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Effect of integrated nutrient management on growth and yield of soybean (*Glycine max* L. Meril)

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Abstract
A field experiment on soybean *Cv*. MAUS-71 was conducted at department of soil science and Agril. Chemistry, College of agriculture, Latur during *kharif* season of 2008-2009, to find out the effect of integraetd nutrient management for improvement in growth and yield of soybean under rainfed conditions. Growth characters *viz*. height, number of branches, number of leaves, number of nodules, nodules fresh and dry weight of plant were studied and found significantly improved due to application of 100% RDF + 10 t FYM+ 45 kg S ha^{-1} +Biofertilizer followed by 50% RDF + 10 t FYM+ 45 kg S ha^{-1} +Biofertilizer at all the critical growth stages of soybean. The treatment 100% RDF + 10 t FYM+ 45 kg S ha^{-1} +Biofertilizer recorded significantly higher number of flowers, pods and grains per plant howerer it was at par 50% RDF + 10 t FYM+ 45 kg S ha^{-1} +Biofertilizer with the highest grain 2731 kg ha^{-1} and straw 4111 kg ha^{-1} yield were recorded due to treatment 100% RDF + 10 t FYM+ 45 kg S ha^{-1} + Biofertilizer followed by treatment 50% RDF + 10 t FYM+ 45 kg S ha^{-1} +Biofertilizer. Percent increase in yield was highest (23.96%) with the application of treatment 100% RDF + 10 t FYM + 45 kg S ha^{-1} + Biofertilizer followed by 50% RDF + 10 t FYM+ 45 kg S ha^{-1} + Biofertilizer. The results indicated that under rainfed condition for achieving higher grain and straw yield soybean crop should be fertilizer with 50 RDF+10 t FYM ha^{-1}+ 45 kg S ha^{-1} + biofertilizer which is more beneficial and reduces 50% dose of fertilizer over treatment 100% RDF + 10 t FYM + 45 kg S ha^{-1} +Biofertilizer.

Keywords: Soybean, FYM, sulphur and biofertilizer

Introduction
Soybean (*Glycine max* L. Meril), often designated as Golden Bean is an important pulse as well as oilseed crop of the world Being a legume plant with the help of root notule bacteria and to add organic matter in the soil.

India ranks fifth in area and production of soybean in the world. The total production in India during year 2008-09 was 108.02 lakh mi on an area of 9.62 million hectares with productivity of 1124 kg In Maharashtra soybean production was 36.50 lakh mi on area of 1189 kg ha. Average consumption in India is 4812 tone giving the sixth rank in largest consumer of soybean in world, anonymous, 2008. Efficient management of organic and inorganic sources is a prerequisite. For achieving continuous production of crops in an economically and ecologically sustainable manner. Organic matter forms a very important source of plant nutrients where as organic manures are used to supply both macro and micro nutrients and sustain amount of humic substances particularly humic and fulvic acid that helps to maintain soil Ph. Thus for maintenance of the soil fertility, productivity and soil health with the FVM, compost and biofertilizers cannot replace chemical fertilizers but certainly are capable of reducing their input. Seed inoculation with effective. *Rhizobium* inoculant is recommended to ensure additional nodulation and N_2 fixation for maximum growth and yield of pulse crop.

Materials and Methods
The field experiment was conducted at Research farm, Department of soil science and agricultural chemistry, Collage of Agriculture, Latur during *Kharif* season of 2008-09 using soybean (*MAUS-71*) as a test crop. The experimental Soil was deep black with clay in texture, calcareous in nature and slightly alkaline in reaction. The experiments was conducted in RBO comprising three replication and nine treatments *viz.* T_1 (100% RDF.), T_2 (100% RDF+10 t FYM ha $^{-1}$), T_3 (50% RDF +10 t FYM ha $^{-1}$ + Biofertilizer), T_4 (100% RDF+10 t FVM ha^{-1} + Biofertilizer), T_5 (100% RDF+45 Kg S ha^{-1}), T_6 (50% RDF+10 t FYM ha^{-1} + 45 kg S ha $^{-1}$), T_7

(100% RDF+ 45 kg S ha^{-1} +Biofertilizer) and T_8 (50% RDF+10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer). Five plants from each plot were randomly selected and used for recording biometric observations at important critical growth stages i.e. at branching flowering, pod formation and maturity separately from each net plot. It was sun dried and threshed.

Results and Discussion

Effect of INM on growth character of soybean

The results regarding plant height, number of branches and leaves per plant recorded at branching, flowering, pod formation and maturity are presented in table 1. Taller plants and higher number of branches were observed with treatment 100% RDF+10t FYM ha^{-1} + 45 kg S ha^{-1} Biofertilizer at all the growth stages of soybean. The Treatment 100 % RDF +10 t FYM ha^{-1}+ 45 kg S ha + Biofertilizer recorded significantly higher plant height at branching (35 cm), flowering (44cm), pod formation (47cm) and maturity(50.33) than the rest of the treatments. This increase in plant height, branches and leaves per plant might be due to greater availability of macro and micronutrients, form of organic and inorganic sources which helped in acceleration of various metabolic processes of N P and k which help in better absorption of nutrients coupled with proper distribution, these results are in conformity with the reports of Dash *et al.* (2005) [4].

