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

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### Abstract

The present research entitled “Effect of integrated nutrient management on growth and yield of Soybean (*Glycine max* L.)” was carried out during *kharif* season 2019 at Instructional Farm, BTC College of Agriculture and Research Station, Bilaspur (C.G.). The result revealed that maximum values of growth parameters *i.e.* plant height (cm), number of trifoliolate leaves plant<sup>-1</sup>, number of branches plant<sup>-1</sup>, number of nodules plant<sup>-1</sup> and yield attributes *viz.*, number of pods plant<sup>-1</sup>, seed yield (g plant<sup>-1</sup>), test weight (g), seed yield (q ha<sup>-1</sup>), stover yield (q ha<sup>-1</sup>) and harvest index (%) was observed significantly superior with the application of 75% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia (T<sub>9</sub>) also found at par with the application of 75% RDF + 5 t FYM ha<sup>-1</sup> enriched with Consortia (T<sub>7</sub>). Treatment Control (T<sub>1</sub>) showed inferior values for all the parameters mentioned above. The parameters like plant population (m<sup>-2</sup>) and No. of seeds pod<sup>-1</sup> indicated non-significant differences in response to various nutrient management practices.

**Keywords:** Soybean, integrated nutrient management, consortia, FYM, vermicompost

### Introduction

Soybean (*Glycine max* L.) occupies a significant place in International trade due to its very high protein content (42-43%) and edible oil (18-20%) with major essential fatty acids, lecithin, vitamins (A and D) etc. It is known as golden bean, man-made meat. Due to its various uses is rightly called as “Golden gift of nature to mankind” also known as natural fertilizers factory because of having high nitrogen fixing capacity from the atmosphere through root nodules. In the Asia- Pacific region India holds second position after China with respect to area (11.80 m ha) and production (12.50 m t). In India Madhya Pradesh is the preceding state with 5.40 m ha area, 5.51 m t production and 1258 kg ha<sup>-1</sup> productivity (Anonymous, 2018-19). Integrated nutrient management includes combine application of inorganic fertilizers, biofertilizers and organic manures *i.e.* Vermicompost, Farmyard manure, Green manure and Other sources for nutrient supply to the plants in profitable and integrated manner. Maintaining soil fertility for sustainable production, a judicious and balanced nutrient application is must to heighten the productivity of Soybean crop. Organic manures along with biofertilizers (Consortium) supplies more energy to beneficial micro-organism and helps to mitigate the multiple nutrient deficiencies. Plant Consortium (mixture of *Bradyrhizobium japonicum* + *Azotobacter* + PSB (*Bacillus strelitziae*) + KMB (*Potassium mineralizing bacteria*) is a mixture of different plant growth promoting microbes with different attributes, which can work synergistically and promote each other’s beneficial effects.

### Material and Methods

The present research entitled “Effect of integrated nutrient management on growth and yield of Soybean (*Glycine max* L.)” was carried out during *kharif* season 2019 at Instructional Farm, BTC College of Agriculture and Research Station, Bilaspur (C.G.), which was situated in dry moist, sub-humid region at an altitude of 292 m above mean sea level on 22.09°N latitude and 82.12°E longitude. The soil of the experimental site was clayey-loam in texture. The Soybean (var. JS-2029) was grown and treatments were replicated three times in RBD. The experiment consists of ten treatments *viz.*, Control (T<sub>1</sub>), 100% RDF (25:60:25 kg N:P:K ha<sup>-1</sup>) (T<sub>2</sub>), 75% RDF + 5 t FYM ha<sup>-1</sup> (T<sub>3</sub>), 50% RDF + 5 t FYM ha<sup>-1</sup> (T<sub>4</sub>), 75% RDF + 5 t Vermicompost ha<sup>-1</sup> (T<sub>5</sub>), 50% RDF + 5 t Vermicompost ha<sup>-1</sup> (T<sub>6</sub>), 75% RDF + 5 t FYM ha<sup>-1</sup> enriched with Consortia (T<sub>7</sub>), 50% RDF + 5 t FYM ha<sup>-1</sup> enriched with Consortia (T<sub>8</sub>), 75% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia (T<sub>9</sub>) and 50% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia (T<sub>10</sub>). The crop was sown on 23<sup>rd</sup> July, 2019 and harvesting was done on 15<sup>th</sup> November, 2019.

