

## The Influence of Integrated Nutrient Management on Growth and Production on Soybean

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### ABSTRACT

An agronomic investigation entitled effect of integrated nutrient management on growth and yield of soybean (*Glycine max* L.) was conducted at experimental farm of Khalsa College, Amritsar during *kharif* season of 2019. The field experiment was laid out in Randomized Block Design with three replications and twelve treatments. The experimental soil was alkaline (pH 8.18), having low salt content (EC) (0.30 dS m<sup>-1</sup>). As regards, available nitrogen (220.74 kg ha<sup>-1</sup>), phosphorus (16.87 kg ha<sup>-1</sup>) and potassium (293.64 kg ha<sup>-1</sup>) were low, medium and medium, respectively. The result revealed that the values of

plant height (118.21 cm), dry matter (36.31 g/plant), leaf area index (2.42) and yield attribute number pods per plant (72.98) were recorded highest with the 100% RDF for soybean. However, number of seeds per pod was recorded as non-significant among the different treatments. This treatment also gave significantly higher values of seed yield (18.36 q/ha), stover yield (30.72 q/ha), net return (Rs 67391/ha) and B:C ratio 2.49 than the rest of the treatments. The lowest growth parameters, yield attributes and yield of soybean were recorded in control.

**Keywords** INM, Growth, Yield, Soybean.

### INTRODUCTION

Soybean (*Glycine max* L.) is an important pulse as well as oil seed crop and belongs to the family Fabaceae and sub-family Papilionaceae. It is a native of East Asia widely grown for its numerous uses. The major soybean-producing nations are the United States, Brazil and Argentina. These three countries dominate global production, accounting for 80% of the world's soybean supply. It ranks first in edible oil in the world and third largest oilseed crop of India after rapeseed-mustard and groundnut. India ranks 5<sup>th</sup> in area and production in the world (Anonymous 2018). Its production was 8.59 MT from an area of 11.67 m ha with an average yield of 737 kg/ha. In terms of area and production of soybean, Madhya Pradesh stood the first rank as 5.91 m ha and 4.91 MT respectively which is followed by Maharashtra, Ra-

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Soybean is also called 'Gold of Soil' or 'Wonder crop' (Aziz *et al.* 2015). It contains 40-42% protein, 18-20% oil, calcium, iron and phosphorus. In India, soybean has emerged as the main oilseed crop in a short period of time. Being a good source of flavones, it helps in the prevention of diseases like heart disease, cancer and HIV (Verma *et al.* 2017). Its protein has 5% lysine which is deficient in most of cereals. It is considered a natural fertilizer factory because of its high nitrogen-fixing property with Rhizobium accounting 35-40 kg N/ha. By producing large amount of biomass, it also increases organic matter in the soil (Raghuveer and Keeerti 2017). The annual consumption of fertilizers increased from about 255.36 LMT in 2012-13 to 259.49 LMT in 2016-2017 (Anonymous, 2017). It has been established that continuous use of high analysis chemical fertilizers leads to deficiency of secondary and micronutrients, soil salinity and environmental pollution (Aziz *et al.* 2015). However, there is a need for the integrated application of different sources of nutrients for sustaining the required crop productivity by integrated nutrient management. Organic manures like FYM, poultry manure, vermicompost have been traditionally used by farmers under integrated nutrient management. By integrated nutrient management we can attain maximum economic yield without stagnating the physico-chemical and biological properties of soil (Verma *et al.* 2017). Therefore, the experiment was conducted to study the effect of integrated nutrient management on the growth, yield and quality of soybean (*Glycine max* L).

## MATERIALS AND METHODS

In view of the above, the present investigation was undertaken to find out the effect of integrated nutrient management on the growth and yield of soybean (*Glycine max* L). The field experiment was initiated during *kharif* season 2019 at Khalsa College, Amritsar Punjab. The soil of the experimental site was sandy loam in texture, alkaline in reaction (pH 8.18). The soil was medium in available nitrogen (220.74 kg/ha), phosphorus (16.87 kg/ha) and high in potassium (293.64 kg/ha). Soybean variety SL 958 was sown during the second fortnight of July and harvested

during the first fortnight of November.

The experiment was laid out in a Randomized Block Design with three replications. Treatments were: T<sub>1</sub>- 100% RDF, T<sub>2</sub>- 100% FYM, T<sub>3</sub>- 100% vermicompost, T<sub>4</sub>- 75% NPK + 25% FYM, T<sub>5</sub>- 75% NPK + 25% vermicompost, T<sub>6</sub>- 50% NPK + 50% FYM, T<sub>7</sub>- 50% NPK + 50% vermicompost, T<sub>8</sub>- 50% NPK + 50% vermicompost + 2 spray of vermiwash, T<sub>9</sub>- 50% NPK + 50% FYM + 2 spray of 2% urea, T<sub>10</sub>- 50% NPK + 50% FYM + 2 spray of vermiwash, T<sub>11</sub>- 50% NPK + 50% vermicompost + 2 spray of 2% urea, T<sub>12</sub>- Control.

Doses of N and P<sub>2</sub>O<sub>5</sub> (SSP) were applied before sowing and thoroughly mixed in the soil. Before sowing, soybean seeds were first inoculated with biofertilizers as per treatment. A seed rate of 70 kg/ha was used. The seeds were sown in raised bed manually at a depth of 3-4 cm in rows spaced at 30 cm and plant to plant distance 10 cm apart. Vermicompost (1.63% N, 0.98% P<sub>2</sub>O<sub>5</sub> and 1.25% K<sub>2</sub>O) and farmyard manure (0.62% N, 0.38% P<sub>2</sub>O<sub>5</sub> and 0.57% K<sub>2</sub>O) were applied one week before sowing. The weeds were controlled by pre-emergence application of stomp 30 EC (Pendimethalin) herbicide applied after sowing on the same day. Hand weeding was carried out twice at 30 and 60 DAS. The crop was harvested with sickle and threshed manually.

