EFFECT OF INTEGRATED USE OF FERTILIZER, FYM AND BIOFERTILIZER ON GROWTH AND YIELD PERFORMANCE ON SOYA BEAN (*GLYCINE MAX* (L) Merill)

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Abstract: *A field experiment was conducted during 2006 – 2007 at Agriculture College Farm, Amritsar to study the impact of integrated nutrient management in soybean on residual fertility status of soil. It was observed that the maximum plant height of 16.89 cm, 65.78cm, and 73.37 cm at 30,60 and 90 DAS,the highest number of pods per plant (80.40) and heighest test weight(17.02g) was recorded in the treatment where 50 per cent recommended N applied through urea + 50 per cent Nthrough FYM +PSB and the lowest of these were found in the control treatment.*

Key words: *Soybean, Integrated Nutrient Management, Residual fertility*

INTRODUCTION

Modern agricultural practices have emphasized the widespread use of fertilizer and this approach has certainly increased grain yields in many countries in the last three decades. However, long term use of chemical fertilizers also led to a decline in crop yields and soil fertility in the intensive cropping system. There is evidence that over fertilization has increased the concentration of many plant nutrients in both surface and ground water, which has created a potential health hazard. This has in turn paved the way for integrated plant nutrition involving judicious and integrated use of chemical/synthetic sources of nutrients alongwith biofertilizers in addition to nutrient recycling through use of organic manures, green manuring and biodegradable wastes, etc. Biofertilizers offer a cheaper low capital intensive and ecofriendly route to boosting farm productivity depending upon their activity of mobilizing different nutrients. Integrated Nutrient Management (INM) holds great promise in meeting the growing nutrient demands of intensive agriculture and maintaining the crop productivity at higher levels with overall improvement in the quality of resource base. Soybean is a highly exhaustive crop and require higher amount of nutrients particularly P for its optimum production. Most agricultural soils in India have low native fertility. Successful and sustained crop production on these soils requires regular nutrient inputs through chemical fertilizers and/or organic manures to replenish soil nutrient reserves depleted by crop removal and other losses. It is essential to recognize that even in rainfed production systems with relatively low productivity level, the quantity of nutrient removal is quite substantial and exceeds addition. Furthermore, the quantum of nutrients available for recycling via crop residues and animal manures is grossly inadequate to compensate for the amounts removed in crop production. Thus, mineral fertilizers have come to play a key role in areas with low fertility soils, where increased agricultural production is required to meet growing food demand. Chemical fertilizers as source of plant nutrients are considered as the major contributor to enhancing crop production and maintaining soil productivity. Over the last 35 years, additional nutrients applied as manufactured fertilizers have been responsible for about 50 per cent of the yield increases in developing countries including India. Though the consumption of chemical fertilizers in India increased steadily over the years, the use efficiency of nutrients applied as fertilizers continues

to remain awfully low (40-50% for N, 20-25% for P and 2-5% for Zn, Fe & Cu) owing to nutrient losses from the soils or conversion of nutrients into slowly cycling/recalcitrant pools within the soil. Further, at national level the partial factor productivity (PFPf) and incremental use efficiency (IUEf) of fertilizers used in food grain production have been gradually declining over the years Soybean (*Glycine max* (L) Merill) a grain legume is considered as a wonder crop due to its dual qualities viz., high protein (40-43%) and oil content (20%). It was introduced in India during 1960s and is gaining rapid recognition as a highly desirable pulse and oil seed crop. India stands next only to China in the Asia - Pacific region, with respect to area (7.2 million ha) and production (8.7 million tones). Soybean being the third in area and production of overall commercial oil seed crops, contributes 33 per cent of our commercial oil seeds and 21 per cent of total pulse production. Soybean being a potentially high yielding crop can play a greater role in boosting oil seed production in the country. This legume is making straight way in Indian agriculture to meet protein and oil requirement. It is outstanding in its nutritive value with enhanced protein and oil content and is also rich in vitamins, minerals, salts and other essential amino acids. In addition to this, soybean protein has five per cent lysine, which is deficit in most of the cereals and enriching the cereal flour with soybean improves the nutritive quality.

