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RESEARCH ARTICLE

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Effect of integrated nutrient management on growth and yield of soybean [*Glycine max* (L) Merril]

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ABSTRACT

The study revealed that the growth attributes *viz.,* plant height, number of branches, leaf area, dry matter and number of root nodules per plant were significantly increased with increased levels of fertilizers application upto to 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}. Integrated use of inorganic fertilizer with combination of FYM increased the yield attributes and yield. Highest yield attributes *viz.,* number of pods, pod weight, number of grains, grain weight per plant were significantly increased with increased levels of K_2O and FYM levels. Highest grain yield (28.01 q ha^{-1}), biological yield (61.33 q ha^{-1}) and harvest index (45.68%) was recorded with the application of 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}.

KEY WORDS : Growth attributes, Yield, Organic manures FYM, Organic manures and Soybean

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INTRODUCTION

Average productivity of soybean in India (750 kg ha^{-1}) and Maharashtra (810 kg ha^{-1}) is very low (Anonymous, 2006). This is due to low use of chemical fertilizers and organic manures/ bio fertilizers. Soybean requires proper supply of plant nutrients especially NPK fertilizers for ensuring good plant growth and higher yield. The fertilizers are powerful tools for better crop management and can make effective contribution to crop production factors with reasonable balance and receive appropriate attention. Several workers reported significantly higher seed yield of soybean through use of different fertilizer levels. The basic concept underlying the integrated nutrient management system is the maintenance of yield stability through correction of marginal deficiencies of secondary and micro-nutrients, enhancing efficiency of applied nutrients and providing favourable soil physical conditions (Bisht and Chandel, 1996). Incoming decades in addition to nitrogenous and phosphoric fertilizer, potassic fertilizers are used. Potash plays an important role in protein formation in soybean. Diseases resistant balance the effect of very excess nitrogen and phosphorous etc. Hence, present investigation was carried out with view to study the effect of integrated nutrient management on growth and yield of soybean.

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MATERIALS AND METHODS

The field experiment was laid out in a Randomized Block Design (RBD) with eight treatments replicated thrice during *Kharif* season 2005 at 'D' block, Director of Farms, Mahatama Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar (Maharashtra). There were following eight treatment combinations formed due to fertilizers levels *viz*., T_1 : Control, T_2 : 50 kg N + 75 kg P_2O_5, T_3 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O, T_4 : 50 kg N +75 kg P_2O_5 + 50 kg k_2O, T_5 : 50 kg N + 75 kg P_2O_5 + 25 kg + 2.5 t FYM, T_6 : 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM,T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+ 2.5 t FYM,T_8 :50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1}. The fertilizer dose NPK and organic material through urea, single superphosphate, muriate of potash and FYM, respectively were incorporated basally, as per treatment at the time of sowing. The seeds were inoculated with *Rhizobium* and PSB culture for all treatments before sowing. The gross and net plot size were 4.80 x 3.60 m and 4.20 x 3.00 m, respectively. Sowing was done on 5th July, 2005 by dibbling the seeds of soybean variety DS-228 (Phule Kalyani) at spacing of 30x10 cm. All recommended management practices were followed. Need-based inter culture and

plant protection were adopted. Harvesting of crop was done manually.

The growth and yield contributing characters were recorded on five randomly selected plants from each net plot and reported on per plant basis. The seed and haulm yields recorded after threshing of all the plants from net plot.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as well as relevant discussion have been presented under following heads :

Growth and growth contributing characters:

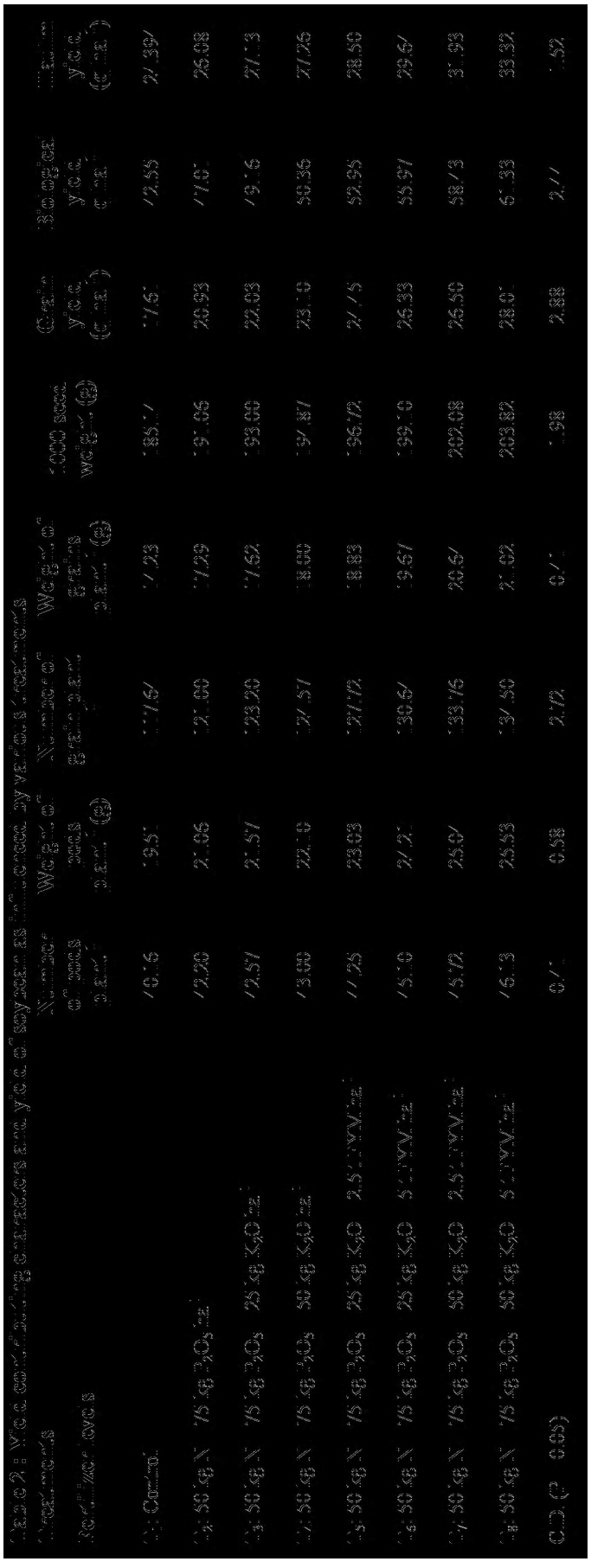
Mean growth parameters as influenced by various treatments are given in (Table 1). The data pertaining to mean plant height differed significantly among the treatments. The mean plant height was more in the treatment T_8 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1}. (70.18 cm) at harvest. Whereas, lowest plant height was recorded in control treatment (56.23 cm). The highest (8.92) mean number of branches per plant at harvest was found in the treatment. T_8 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1}. Lowest (5.05) mean number of branches per plant was recorded in control, T_1 treatment *i.e.* without fertilizer which may be due to inadequacy of plant nutrient as compared to fertilizer application. These results are in accordance with the findings of Nagre *et al.* (1991) and Singh *et al.* (2000).

The data regarding mean leaf area as influenced by different treatments significantly and shown in Table 1. The highest mean leaf area (21.73 dm^2 /plant) was recorded in treatment T_8: 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} and was at par with T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+2.5 t FYM ha^{-1}. Lowest leaf area was recorded in control (11.17 dm^2). Highest dry matter accumulation was recorded (46.08 g/plant) in treatment T_8 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} which was at par with T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+2.5 t FYM ha^{-1} (45.82 g). The increase in plant vigour in terms of plant height, number of branches/plant, leaf area and total dry matter due to higher levels of fertilizers were found to be useful in increasing photosynthetic activities and there by accumulation of more carbohydrates and consequently higher dry matter with higher levels of fertilizers. These results are in agreement with findings of Sharma and Mishra (1997). The addition of organic matter to soil by FYM which might contribute fertility of soil resulting in vigrous growth of plant. These results are in agreement with findings of Duraisingh and Gopalswamy (1991) and Sharma *et al.* (1997).