Plant height, dry matter accumulation and the number of root nodules were recorded at harvest. Yield parameters viz. number of pods per plant, number of seeds per pod and seed and stover yield were recorded at harvest. The statistical analysis of the data was done using the EDA software developed by the Department of Mathematics and Statistics, PAU, Ludhiana.

## RESULTS AND DISCUSSION

Growth parameters showed significant variation due to the different treatment combinations. Plant height, leaf area index and dry matter accumulation were significantly maximum with the application of 100% RDF of soybean (Table 1). However, it was at par with the application of 75% RDF + 25% vermicompost. These growth parameters may be highest due to the

**Table 1.** Effect of integrated nutrient management on plant height, leaf area index (LAI) and dry matter accumulation (DMA) of soybean at harvest.

Treatments	Plant height (cm)	Leaf area index (LAI)	Dry matter accumulation (DMA) (g/plant)
100% RDF	118.21	1.94	36.01
100% FYM	75.12	1.00	26.49
100% vermicompost	77.85	1.17	27.60
75% RDF + 25% FYM	107.21	1.71	33.57
75% RDF+25% vermicompost	114.65	1.84	35.09
50% RDF+50% FYM	88.31	1.44	30.78
50% RDF + 50% vermicompost	89.53	1.43	30.53
50% RDF + 50% Vermicompost + 2 spray of vermiwash	92.65	1.40	30.11
50% RDF+50% FYM + 2 spray of 2% urea	97.32	1.56	31.78
50% RDF + 50% FYM + 2 spray of vermiwash	89.75	1.38	29.85
50% RDF + 50% vermicompost + 2 spray of 2% urea	103.21	1.64	32.90
Control	64.72	0.80	24.32
CD (p=0.05)	10.50	0.19	2.08

application of nitrogen to the crop which helps in enhancing above-ground vegetative growth like plant height as nitrogen is associated with an increase in

protoplasm, cell division and cell enlargement (Bhangu and Virk 2019). Dry matter accumulation increased with the recommended dose of inorganic fertilizers might have due to more vegetative growth resulting in the utilization of nutrients, water, solar radiation and increase in metabolic activity, leaf area and root development which have resulted in maximum dry matter production (Bachhav *et al.* 2012).

Yield attributes i.e., the number of pods per plant, seed and stover yield were significantly influenced by various treatments. The highest yield attributes, seed and stover yield were observed with the treatment of 100% RDF of soybean. The data of the number of seed per pod was calculated and it was showed that statistically there was no significant difference between different nutrient management treatments. These findings also get support from (Singh *et al.* 2013). The increase in a number of pods per plant might be due to the increased supply of almost all plant essential nutrients by translocation of the photosynthates accumulated under the influence of the sources of organic nutrients (Singh *et al.* 2019). The increase in seed yield might be due to the balanced supplement of nitrogen through inorganic fertilizers may have induced cell division, expansion of cell wall, meristematic activity, photosynthetic efficiency and regulation of water intake into the cells, resulting in the enhancement of yield (Verma *et al.* 2017). The increase in stover yield might be due to the recommended dose of fertilizer produce higher

**Table 2.** Effect of integrated nutrient management on number of pods per plant, number of seed per pod, seed yield, stover yield and B:C ratio of soybean.

Treatments	Number pods per plant	Number of seed per pod	Seed yield (q/ha)	Stover yield (q/ha)	B:C
100% RDF	72.98	2.44	18.36	30.72	2.49
100% FYM	44.15	2.22	12.60	20.07	1.85
100% vermicompost	48.87	2.22	13.20	21.37	1.28
75% RDF + 25% FYM	65.70	2.44	16.98	28.06	2.35
75% RDF + 25% vermicompost	69.87	2.44	17.94	29.65	2.23
50% RDF + 50% FYM	56.01	2.22	14.60	24.45	2.06
50% RDF + 50% vermicompost	55.70	2.22	14.82	24.17	1.68
50% RDF + 50% vermicompost + 2 spray of vermiwash	55.11	2.33	15.12	23.97	1.68
50% RDF + 50% FYM + 2 spray of 2% urea	60.71	2.33	15.80	26.01	2.21
50% RDF + 50% FYM + 2 spray of vermiwash	54.97	2.33	15.01	23.78	2.08
50% RDF + 50% vermicompost + 2 spray of 2% urea	62.10	2.33	16.50	26.87	1.87
Control	38.01	2.0	9.10	17.73	1.70
CD (p=0.05)	5.91	N.S.	1.32	2.27	

dry matter production in plants. Higher production of dry matter in plants might have improved values of yield attributes under organic and inorganic nutrient combinations treatment which resulted in a higher straw yield of soybean (Mehetre *et al.* 2019).

Data pertaining to B:C ratio as affected by different treatments were recorded and presented in Table 2. Treatment 100% RDF gave a maximum B:C ratio of 2.49. Economic analysis of soybean crop showed that higher gross (Rs 71611/ha) and net returns (Rs 67391/ha) were obtained with the application of 100% RDF followed by 75% RDF + 25% vermicompost. It may be due to the growth and yield attributes improved significantly with the integrated use of chemical fertilizers with organic manure (Verma *et al.* 2017).

## CONCLUSION

It is concluded that among various treatments, the application of 100% inorganic fertilizers improved significantly growth parameters, yield attributes and yield and it was at par with the treatment 75% RDF + 25% vermicompost. It may be due to the better growth and yield contributing characters. These results indicate that up to 25% of inorganic fertilizers can be substituted by vermicompost without significantly affecting the yield.

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