MATERIALS AND METHODS

In view of the above the present investigation was under taken to find out the influence of Integrated Nutrient Management on Growth and Yield of Soybean. The field experiment was conducted during kharif 2006 at Khalsa College of Agriculture, Amritsar Punjab. Soil of the experimental site was sandy loam in texture, pH 5.8, EC) 0.16 (dsm-1 at 250C). The organic carbon content was 3.65 g kg-1. The soil fertility was low with respect to available N (158.60 kg ha-1) medium with respect to available P_2O_5 (22.99 kg ha-1) and medium in available K2O (144 kg ha-1). The exchangeable Calcium (1.95 cmol (p+) kg-1), Magnesium (0.89 cmol(p+) kg-1) and available Sulphur content was 15.51 ppm and the contents of DTPA extractable micro nutrient such as Fe (37.25 ppm), Zn (1.55 ppm), Mn (14.87 ppm), Cu (1.18 ppm). The experiment was laid out in randomized block design with nine treatments combination with different ratios of organic manures and inorganic fertilizers with three replications. The variety KHSB-2 was used. The growth parameters viz., plant height, number of trifoliate leaves per plant were recorded on five randomly selected plants from each net plot at 30, 60 and 90 days after sowing. The plants selected for growth studies were also utilized for recording the observations on the yield components such as number of pods per plant, number of seeds per pod, test weight and seed yield per plant. The pods from five randomly selected plants were counted. Mean of the five plants was taken as the number of pods per plant. The number of seeds per pod from five plants was recorded and number of seeds per pod was worked out by dividing the total number of seeds by total number of pods. The weight of pods from five plants was recorded. Weight of pods per plant was worked out by dividing the total weight of pods by total number of plants. From each treatment, hundred seeds were selected at random and their weight was recorded (g). All pods from randomly selected plants were threshed, cleaned and the seed weight was recorded. Mean of the five plants gave the seed yield per plant. Seed yield was recorded after threshing and winnowing the pods from the net plot area. Seed yield per net plot were converted to kilogram per hectare.

RESULTS AND DISCUSSIONS

The dry matter per net plot at harvest was recorded after complete sun drying and stem yield (kg ha-1) was worked out. The number of trifoliate leaves was found to vary

significantly among the treatments as influenced by integrated nutrient management practices (Table 1). The number of trifoliate leaves at 30 days after sowing was 4.40 to 6.93 in control and 50 per cent recommended N applied through urea + 50 per cent applied N through FYM+PSB respectively and the number of trifoliate leaves at 60 days after sowing was 17.40 to 26.70 in control and treatment with 50 per cent recommended N applied through urea+50 per cent N applied through FYM+PSB and the number of trifoliate leaves at 90 days after sowing was 10.53 in control and 21.20 in the treatment that received 50 per cent recommended N applied through urea +50 per cent N applied through FYM +PSB. The data pertaining on plant height varied significantly (Table 1). The maximum plant height of 16.89 cm, 65.78 cm, and 73.37cm at 30, 60 and 90 days after sowing was observed in the treatment that received 50 per cent recommended N applied through urea +50 per cent N applied through FYM+PSB applied plots respectively. Where as the lowest plant height (13.23 cm, 45.13 cm and 49.53 cm) at 30, 60 and 90 days after sowing and the lowest (2.10) in control. No significant differences were recorded in the number of seeds pod-1 as influenced by different levels of fertilizer, FYM and biofertilizers.

Table 1.

Number of trifoliate leaves per plant and plant height at different growth stages in soybean as influenced by integrated nutrient management practices

Treatments	Days after sowing (Number of trifoliate leaves/plant)			Days after sowing (Plant height in cm.)		
	30	60	90	30	60	90
T1 : Absolute control	4.40	17.40	10.50	13.25	45.26	49.56
T2 : RDF + Recommended FYM	5.86	24.93	19.20	16.00	61.51	66.46
T3 : RDF + Phosphate solubilising micro organisms	4.90	22.03	11.73	13.57	53.31	61.99
T4 : 50% of Recommended -N + 50% N through FYM	5.87	25.43	19.90	16.27	62.86	67.51
T5 : 50% of Recommended -N +50% N through FYM + PSB	6.93	26.70	21.20	16.89	65.78	73.37
T6 : 75% of Recommended -N + 25% N through FYM	5.35	24.06	18.40	14.80	59.45	65.33
T 7 : 75% of Recommended -N + 25% N through FYM + PSB	5.62	24.45	19.33	15.37	61.46	66.23
T8 : 25% of Recommended -N + 75% N through FYM	5.24	22.73	12.70	14.75	58.58	63.26
T9 : 25% of Recommended -N +75% N through FYM + PSB	5.37	24.20	19.26	15.16	60.33	60.30
S.Em±	0.24	0.70	0.62	0.29	1.42	2.04
CD at 5%	0.71	2.12	1.85	0.88	4.22	6.09

NOTE: FYM- Farm yard manure, RDF- Recommended dose of fertilizer PSB- Phosphorus solubilising bacteria.