The data regarding mean number of root nodules per plant was significantly influenced by various treatment at 50% flowering and at physiological maturity. The highest mean number of root nodules was observed in treatment. T_8: 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} (47.62 and 40.34) at 50% flowering and at physiological maturity, respectively. Whereas, lower number of root nodules per

Table 1: Growth attributes as influenced by various treatments

Treatments / Fertilizer levels	Plant height plant^{-1}	Number of branches plant^{-1}	Leaf area dm^2 plant^{-1}	No. of root nodules plant^{-1}		Dry matter (g plant^{-1})
				At 50% flowering	Physiological maturity stage	
T_1: Control	56.23	5.05	11.17	40.02	33.28	42.12
T_2: 50 kg N + 75 kg P_2O_5 ha^{-1}	61.20	5.83	14.48	41.22	35.06	43.27
T_3: 50 kg N + 75 kg P_2O_5 + 25 kg K_2O ha^{-1}	62.76	6.17	16.12	42.35	36.19	43.77
T_4: 50 kg N + 75 kg P_2O_5 + 50 kg K_2O ha^{-1}	62.93	6.50	17.44	43.12	36.41	44.04
T_5: 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 2.5 t FYM ha^{-1}	63.34	6.99	18.08	44.86	37.14	44.32
T_6: 50 kg N + 75 kg P_2O_5 + 25 kg K_2O + 5 t FYM ha^{-1}	66.82	7.69	19.54	45.49	38.42	45.00
T_7: 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 2.5 t FYM ha^{-1}	68.94	8.56	20.23	46.73	39.53	45.82
T_8: 50 kg N + 75 kg P_2O_5 + 50 kg K_2O + 5 t FYM ha^{-1}	70.18	8.92	21.73	47.62	40.34	46.08
S.E. $\pm$	0.64	0.25	0.21	0.32	10.35	0.22
C.D. (P = 0.05)	1.94	0.76	0.64	0.97	1.06	0.67



plant was recorded in control treatment (33.28). The formations of root nodules per plant were significantly increased within increased levels of fertilizer application in conjugation with FYM. The FYM provided the micronutrients like molybdenum alongwith all other essential elements which might have acted as coenzyme for formation of root nodules as well as enhance the *rhizosphere* counts. These results are in confirmly with Prabhakaran and Ravi (1996) and Quosim *et al.* (2001).

Mean yield and yield contributing characters

The data regarding yield and yield contributing characters are presented in (Table2). The mean number of pods per plant was maximum (46.13) in treatment T_8 and was at par with treatment T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+2.5 t FYM ha^{-1} (45.72). Similar results were obtained by Varma *et al.* (1994). The mean pod weight and weight of grains/plant at harvest was significantly superior in treatment T_8 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} *i.e.* 25.53 Q and 21.02 g, respectively. Similar results were obtained by Grewal *et al.* (1994) and Ghosh *et al.* (1998) The thousand grain weight was significantly increased by treatment T_8 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+5 t FYM ha^{-1} (203.82g) which was at par with T_7 : 50 kg N+75 kg P_2O_5 + 50 kg K_2O+2.5 t FYM ha^{-1} (202.08g).

The yield of soybean can be contributed by pod number, pod weight, grain weight and thousand grain weight. These yield contributing characters were significantly increased by the inorganic fertilizer and their conjoint use with FYM.

This might be due to increased availability of nutrients in soil by conjoint use of organic and inorganic fertilizer levels which favoured the luxirient growth and development of soybean. Secondly conjoint use also favoured root nodulation and assimilation of nitrogen, which was utilized by soybean. This reflected in yield contributing characters. Similar results were recorded by Varma *et al.* (1994)

Results observed in the present study indicated that conjoint use of inorganic fertilizer and organic manures responded significantly for enhancing the growth and yield contributing characters in soybean.

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