## Results and Discussion

### Effect of integrated nutrient management on growth characteristics of Soybean

The results regarding growth parameters are presented in Table 1. Higher values of growth parameters were observed with treatment T<sub>9</sub>; 75% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia at all the growth stages of Soybean. The treatment 75% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia recorded significantly higher plant height (67.73cm), number of branches (10.67), number of trifoliolate leaves (40.53), number of nodules (32.20) than the rest of the

treatments. This increase in plant height, branches, leaves, nodules might be due to great availability of macro and micro nutrients from both organic and inorganic sources. Inorganic fertilizers offer nutrients to the plant which are readily soluble in soil solution and thereby instantly available to the plants. These results were conformity with Devi *et al.*, (2013)<sup>[3]</sup> and Verma *et al.*, (2017)<sup>[5]</sup>. Great availability of nutrients with the application of biofertilizers or inoculants seems to have promoted various physiological activities of plant thus growth and development of the plant similar findings were also reported by Dipak *et al.*, (2018)<sup>[2]</sup>.

**Table 1:** Effect of integrated nutrient management on growth characteristics of Soybean

Treatment	Plant height (cm)			No. of trifoliolate leaves plant <sup>-1</sup>		No. of branches plant <sup>-1</sup>		No. of nodules plant <sup>-1</sup>
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	30 DAS	60 DAS	60 DAS
T <sub>1</sub> Control (25:60:25 kg N:P:K ha <sup>-1</sup> )	17.80	38.00	37.40	6.46	18.60	2.07	4.07	20.00
T <sub>2</sub> 100% RDF	24.40	64.60	63.87	12.83	37.46	5.60	9.87	31.17
T <sub>3</sub> 75% RDF + 5 t Farm Yard Manure ha <sup>-1</sup>	22.67	60.50	59.53	12.00	35.20	5.00	9.27	28.15
T <sub>4</sub> 50% RDF + 5 t Farm Yard Manure ha <sup>-1</sup>	20.83	52.83	52.17	9.73	27.67	3.50	8.13	25.87
T <sub>5</sub> 75% RDF + 5 t Vermicompost ha <sup>-1</sup>	23.10	63.03	62.23	12.36	36.40	5.53	9.53	30.15
T <sub>6</sub> 50% RDF + 5 t Vermicompost ha <sup>-1</sup>	21.30	54.60	53.67	10.53	29.73	3.90	8.33	26.50
T <sub>7</sub> 75% RDF + 5 t Farm Yard Manure ha <sup>-1</sup> enriched by consortia	25.17	65.43	64.60	13.26	38.80	5.87	10.27	31.83
T <sub>8</sub> 50% RDF + 5 t Farm Yard Manure ha <sup>-1</sup> enriched by Consortia	21.87	58.47	57.80	10.60	30.46	4.23	8.47	27.67
T <sub>9</sub> 75% RDF + 5 t Vermicompost ha <sup>-1</sup> enriched by Consortia	25.80	68.40	67.73	14.00	40.53	6.20	10.67	32.20
T <sub>10</sub> 50% RDF + 5 t Vermicompost ha <sup>-1</sup> enriched by Consortia	22.20	59.60	58.87	11.60	32.10	4.60	8.73	29.13
S.Em±	1.02	2.43	2.54	0.57	1.51	0.20	0.42	1.83
CD at 5%	3.03	7.21	7.54	1.69	4.48	0.60	1.26	3.84

### Effect of integrated nutrient management on yield attributes and yield of Soybean

Integrated nutrient management indicated significant effect on yield attributes and yield of Soybean crop (Table 2). Results revealed that the maximum number of pods plant<sup>-1</sup> (81.13),

test weight (152.80g), seed yield plant<sup>-1</sup> (23.38g), seed yield (26.75q ha<sup>-1</sup>), stover yield (36.86 q ha<sup>-1</sup>) and harvest index (42.05%) were noticed with treatment T<sub>9</sub> (75% RDF + 5 t Vermicompost ha<sup>-1</sup> enriched with Consortia).

