table 3 indicated that the mean leaf area per plant was significantly influenced during all the growth stages due to dissimilar varieties under study. Variety MAUS-158 has produced the highest mean leaf area per plant during all growth stages of the crop and was significantly superior over rest of the genotypes under study. The minimum leaf area per plant was produced by the variety MAUS-162 at the all growth stages of the crop. This is due to the growing habit of soybean crop. Sharief *et al.* (2010) also found significant variation in number of branches due to different genotypes.

Fertilizer Levels

Mean leaf area was affected significantly during various stages due to different fertilizer levels. During all growth stages maximum leaf area was recorded with 125% RDF. Application of 125% of RDF was

significantly superior over 75% RDF and on par with 100% of RDF during all growth stages. Application of 100% RDF was found superior over 75% of RDF during all growth stages of crop. The lowest leaf area per plant was recorded in 75% of RDF.

Mean Number of Branches Per Plant

The data on mean number of branches per plant as influenced by different treatments at various stages of crop growth are shown in Table 4. It is observed from the table that mean number of branches plant^{-1} was increased continuously up to harvest of the crop.

Varieties

The mean number of branches plant^{-1} were influenced significantly due to different varieties at various growth stages of crop. The mean number of branches per plant was highest with variety MAUS-158 during all the growth stages of the crop. It was found significantly superior over rest of cultivars from 45 DAS onward up to harvest of the crop.

Fertilizer Levels

The various fertilizer levels influenced significantly the number of branches during all growth stages. Application of 125 % RDF recorded highest number of branches during all growth stages of the crop and it was found significantly superior over remaining fertilizer level. Fertilizer levels 100% RDF was found significantly superior over 75% RDF during all growth stages of the crop. Lowest number of branches per plant were recorded with application of 75% RDF.

Total Dry Matter Per Plant

The data on mean dry matter per plant at all growth stages of crop as influenced by different varieties and fertilizer levels are presented in Table 5.

Data from Table indicated that mean dry matter accumulation was increased progressively at every stages of crop growth due to varietal differences and fertilizer levels. The rate of increase was faster during 45 to 60 DAS.

Varieties

The data from in Table 5 revealed out that at 30 DAS none of the varieties was found significant concerning to total dry matter accumulation per plant. Whereas, differences regarding to total dry matter accumulation per plant were significant from 30 DAS onward due to various cultivars used in the experiment. At all growth stages of the crop, variety MAUS-158 was found significantly superior over rest of cultivars regarding to total dry matter per plant, except at 30, 75 DAS and at harvest where it was at par with cultivar MAUS-71. Larger leaf area resulted in more photosynthetic activities and more accumulation of carbohydrates and by this means increased dry matter accumulation. Chiezey and Odunze (2005) studied parallel results in respect of total dry matter accumulation.

Fertilizer Levels

Various fertilizer levels produced significant effect during all the growth stages of crop. The fertilizer level 125% RDF recorded highest amount of dry matter accumulation per plant. This treatment was found significantly superior over 75% RDF and on par with fertilizer level 100% of RDF during all growth stages of crop. Application of 100% RDF was significantly superior over application of 75% RDF during all growth stages of crop. Lowest dry matter accumulation was recorded with fertilizer level 75% RDF.

Effect on Yield

The data on mean seed yield, straw yield and biological yield (kg ha^{-1}) and harvest index (%) as influenced by different varieties and fertilizer are quoted in Table 18 and graphically shown in Fig. 9. The mean seed, straw, biological yield (kg ha^{-1}) and harvest index are 2226, 2719, 4940 (kg ha^{-1}) and 45.03(%), respectively.

Varieties

The data presented in Table 6 indicated that the seed yield of soybean differed varied significantly due to different varieties used in the experiment. The variety MAUS – 158 has recorded highest seed yield (2519 kg ha^{-1}), which was significantly superior over variety MAUS –162 and JS-335 but remained at par with the variety MAUS – 71. the straw yield of soybean crop was significantly influenced by different varieties used under investigation. The straw yield that produced by variety MAUS – 158 was higher and it was significantly superior over variety MAUS – 162 and JS-335 but remained at par with variety MAUS – 71. the variety MAUS – 158 has recorded highest biological yield. It was found significantly superior over variety MAUS – 162 and JS-335 but remained at par with variety MAUS – 71.Jay Davison, (2000) and Rattiyaporn Jaidee, *et al* (2012) reported the similar results regarding the grain and straw yield.

Fertilizer Levels

Application of 125% RDF gave maximum seed yield which was significantly higher than rest of the fertilizer

levels under study and on par with application of 100 % RDF. Application of 100 % RDF was superior over application of 75% of RDF in respect to grain yield. Various fertilizer levels also recorded significant effect on straw yield of soybean. The trend of straw yield as influenced by fertilizer levels was found similar to that of grain yield. Different Fertilizer levels significantly affected the biological yield of crop. Highest biological yield was reported with application of 125 % RDF and it was found significantly superior over application of RDF 75% of RDF and on par with application of 100% of RDF. Application of 100% of RDF was also found superior over 75% of RDF. The lowest biological yield was obtained with 75% RDF application. Ramesh *et al* (2008) reported the same results.