Greater availability of nutrients with the application of microbial inoculants (R_2 and psr) seems to have promoted various physiological activities in plant which are considered to be indispensable for proper growth and development similar findings were also reported by Umale *et al*. (2002) [10].

Table 1: Effect of Integrated Nutrient Management on growth characters of soybean.

Treatment details	Plant height at Maturity (cm)	No. of branches $Plant^{-1}$ at Maturity	No. of flowers $Plant^{-1}$
T_1 (100% RDF.)	42	16	44.6
T_2 (100% RDF+10 t FYM ha^{-1})	47	21	57.0
T_3 (50% RDF +10 t FYM ha^{-1} + Biofertilizer)	44	19	52.3
T_4 (100% RDF+10 t FYM ha^{-1} + Biofertilizer)	47.3	22	59.6
T_5 (100% RDF+45 Kg S ha^{-1})	43	17	50.6
T_6 (50% RDF+10 t FYM ha^{-1} + 45 kg S ha^{-1})	46	20	55.0
T_7 (100% RDF+45 kg S ha^{-1} + Biofertilizer)	44	18	49.3
T_8 (50% RDF+10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer)	49	23	63.0
T_9 (100% RDF+10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer)	50.3	24	67.6
SE+	1.55	1.21	2.25
CD at 5%	4.66	3.63	6.74

Effects of INM on yield attributes and yield of soybean:

Number of pods and number of grains per plant were significantly affected due to INM treatments (table no. 2). The treatment T_9 (100 % RDF+ 10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer) recorded significantly higher number of flowers, number of pod per plant than the rest of the treatments. Maximum values of yield contributing characters were recorded with combined application of 100 % recommended dose of NPK +FYM 10 t ha^{-1} indicating that supplementing the inorganic fertilizers with organic sources like FYM improved the general soil environment physical, chemical and biological condition which helped to improve the soybean growth and yield contributing characters (Chaturvedi and chandel, 2005) [3]

Table 2: Effect of Integrated Nutrient Management on yield attributes and yield of soybean

Treatment details	No. of Pods $Plant^{-1}$	No. of grains $Plant^{-1}$	Grain yield (qt ha^{-1})	% increase in yield over control	Straw yield (qt ha^{-1})
T_1 (100% RDF)	50.0	83.33	44.66	40.0	83.33
T_2 (100% RDF+10 t FYM ha^{-1})	51.66	108.3	57.00	51.66	108.3
T_3 (50% RDF +10 t FYM ha^{-1} + Biofertilizer)	47.33	99.33	52.33	47.33	99.33
T_4 (100% RDF+10 t FYM ha^{-1} + Biofertilizer)	54.0	111.3	59.66	54.0	111.3
T_5 (100% RDF+45 Kg S ha^{-1})	41.66	87.66	50.66	41.66	87.66
T_6 (50% RDF+10 t FYM ha^{-1} +45 kg S ha^{-1})	50.00	102.3	55.0	50.0	102.3
T_7 (100% RDF+45 kg S ha^{-1} + Biofertilizer)	43.33	93.33	49.33	43.33	93.33
T_8 (50% RDF+10t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer)	57.0	117.6	63.00	57.0	117.6
T_8 (50% RDF+10t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer)	62.0	123.0	67.66	62.00	123.0
SE+	2.60	3.26	2.25	2.60	3.26
CD at 5%	7.80	9.80	6.74	7.80	9.80

The data regarding grain and straw yield is presented in table 2 indicates that significantly highest yield recorded due to treatment T_9 (100% RDF+ 10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer.) over rest of the treatments but it was at par with treatment T_8 (50% RDF+ 10 t FYM ha^{-1} + 45 kg S ha^{-1} + Biofertilizer.). Thus, the treatment nutrient supply system involving inorganic and organic sources (T_9) was superior over inorganic or organic alone. This was attributed to the better proliferation and development of mostly favored the crop to extract soil moisture and nutrients from greater volume of the soil with combined use of organic and inorganic sources. Similar results were recorded by Hate *et al.* (2001) with soybean in *vertisol*. The balanced use of inorganic fertilizer and organic sources of nutrients maintained soil fertility and physical behavior resulting into higher soybean yields. Similarly, chaturvedi and chandel (2005) [3] found that combined application of 100% recommended dose of NPK+ FYM @ 10 tones ha^{-1} improved the biological condition which helps to improve the yield of soybean.

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