**Table 2:** Effect of integrated nutrient management on yield & yield attributes of Soybean

Treatment	No. of pods plant <sup>-1</sup>	No. of seeds pod <sup>-1</sup>	Test weight (g)	Seed yield plant <sup>-1</sup> (g)	Seed yield (q ha <sup>-1</sup> )	Stover yield (q ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> Control	35.23	2.07	118.63	12.30	9.13	20.28	21.04
T <sub>2</sub> 100% RDF (25:60:25 kg N:P:K ha <sup>-1</sup> )	78.93	2.73	145.65	22.78	25.19	35.81	41.30
T <sub>3</sub> 75% RDF + 5 t Farm Yard Manure ha <sup>-1</sup>	76.40	2.60	138.57	19.62	23.58	34.17	40.83
T <sub>4</sub> 50% RDF + 5 t Farm Yard Manure ha <sup>-1</sup>	60.87	2.33	128.82	15.50	19.25	31.03	38.29
T <sub>5</sub> 75% RDF + 5 t Vermicompost ha <sup>-1</sup>	76.53	2.67	142.70	20.83	24.25	34.80	41.07
T <sub>6</sub> 50% RDF + 5 t Vermicompost ha <sup>-1</sup>	61.87	2.40	130.64	16.53	19.44	31.67	38.04
T <sub>7</sub> 75% RDF + 5 t Farm Yard Manure ha <sup>-1</sup> enriched by consortia	80.20	2.87	148.57	23.00	26.08	36.12	41.93
T <sub>8</sub> 50% RDF + 5 t Farm Yard Manure ha <sup>-1</sup> enriched by Consortia	65.27	2.47	134.82	18.10	21.10	32.06	39.69
T <sub>9</sub> 75% RDF + 5 t Vermicompost ha <sup>-1</sup> enriched by Consortia	81.13	2.93	152.80	23.38	26.75	36.86	42.05
T <sub>10</sub> 50% RDF + 5 t Vermicompost ha <sup>-1</sup> enriched by Consortia	71.60	2.53	136.00	18.91	22.50	33.00	40.54
S.Em±	2.85	0.17	4.03	0.94	1.05	1.58	-
CD at 5%	8.45	NS	11.98	2.78	3.12	4.55	-

The feasible reason for higher values of yield and yield attributing characters could be because of the integration and availability of mineral fertilizers, organic manures along with consortia throughout the growing period of crop, this leads to ease of nitrogen availability to the crop, thus plant did not place in nutrient stress condition at any stage. This outcome was already obtained by Devi *et al.*, (2013)<sup>[3]</sup> and Morya *et al.*, (2018)<sup>[4]</sup>.

### Conclusion

- Use of 75% RDF with 5 t Vermicompost ha<sup>-1</sup> enriched by

Consortia (T<sub>9</sub>) illustrated significantly higher seed (26.75 q ha<sup>-1</sup>) and stover (36.86 q ha<sup>-1</sup>) yield strongly chased by 75% RDF along with 5 t FYM ha<sup>-1</sup> enriched by Consortia (T<sub>7</sub>) and T<sub>2</sub> 100% RDF (25.19 q ha<sup>-1</sup> seed and 35.81 q ha<sup>-1</sup> stover yield). Whereas, significantly inferior values (9.13 q ha<sup>-1</sup> seed yield and 25.28 q ha<sup>-1</sup>) were noticed in Control plot (T<sub>1</sub>). Treatment (T<sub>9</sub>) assigned seed yield advantage of only 6.19% as compared to T<sub>2</sub> (100% RDF).

- These results showed that the integration of organic and inorganic fertilizer significantly enhance the seed yield of Soybean, also combining consortia enhance the efficacy

of organic manures. This increase in seed yield may be because of the constructive role of organic manures in promoting biological activity of soil, thus increase mobilization of nutrient from both chemical and organic sources, while additional supply of consortia increased nutrient uptake and better translocation of nutrients thus finally enhanced the seed production.

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