HARVEST INDEX

Varieties

The data furnished in Table 6 indicated that the maximum harvest index was recorded with variety MAUS – 158 that was found significantly superior over rest of varieties.

Fertilizer Levels

The highest value of harvest index was observed at application of 100% of RDF among the rest of fertilizer doses.

Interaction Effect

Among all the parameters there were no any significant interactions. All the parameters had remained non significant.

Table 1
Mean plant height (cm) as influenced by different treatments during various growth stages of crop.

Treatment	*DAS*				*At*
	30	*45*	*60*	*75*	*harvest*
Varieties (V)					
V_1 JS-335	28.38	49.48	54.46	56.29	59.07
V_2 MAUS – 162	30.63	57.08	63.36	67.36	68.93
V_3 MAUS-71	28.83	54.21	60.31	62.45	64.34
V_4 MAUS-158	28.07	51.33	53.55	55.71	58.04
SE ±	0.35	0.586	1.29	0.36	0.85
CD at 5 %	NS	1.754	3.87	1.08	2.54
Fertilizer levels (F)					
F_1 - 75 % RDF	28.41	52.03	53.81	59.66	60.60
F_2 - 100 % RDF	28.69	52.99	58.03	60.48	62.61
F_3 - 125 % RDF	29.85	54.06	61.52	62.22	66.57
SE ±	0.35	0.37	1.05	0.22	0.951
CD at 5 %	1.07	1.10	3.15	0.67	2.85
Interaction (V x F)					
SE ±	0.71	0.74	2.10	0.45	1.90
CD at 5 %	NS	NS	NS	NS	NS
General mean	28.98	53.02	57.92	60.45	62.59

Table 2
Mean number of functional leaves plant^{-1} as influenced by different treatments during various growth stages of crop

Treatment	*DAS*			
	30	*45*	*60*	*75*
Varieties (V)				
V_1 JS-335	7.42	11.49	25.04	24.69
V_2 MAUS – 162	6.66	13.22	22.65	23.16
V_3 MAUS-71	7.11	14.29	24.22	21.77
V_4 MAUS-158	8.10	16.21	27.15	27.83
SE ±	0.31	0.29	0.56	0.81
CD at 5 %	NS	0.89	1.68	2.42
Fertilizer levels (F)				
F_1 - 75 % RDF	5.12	13.36	23.51	23.12
F_2 - 100 % RDF	7.40	14.89	24.86	24.41
F_3 - 125 % RDF	7.86	15.74	25.92	25.55
SE ±	0.19	0.40	0.39	0.35
CD at 5 %	0.59	1.22	1.18	1.06
Interaction (V x F)				
SE ±	0.39	0.81	0.79	0.71
CD at 5 %	NS	NS	NS	NS
General mean	7.32	16.70	24.76	24.36

Table 3
Mean leaf area (cm^2) plant^{-1} as influenced by different treatments during various growth stages of crop.

Treatment	*DAS*			
	30	*45*	*60*	*75*
Varieties (V)				
V_1 JS-335	380	1305	1460	1088
V_2 MAUS – 162	355	1257	1333	1151
V_3 MAUS-71	401	1361	1510	1228
V_4 MAUS-158	418	1458	1661	1388
SE ±	4.27	13.56	39.85	32.14
CD at 5 %	12.80	40.60	119.31	96.22
Fertilizer levels (F)				
F_1 - 75 % RDF	372	1294	1411	1138
F_2 - 100 % RDF	391	1346	1502	1235
F_3 - 125 % RDF	403	1396	1559	1268
SE ±	5.85	21.60	34.48	29.13
CD at 5 %	17.53	64.68	103.24	87.22
Interaction (V x F)				
SE ±	11.71	43.21	68.57	58.27
CD at 5 %	NS	NS	NS	NS
General mean	388	1345	1491	1214

Table 4
Mean number of branches plant^{-1} as influenced by different treatments during various growth stages of crop.

Treatment	DAS			At
	45	60	75	harvest
Varieties (V)				
V_1 JS-335	2.90	3.15	4.40	4.66
V_2 MAUS – 162	3.01	3.57	4.83	4.91
V_3 MAUS-71	3.35	3.91	5.06	5.23
V_4 MAUS-158	3.91	4.46	5.56	5.83
SE ±	0.10	0.22	0.11	0.22
CD at 5 %	0.31	0.68	0.35	0.67
Fertilizer levels (F)				
F_1 - 75 % RDF	2.88	3.47	4.71	4.81
F_2 - 100 % RDF	3.16	3.77	4.92	5.15
F_3 - 125 % RDF	3.53	4.07	5.26	5.51
SE ±	0.10	0.15	0.09	0.18
CD at 5 %	0.32	0.45	0.27	0.54
Interaction (P x F)				
SE ±	0.21	0.30	0.18	0.36
CD at 5 %	NS	NS	NS	NS
General mean	3.19	3.77	4.96	5.16

Table 5
Total dry matter plant^{-1} (g) as influenced by different treatments during various growth stages of crop.

