

Effect of bio and inorganic fertilizers combination on growth and yield of soybean

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ABSTRACT

A field experiment was conducted during the *Kharif* season 2006-2007 at Farm of University Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to study the "Effect of bio and inorganic fertilizer combinations on growth and yield of soybean". Four fertilizer levels viz., No fertilizer (F_0), 50% RDF (F_1), 75% RDF (F_2) and 100% RDF (F_3) in main plots and four biofertilizer treatments viz., No culture (B_0), *Rhizobium* culture (B_1), PSB culture (B_2) and *Rhizobium* + PSB culture (B_3) in sub plots were replicated four times in a split plot design. *Rhizobium* strains *Rhizobium japonicum* and PSB strain *Pseudomonas striata* were inoculated @ 25 g each kg^{-1} seed. The effect of biofertilizer levels and inorganic fertilizer levels on growth and yield of soybean were statistically significant. Higher grain yield was obtained with 30 kg N + 75 kg P_2O_5 + 30 kg K_2O ha^{-1} (100% of RDF) and *Rhizobium* + PSB. (250 g each to 10 kg of seed)

Key words : N.P.K, PSB, *Rhizobium*, Yield and soybean

INTRODUCTION

Soybean is an important pulse and oilseed crop grown through out the world. It is *Kharif* crop so grown in rainy season. It is third major oilseed crop in India. It is originated in China and established itself as a leading crop in USA, Brazil and China. India ranks 5th in soybean production in world after Brazil, America, Australia and France (Anonymus, 2007). Generally soybean is grown in soil with low N and P status or with application of lesser quantity of organic, inorganic and bio-fertilizers which has resulted in deterioration of both *i.e.* soil health and productivity. The productivity of soybean can be increased by inoculation of bio-culture *i.e.* *Rhizobium* and phosphorus solubilizing bacteria which showed encouraging results in sustaining the crop productivity and to improve the soil fertility (Dubey, 1997).

MATERIALS AND METHODS

Field experiment was carried out at the Agronomy Department Farm of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola on plot No. 66 during the *Kharif* season of 2006-07. It was observed from the analysis that, the soil of experimental field was clay in texture. Soil was slightly alkaline in reaction. The soil was medium in available nitrogen (285 Kg ha^{-1}), low in available phosphorus (19.12 kg ha^{-1}), fairly high in available potassium (356 kg ha^{-1}) and moderate in organic carbon.(0.52 %) The experiment was laid out in split plot design with four replications, four combinations of nitrogen, phosphorus and potassium levels through urea; single super phosphate and murate of potash *i.e.* F_0 : Control, F_1 : 15 kg N + 37.5 kg P_2O_5 K + 15 kg K_2O ha^{-1} (50%

of RDF), F_2 : 22.5 kg N + 56.25 kg P_2O_5 + 22.5 kg K_2O ha^{-1} (75% RDF), F_3 : 30 kg N + 75 kg P_2O_5 + 30 kg K_2O ha^{-1} (100% of RDF) and Four levels of biofertilizers *i.e.* Control, *Rhizobium* (250 gm per 10 kg seed), Phosphate solubilising micro-organisms – (250 g per 10 kg seed) and *Rhizobium* + PSB (250 g each to 10 kg of seed). The soybean seeds were sown on 2nd July with seed rate 75 kg ha^{-1} at different row spacing 45 x 5. Weed control was done by one hand operated hoeing and 2 weeding and spray of Endosulfan (35 EC). Organic manure *i.e.* FYM was given to all the plot as per the recommended dose (5 t /ha). The various fertilizers and biofertilizers were applied as per the treatments. One pre-emergence and one protective irrigation were given. The total rainfall received during the crop season was 740.2 mm.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Effect of inorganic fertilizers on the growth and yield of the soybean:

Maximum plant height was observed at all stages by 100 per cent recommended dose of fertilizer (F_3) which was at par with 75% of RDF (F_2). This might be due to more amount of nutrient applied through chemical fertilizers at sowing as well as one month after sowing which provide nutrient in more amount as compared to other treatments. Rapid availability of nutrient through fertilizers caused more uptake of nutrients through plant. N, P and K are major plant nutrients causing increased meristematic activity of the plant as a result of increased

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supply therefore, brought proportionate increase in growth attributes (Table 1.) Ghosh *et al.* (2005).