Maximum weight of pods plant-1 was recorded in the treatment 50 per cent recommended N applied through urea+50 per cent N through FYM + PSB (48.50 g) and the lowest weight of pods plant-1 (31.50 g) was recorded in control. The seed yield plant-1 varied significantly by the application of different treatments. The highest seed yield plant-1 was recorded in treatment 50 per cent recommended N applied through urea + 50 per cent N through FYM + PSB (23.50 g) which was on par with 50 per cent recommended N applied through urea + 50 per cent N through FYM (22.00 g) and the lowest seed yield plant-1 (11.00 g) in control. This is due to combined effect of chemical, biochemical and yield attributing characters. Increase in seed yield was also associated with higher number of pods plant-1, number of trifoliate leaves, plant height, over rest of the treatments as reported by KALITA et al. (1995). Respectively was noticed in control. Beneficial effect of FYM in conjunction with RDF may be due to the effect of organic matter in improving physical, chemical and biological

environment of soil conducive to better plant growth (DESHMUKH et al., 2005). The number of pods plant-1 influenced by treatment combinations of FYM, fertilizers and biofertilizer varied significantly (Table 2). The highest number of pods plant-1 (80.40) was noticed in the treatment that received 50 per cent recommended N applied through urea+50 per cent N applied through FYM + PSB and the lowest number of pods plant-1 (43.10) in control. The similar findings had been reported by SURYAWANSHI et al. (2006) and KANASE et al. (2006). The data pertaining on number of seeds pod-1 (Table 2) recorded maximum (2.46) in the treatment that received 50 per cent recommended N applied through urea +50 per cent N applied through FYM+PSB SRIVASTAVA and AHLAWAT (1995) studied the response of P, Mo and biofertilzer and observed that seed inoculation with Rhizobium and or PSB increased the seed yield (SNEHA et al., 2004). The highest test weight was recorded in the treatment (17.02 g) 50 per cent recommended N applied through urea+50 per cent N through FYM + PSB and the lowest test weight in the (14.98 g) control. The results corroborate with the findings of SURYAWANSHI et al. (2006). The highest seed yield was recorded in the treatment (1149.82 kg ha-l) that received 50 per cent recommended N applied through urea+50 per cent N applied through FYM + PSB and the lowest seed yield (695.74 kg ha-l) in control (Table 2). Seed yield is mainly dependent on source sink relation. As the reproductive get more photosynthetic assimilate, an increase in seed yield is resulted. Increase in various plant growth characters such as plant height, leaf area, the total dry matter ultimately results into increase in seed yield. This might be thereasons responsible for spectacular increase in overall seed yield of soybean. The results corroborate with the findings of SURYAWANSHI et al. (2006).

Table 2.

Yield attributes and yield of soybean as influenced by integrated nutrient management practices

	No. of Pods/ plant	No. of Seeds /pod	Weight of pods / Plant (g)	Seed yield /Plant (g)	Test Weight (g)	Seed Yield (kg ha^{-1})	Stalk Yield (kg ha^{-1})
T1	43.10	2.10	31.50	11.00	14.98	695.74	1734.12
T2	70.52	2.34	45.26	21.65	16.52	993.45	2489.23
T3	44.60	2.22	35.50	12.83	15.28	855.40	1887.89
T4	76.15	2.35	45.26	22.30	16.58	1093.90	2733.25
T5	80.40	2.46	48.56	23.58	17.02	1149.56	2869.32
T6	49.50	2.27	38.25	16.35	15.95	915.68	2109.54
T7	68.30	2.34	44.25	20.32	15.94	949.65	2425.68
T8	47. 37	24	38.25	15.25	15.48	885.65	2023.56
T9	51.30	2.30	41.65	19.98	15.95	925.68	2364.25
S.Em±	1048	0.08	1.01	0.59	0.15	22.36	44.58
CD at 5%	4041	-	3.03	1.79	0.52	66.26	132.25

The highest stalk yield was recorded in the treatment (2863.09 kg ha-l) 50 per cent recommended N applied through urea+50 per cent N applied through FYM+PSB which was on par with the treatment 50 per cent recommended N applied through urea+50 per cent N through FYM (2733.13 kg ha-l) and lowest stalk yield was recorded in (1734.12 kg ha-l) control. Seed yield trend was noticed for stalk yield also. MENARIA et al. (2003) reported that application of 75 per cent recommended N through RDF+ 25 per cent N through weed biomass + PSB + Rhizobium increased growth and yield contributing parameters. From above study it was concluded that the application of FYM, recommended dose of fertilizer and biofertilizers (PSB) enhanced the growth parameters such as number of leaves, plant height and yield attributes such as number of podsplant-1, number of seeds pod-l, weight of pods plant-1 (g) and highest seed yield and stalk yield was recorded in the treatment 50 per cent recommended N applied through urea + 50 per cent N applied through FYM + PSB (1149.82 kg ha-1 and

2863.09 kg ha-l) respectively. The highest and significant seed yield was obtained in the treatment recommended N applied through urea + 50 per cent N applied through FYM+PSB which accounted for 60.50 per cent seed yield increased over control.

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