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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND CHEMICAL PROPERTIES OF SOYBEAN (*GLYCINE MAX*)

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ABSTRACT

A field experiment was conducted at Faculty of Agriculture, RKDF University Bhopal (M.P.) during Kharif 2020-21 to study the effect of Integrated Nutrient Management on growth, yield and chemical properties of soybean. Eight treatments comprising of T1- Control, T2-50% Recommended Dose of NPK, T3-100% Recommended Dose of NPK, T4-100% Vermicompost, T5-100% Farm Yard Manure, T6-50% Recommended Dose of NPK+ 50% Vermicompost, T7-50% Recommended Dose of NPK + 50% Farm Yard Manure and T8-50% Farm Yard Manure+ 50% Vermicompost, were evaluated in Randomized Block Design with three replications. Different observations on the crop parameters were carried out during the course of investigation. Growth parameters viz., plant height (cm), branches/plant, chlorophyll content of leaf, root length (cm)/plant, root nodules/plant, dry weight (g)/plant Yield attributing traits viz., pods/plant, seeds/pod and seed index were recorded treatment wise at the time of harvesting. Harvest index and economic viability of treatments were done from data generated. Data pertaining to various parameters were tabulated and subjected to statistical analysis for interpretation of results. After the investigation T4-100% vermicompost was found superior. All the growth Parameters, yield attributing characters and yield of soybean were found significantly superior under 100% vermicompost, While, minimum under T1.

Keywords : Integrated Nutrient Management, growth, yield, chemical properties, *Glycine max*

Introduction

Soybean [*Glycine max* (L.) Merrill] is one of the important oilseed crops of India. It is the third largest oilseed crop of India after rapeseed mustard and groundnut and ranks first in edible oil in world. Soybean is a miracle crop due to its excellent quality as it contains 40-42 % protein, 18-20% oil 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 deficient in most of the cereals and enriching the cereal flour with the nutritive quality (Raghuveer and Keerti, 2017). In spite of its high yielding potential, soybean productivity is much less in India. Among the factors responsible for low productivity, inadequate fertilizer use and emergence of multiple-nutrient deficiencies due to poor recycling of organic resources and unbalanced use of fertilizers are important (Chaturvedi *et al.*, 2010). Soybean is an energy rich crop and hence the requirement of major nutrients including secondary and micronutrients is high (Singh *et al.*, 2006). INM has multifaceted potential for the improvement of plant performance and resource efficiency while also enabling the protection of the environment and resource quality. It may include organic manures, i.e. vermicompost, farmyard manure, green manure and other sources for sustainable agriculture. Vermicompost is highly efficient organic manure, which is made from the farm waste and involves the advantage of increase in production and improve the quality of agricultural produce.

Vermicompost increases the value of land by increasing the NPK content, water holding capacity and productivity of land. Farmyard manure is another source of nutrients, which also helps in maintaining soil fertility and increasing the water holding capacity of soil and productivity of the soil. The integrated nutrient supply system is the most logical concept for managing long term soil fertility and productivity (Ramesh *et al.*, 2009). Use of chemical fertilizers and organic manures has been found promising in arresting the decline trend in soil-health and productivity through the correction of marginal deficiencies of some secondary and micro-nutrients, micro-flora and fauna and their beneficial influence on physical and biological properties of soil. Integrated nutrient management system can bring about equilibrium between degenerative and restorative activities in the soil eco-system (Upadhyay *et al.*, 2011).

Material and Methods

Field experiments were conducted during 2020-21, ELP field Faculty of Agriculture RKDF University Bhopal, is situated in the central part of Madhya Pradesh at 23.31250 North latitude and 77.35960 East longitudes with an altitude of 411.78 m above the mean sea level. The soil of the experimental site had a pH 7.4, EC 0.51 dS/m and organic carbon 0.7%. The available soil nitrogen, phosphorus and potash were 264, 12.6 and 282 kg/ha, respectively. The bulk density of the soil was 1.35 Mg/m³. The experiment was conducted in randomized block design with 8 treatments T1-

Control, T2-50% Recommended Dose of NPK, T3-100% Recommended Dose of NPK, T4-100% Vermicompost, T5-100% Farm Yard Manure, T6-50% Recommended Dose of NPK+ 50% Vermicompost, T7-50% Recommended Dose of NPK + 50% Farm Yard Manure and T8-50% Farm Yard Manure+ 50% Vermicompost with three replications. Observation on plant height (cm), No of branches per plant, nodules perplant, pods per plant, seed index, seed yield, harvest index (%) were recorded at of variance prescribed for randomized block design.