The four levels of fertilizers resulted in variation in number of pods per plant, weight of grain per plant but the 100 seed weight remain unchanged. These all attributes were maximum in treatment F₃ (100% RDF) followed by treatment F₂ (75% RDF). This might be due

to more accumulation of carbohydrates and proteins and their translocation to the respiratory organs. The maximum response in respect of seed and straw yield was found due to application of 100% RDF followed by application of 75% RDF resulted in greater yield attributes and finally lead to higher grain and straw yield (Table 2.) Sharma and Raghu (2002).

Table 1 : Growth components of soybean as influenced by inorganic and biofertilizers

Treatments	Plant height (cm)	No. of branches	No. of leaves	Dry matter	No. nodules
Fertilizer levels					
F ₀ – No fertilizer dose	56.93	5.49	48.33	31.92	34.00
F ₁ – 50% RDF	59.80	5.58	49.27	32.78	34.69
F ₂ – 75% RDF	62.53	5.95	52.72	33.68	34.69
F ₃ – 100% RDF	63.23	6.95	53.02	34.06	35.81
S.E.±	0.797	0.110	0.94	0.37	0.29
C.D. (P=0.05)	2.19	0.30	2.61	1.03	0.80
Biofertilizers					
B ₀ – No culture	59.18	5.58	49.46	31.29	32.75
B ₁ – <i>Rhizobium</i> culture	59.35	5.85	49.65	32.55	34.75
B ₂ – PSB culture	59.76	5.89	50.47	33.72	34.68
B ₃ – <i>Rhizobium</i> + PSB culture	64.20	6.68	53.77	34.89	37.00
S.E.±	0.754	0.099	0.78	0.61	0.495
C.D. (P=0.05)	2.17	0.28	2.25	1.75	1.42
Interaction A x B					
S.E.±	1.50	0.196	2.21	1.22	0.99
C.D. (P=0.05)	NS	NS	NS	NS	NS
GM	60.62	5.99	50.83	33.11	34.80

NS-Non significant

Table 2 : Yield components of soybean as influenced by inorganic and biofertilizer

Treatments	No. of pods/plant	Seed yield per plant (g)	Test weight (g)	Seed yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)
A. Fertilizer levels					
F ₀ – No fertilizer dose	34.12	8.20	11.71	11.91	23.74
F ₁ – 50% RDF	40.00	8.26	11.77	15.80	26.75
F ₂ – 75% RDF	45.00	9.10	11.99	21.95	29.32
F ₃ – 100% RDF	47.37	9.68	12.56	22.58	31.00
S.E.±	0.091	0.29	0.343	0.45	0.70
C.D. (P=0.05)	0.25	0.83	NS	2.45	1.94
Biofertilizers					
B ₀ – No culture	39.5	8.34	11.74	15.97	24.08
B ₁ – <i>Rhizobium</i> culture	41.30	8.73	11.77	17.44	26.80
B ₂ – PSB culture	41.87	8.40	11.89	18.34	28.79
B ₃ – <i>Rhizobium</i> + PSB culture	43.87	9.77	12.60	20.89	31.13
S.E.±	0.091	0.25	0.280	0.43	0.57
C.D. (P=0.05)	0.26	0.74	NS	2.25	1.64
Interaction A x B					
S.E.±	0.18	0.72	0.56	0.86	1.14
C.D. (P=0.05)	NS	NS	NS	NS	NS
GM	41.62	8.81	12.00	18.06	27.70

NS-Non significant

Effect of biofertilizers on growth and yield of soybean:

During crops season all growth attributes recorded marked improvement due to dual inoculation treatment of *Rhizobium* + PSB (B₃). Plant height was maximum in B₃ in all growth observations because of easy availability of nutrient through biofertilizers like number of branches, number of leaves and leaf area which many due to early canopy development and senescence of leaves and more number of nodules. As a result of better root nodulation, leaf area and height, total dry matter production per plant was also higher in treatment B₃. Similar type of result was also reported by Paratey and Wani (2005).

Dry matter per plant in crop growth period, yield components viz., number of pods plant⁻¹ and weight of grain plant⁻¹ were significantly influenced due to inoculation with *Rhizobium* + PSB. Test weight remain unchanged Increase in total number of pods was due to increase in branching. This increase in total number of pods increased the grain yield per plant due to dual inoculation. The biofertilizers mainly increase the availability of nutrients to the plant, *Rhizobium* fix the atmospheric nitrogen and PSB solubilise the P₂O₅ which helps in improving the uptake by plant and results to increase the various attributes of plant. This increase in attributes increased the grain and stover yield of the crop. The maximum grain yield (20.89 kg/ha) and straw yield (31.13 q/ha) was recorded by treatment B₃ (*Rhizobium* + PSB culture) (Table 1). Similarly results are also reported by Govindan and Thirumaragan (2005).

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