Treatment	DAS				At
	30	45	60	75	harvest
Varieties (V)					
V_1 JS-335	3.31	9.43	20.55	28.86	31.32
V_2 MAUS – 162	3.37	8.66	19.11	28.43	29.39
V_3 MAUS-71	3.53	9.61	21.11	29.86	32.01
V_4 MAUS-158	3.75	10.62	22.51	31.12	32.87
SE ±	0.08	0.29	0.29	0.53	1.96
CD at 5 %	0.24	0.88	0.88	1.59	5.88
Fertilizer levels (F)					
F_1 - 75 % RDF	3.15	8.76	19.75	28.88	30.83
F_2 - 100 % RDF	3.55	9.72	20.95	29.68	31.84
F_3 - 125 % RDF	3.77	10.26	21.75	30.15	31.03
SE ±	0.09	0.36	0.50	0.30	1.50
CD at 5 %	0.77	1.09	1.51	0.91	4.51
Interaction (V x F)					
SE ±	0.18	0.73	1.01	0.61	3.01
CD at 5 %	NS	NS	NS	NS	NS
General mean	3.49	9.58	20.82	29.57	30.90

Table 6
Seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index (%) as influenced by different treatments.

Treatment	Seed yield (kg ha^{-1})	Straw Yield (kg ha^{-1})	Biological Yield (kg ha^{-1})	Harvest Index (%)
Varieties (V)				
V_1 JS-335	1836	2382	4218	43.52
V_2 MAUS – 162	2117	2549	4666	45.37
V_3 MAUS-71	2415	2991	5326	45.34
V_4 MAUS-158	2519	3033	5552	45.37
SE ±	57.55	114.24	149.21	–
CD at 5 %	172.27	341.97	446.66	–
Fertilizer levels (F)				
F_1 - 75 % RDF	2064	2517	4548	45.38
F_2 - 100 % RDF	2264	2704	4968	45.57
F_3 - 125 % RDF	2370	2935	5305	44.67
SE ±	67.28	89.29	106.09	–
CD at 5 %	201.41	267.31	317.59	–
Interaction (V x F)				
SE ±	134.57	178.60	212.19	–
CD at 5 %	NS	NS	NS	NS
General mean	2226	2719	4940	45.03

REFERENCES

Anonymous (2009), Annual report. 2008 – 09. ICAR Research Complex for NEH Region. Umroi Road, Umiam – 793 103, Meghalaya. 47-48 and 69-70. *www.icarneh.ernet.in.*

Bansode (2008), Effect of organic, inorganic sources of nutrient and rain water conservation techniques on periodicity, profitability and moisture use in soybean + pigeonpea (4:2) intercropping system. M.Sc. (Agri.) *Thesis submitted to, M.K.V., Parbhani.*

Chiezey U. F. and A. C. Odunze, (2005), Soybean response to application of poultry manure and phosphorus fertilizer in the Subhumid Savanna of Nigeria. *J. Ecology and Natural Environment*. **1**(2): 25-31.

Jay Davison (2000), The potential for soybean production in Western Nevada. University of Nevada. *Fact Sheet,* **2**: 53.

More, S.R., Mendhe, S.N. and H. S. Kolte, (2006), Growth and yield attributes of soybean as influenced by nutrient management. *J. of Soil and Crops*, **18** (1): 154 – 157.

Ramesh, P. Pawar, N.R., Singh, A.B. and Ramana, S. (2008), Production potential, nutrient uptake, soil fertility and economic of soybean (*Glycine max*)-based cropping systems under organic, chemical and integrated nutrient management practices. *Indian J. Agron*. **54** (3): 278 – 283.

Rattiyaporn Jaidee, Anan Polthanee and Patcharee Saenjan (2012), Growth and yield of soybean cultivars as

affected by ground water levels and phosphorus rates grown under greenhouse and field conditions. *Australian J. Crop Sci*. **6** (1): 81 – 92.

Raut, S.S., Basole, V.D., Deotale, R.D., Ilmulwar, S.R. and S. B. Kadwe, (2003), Effect of hormone and nutrients on morpho-physiological characters and yield of soybean. *J. Soils and Crops*. **13**: 135 – 139.

Ruhul Amin, A.K.M., Jahan, S.R.A., Karim, M.F. and Mirza Hasanuzzaman, (2009), Growth Dynamics of Soybean (*Glycine max* L.) as Affected by Varieties and Timing of Irrigation. *American-Eurasian J. Agronomy*, **2** (2): 95-103.

Sharief, A.E.M., El-Kalla, S.E., Salama, A.M. and E. I. Mostafa, (2010), Influence of organic and inorganic fertilization on the productivity of some soybean cultivars. *CROP & ENVIRONMENT*. **1** (1): 6 – 12.

Siddiqui, M. H., Oad, F.C., Kumbhar, A. M. and U. A. Buriro, (2007), NP requirement of soybean varieties for yield and yield components. Asian Network for Scientific Information. *J. Agron.* **6** (1): 222–224.