Result and Discussion

Growth Parameters

The analysis of the study indicated that (Table-1), Plant height number of branches per plant and plant dry matter were found significantly higher in treatment T4- 100% Vermicompost followed by T8- 50% Farm Yard Manure+ 50% Vermicompost. The lowest plant height was record in T1-Control plot. Nitrogen is the main component of chlorophyll, hence it plays crucial role in photosynthesis process. Plant height depends on the food. More photosynthesis will possess more vegetative growth.

According to Channabasanagowda *et al.* (2008), nitrogen is released slowly through vermicompost due to slow mineralisation which helps plant to attain growth for longer period. Vermicompost gives better plant growth due to presence of growth hormones, enzymes and other secretion of earthworms which stimulates the development and growth of plant. The maximum nodules number per plant was recorded under treatment 100% Vermicompost (T4) followed by 50% Farm Yard Manure+ 50% Vermicompost (T8). Maximum effective nodules per plant was recorded in treatment (T4) followed by (T8) followed by (T5) might be due to increased biological nitrogen fixation and other physiological processes with the addition of vermicompost. The increase in growth parameters was attributed to the fact that application of organic manure increased the soil organic carbon that holds greater moisture in soil and creates of suitable condition for better root growth and proliferation and also opportunity to extract water from larger profile area. These results were in conformity with the findings of Saxena *et al.* (2001), Kadam *et al.* (2008), Ramana *et al.* (2008), Mandal *et al.* (2009), Thenua Shyam Veer (2011).

Table 1 : Effect of Integrated Nutrient Management system on Growth parameters of soybean.

| Treatments | Plant height (cm) at 60 DAS | No of branches at 60 DAS | Plant dry weight (g) at 60 DAS | No of root nodules/ Plant at 60 DAS | Dry weight of nodules (g) at 60 DAS |
|--|-----------------------------|--------------------------|--------------------------------|-------------------------------------|-------------------------------------|
| T ₁ -Control | 34.12 | 4.02 | 8.75 | 26.3 | 0.028 |
| T ₂ -50% Recommended Dose of NPK | 35.20 | 4.23 | 9.14 | 28.2 | 0.030 |
| T ₃ -100% Recommended Dose of NPK | 35.34 | 5.00 | 9.34 | 28.8 | 0.033 |
| T ₄ -100% Vermicompost | 37.32 | 6.02 | 11.78 | 35.7 | 0.036 |
| T ₅ -100% Farm Yard Manure | 36.50 | 5.70 | 10.56 | 35.2 | 0.032 |
| T ₆ -50% Recommended Dose of NPK+ 50% Vermicompost | 36.78 | 5.42 | 10.41 | 32.5 | 0.030 |
| T ₇ -50% Recommended Dose of NPK + 50% Farm Yard Manure | 36.42 | 5.38 | 10.05 | 32.2 | 0.031 |
| T ₈ -50% Farm Yard Manure+ 50% Vermicompost | 37.02 | 5.78 | 11.12 | 34.3 | 0.036 |
| SEm± | 1.45 | 0.67 | 0.40 | 2.02 | 0.45 |
| CD at 5% | 4.35 | 2.03 | 1.20 | 6.03 | NS |

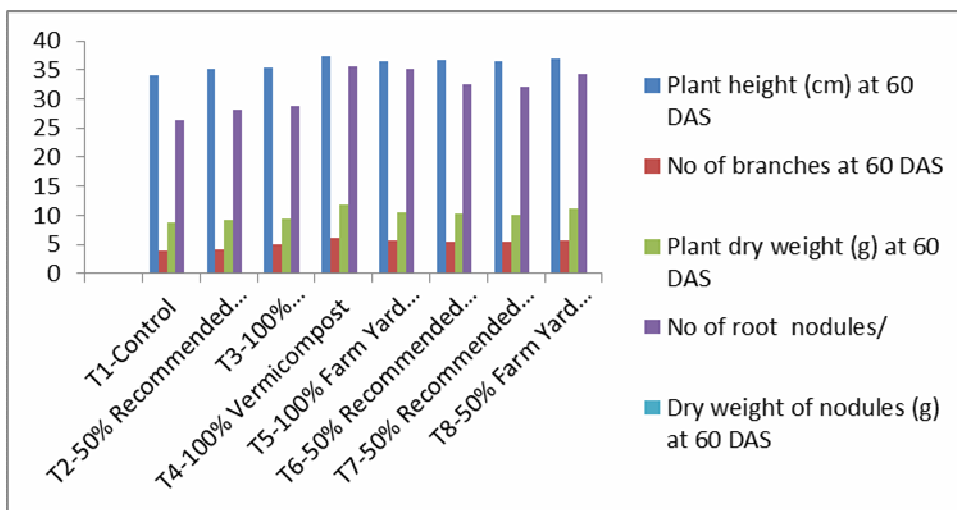


Fig. 1 : Effect of Integrated Nutrient Management system on Growth parameters of soybean.

Yield Parameters

Number of pods per plant (57.20), seeds per pods (3.6), test weight (111.3g), seed yield (26.20q/ha), Stover yield (43.40 q/ha) and harvest index (37.64 %) were found highest under T4 (100% vermicompost) closely followed by T8 (50% Farm Yard Manure+ 50% Vermicompost). While, all the above yield attributes were found minimum under T1

(46.30, 2.80 and 104.6 g, 20.30 q/ha, 37.00 q/ha and 35.42 % respectively). Increase in yield attributes and yield might be due to the favourable effect of vermicompost availability of nutrients to the crop, which enhanced the yield attributes and yield of soybean. These results are closely conformity to the findings of Singh *et al.*, (2007), Shivakumar and Ahlawat (2008), Rathore *et al.* (2009), Dabhi *et al.* (2010),

Table 2 : Effect of Integrated Nutrient Management system on Yield parameters of soybean.

| Treatments | Number of pods per plant | Number of seeds per pod | 1000 seed weight (g) | Seed yield (q/ha) | Stover yield (q/ha) | Harvest index (%) |
|---|--------------------------|-------------------------|----------------------|-------------------|---------------------|-------------------|
| T1-Control | 46.30 | 2.8 | 104.6 | 20.30 | 37.00 | 35.42 |
| T2-50% Recommended Dose of NPK | 49.42 | 3.2 | 106.9 | 21.75 | 38.72 | 35.96 |
| T3-100% Recommended Dose of NPK | 50.22 | 3.2 | 107.3 | 21.40 | 39.20 | 35.67 |
| T4-100% Vermicompost | 57.20 | 3.6 | 113.3 | 26.20 | 43.40 | 37.64 |
| T5-100% Farm Yard Manure | 55.12 | 3.5 | 111.5 | 24.52 | 40.32 | 37.81 |
| T6-50% Recommended Dose of NPK+ 50% Vermicompost | 54.13 | 3.3 | 110.7 | 23.92 | 41.15 | 36.76 |
| T7-50% Recommended Dose of NPK + 50% Farm Yard Manure | 54.10 | 3.2 | 108.9 | 22.35 | 40.65 | 35.47 |
| T8-50% Farm Yard Manure+ 50% Vermicompost | 56.70 | 3.6 | 112.4 | 25.21 | 42.42 | 37.63 |
| SEm± | 1.12 | 0.02 | 0.91 | 0.73 | 0.85 | 1.67 |
| CD at 5% | 3.34 | 0.06 | 2.70 | 2.15 | 2.52 | 5.03 |

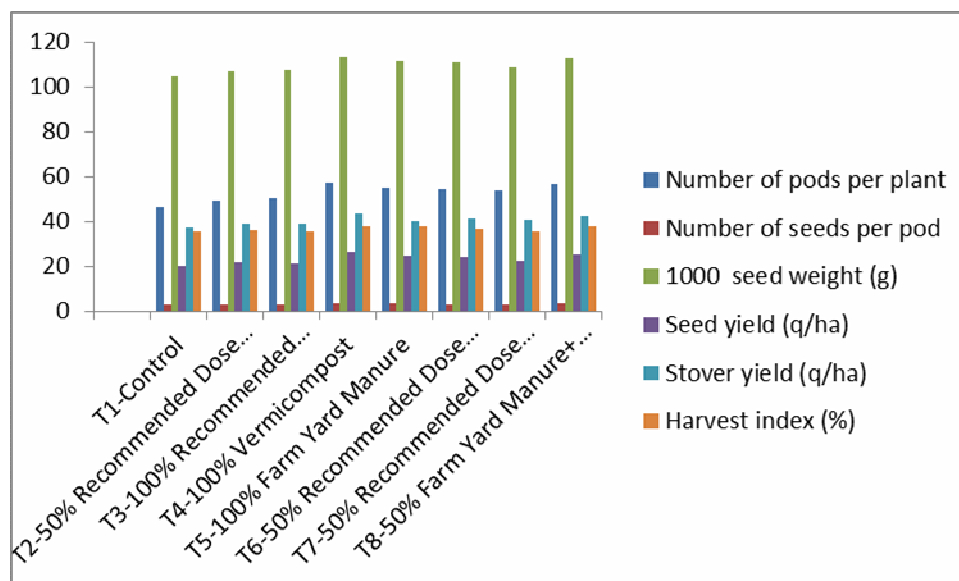


Fig. 2: Effect of Integrated Nutrient Management system on Yield parameters of soybean.

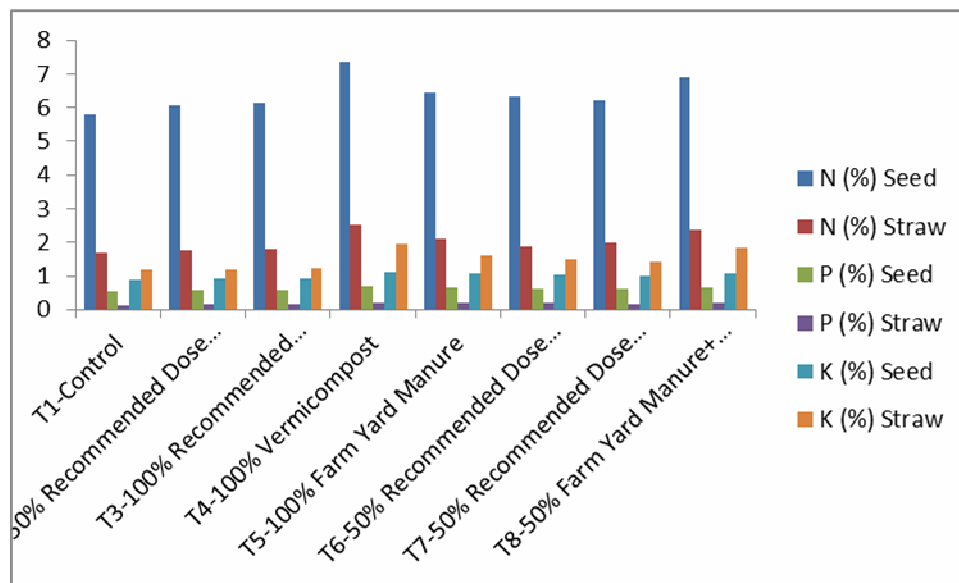
Nutrient content in seed and straw (%)

N (7.34 and 2.53 %), P (0.68 and 0.22%) and K (1.10 and 1.97%) content were higher in seed and stover in the application of 100% vermicompost followed by 50% Farm Yard Manure+ 50% Vermicompost. The lower NPK content found in Treatment T1. However, the concentration of N, P and K by seed and stover was significantly higher with used

of vermicompost as compared to control. Application of vermicompost fertilizer can accelerate the availability of nutrients in the soil, through a faster overhaul of organic matter. Besides that vermicompost fertilizer also contains growth hormones so that it can accelerate plant growth besides fulvic acid and humic acid contained in organics can bind toxic substances in the soil.

Table 3: Effect of Integrated Nutrient Management system on Nitrogen, Phosphorus and Potassium content in seed and straw in soybean.

| Treatments | N (%) | | P (%) | | K (%) | |
|--|--------------|--------------|-------------|-------------|-------------|-------------|
| | Seed | Straw | Seed | Straw | Seed | Straw |
| T1-Control | 5.78 | 1.67 | 0.53 | 0.12 | 0.89 | 1.18 |
| T2-50% Recommended Dose of NPK | 6.05 | 1.76 | 0.60 | 0.15 | 0.91 | 1.20 |
| T3-100% Recommended Dose of NPK | 6.13 | 1.81 | 0.60 | 0.15 | 0.91 | 1.22 |
| T4-100% Vermicompost | 7.34 | 2.53 | 0.68 | 0.22 | 1.10 | 1.97 |
| T5-100% Farm Yard Manure | 6.45 | 2.10 | 0.64 | 0.19 | 1.06 | 1.60 |
| T6-50% Recommended Dose of NPK+ 50% Vermicompost | 6.34 | 1.87 | 0.62 | 0.19 | 1.04 | 1.50 |
| T7-50% Recommended Dose of NPK + 50% Farm Yard Manure | 6.23 | 1.98 | 0.61 | 0.17 | 1.02 | 1.42 |
| T8-50% Farm Yard Manure+ 50% Vermicompost | 6.89 | 2.36 | 0.66 | 0.20 | 1.09 | 1.82 |
| SEm± | 0.068 | 0.005 | 0.07 | 0.09 | 0.09 | 0.07 |
| CD at 5% | 0.20 | 0.017 | 0.20 | 0.25 | 0.25 | 0.21 |

**Fig. 3 :** Effect of Integrated Nutrient Management systems on Nitrogen, Phosphorus and Potassium content in seed and straw in soybean.

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