

## Original Research Article

# EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD PARAMETERS OF MAIZE (*Zeamays*~~L.~~)POACEAE

## Abstract

**Aim:** To study effect of integrated nutrient management on growth and yield of maize (*Zea mays* L.).

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**Study design:** A field experiment was conducted at Agronomy farm, school of agriculture, Lovely Professional University, Punjab, [India](#) during *kharif* season of 2022.

**Methodology:** The experiment trail was laid out in randomized block design. It consisted of three replications with ten treatment combinations *i.e.* T<sub>1</sub>- 100% RDF +FYM 15 t ha<sup>-1</sup>; T<sub>2</sub>- 100% RDF + Vermicompost 7.5 t ha<sup>-1</sup>; T<sub>3</sub>-100% RDF + seed priming with Biofertilizers (*Azotobacter*); T<sub>4</sub>- 75% RDF + FYM 11 t ha<sup>-1</sup>; T<sub>5</sub>- 75% RDF + [vermicompost 5.6 t ha<sup>-1</sup> seed priming with biofertilizers \(\*Azotobacter\*\)](#); T<sub>6</sub>-75% RDF + [seed priming with biofertilizers \(\*Azotobacter\*\), vermicompost 5.6 t ha<sup>-1</sup>](#); T<sub>7</sub>- 50% RDF basal dose + Nano urea spray 0.15% [ppmPPM](#) (25 and 50 Days After Sowing, DAS); T<sub>8</sub>- 50% RDF + Nano urea spray 0.30% [ppmPPM](#) (25 and 50 DAS); T<sub>9</sub>- Vermicompost 3.5 t ha<sup>-1</sup> + seed priming with Biofertilizers (*Azotobacter*); T<sub>10</sub>- control.

**Result:** The results showed that application of T<sub>2</sub> 100% RDF + [Vermicompost FYM @ 7.5 t ha<sup>-1</sup>](#) had significant effect on growth and yield of maize. The plant height, number of leaves per plant and dry matter accumulation were [also](#) significantly higher in T<sub>2</sub> [followed by T<sub>1</sub> 100% RDF + FYM 15 @ 7.5 t ha<sup>-1</sup>](#). The highest grain yield (64.36 q ha<sup>-1</sup>) was obtained in T<sub>2</sub> followed by T<sub>1</sub> (63.6 q ha<sup>-1</sup>), T<sub>3</sub> (57.92 q ha<sup>-1</sup>) [and](#) T<sub>8</sub> (56.16 q ha<sup>-1</sup>).

**Conclusion:** Overall, the results and the study suggest the use of integrated nutrient management can improve the growth and yield of maize and provide sustainable solution to meet the nutrient requirements of the crop.

**Key words:** Biofertilizer, [Farmyard manure \(FYM\)](#), [Nano urea](#), [Vermicompost](#), Recommended dose fertilizers (RDF), [Vermicompost Nano urea](#).

## Introduction

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Maize (*Zea mays* L.) is one of the most important cereal, next to rice and wheat and is used as both human food and animal feed. The annual C4 plant belongs to the family Poaceae with its origin in Central America. Maize being one of the most important cereal or grain crop and plays a significant role in the world agriculture economy. It is cultivated throughout the world as it has higher genetic yield potential than any other cereal crop and hence referred to as “Queen of cereals” [11]. Maize (*Zea mays* L.) is one of the most versatile crops having wider adaptability under varied agroclimatic conditions. It is cultivated on nearly 190 million ha in about 160 countries having wider diversity of soil, climate, biodiversity and management practices that contributes 40 per cent in the global grain production [12]. The maize development path in India remains very impressive, with production rising almost 16 times from less than two million tons in the 1950s. Currently 47% of the corn produced in India is utilized in the food industry and 13% as animal feed and starch industry consumes about 14% of the corn. However, there is a growing trend to use maize as digested food, which contributes to about 7% of annual maize consumption in the country [1].

Developing new techniques and varied cropping practices around the world has led to massive production of the crop all over the world. The indigenous and native methods of cultivation have proven to be insufficient to fulfil the food requirement for the rapidly growing population and thus the world has paved the way to use the chemical fertilizers for the immediate surge in the production and match the demand of the food [6, 15]. Poor management of fertilizer is the key factor responsible for obtaining low yields as well as it leads to various environmental hazards such as eutrophication, leaching of nutrients and soil pollution etc., so in order to achieve optimum supply of nutrients application of organic sources, bio-fertilizers and micro-nutrients is recommended [3].

Therefore, integrated nutrient management (INM) aims to maintain soil fertility by supplying plant nutrients to an optimal level for sustaining crop productivity. Adoption of this method also helps farmers to alleviate many issues such as poverty by cutting cost of products and food insecurity and enhancing crop production and improving quality of produce. However, the lack of information about integrated nutrient management in different crops and its various practices, is posing restrictions for its adoption and expansion. Thus, keeping in view the INM as need has present research was structured. The information about the importance and need of INM need to be properly addressed and simplified so that ordinary farmers can understand and use it as much as possible.

## Material and methods

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The field experiment was conducted in Agri farm at School of Agriculture, Lovely Professional University, Phagwara, Punjab during kharif season 2022, to study effect of integrated nutrient management (INM) on growth and yield of kharif maize (*Zea mays*L). The experiment was conducted in randomized block design with ten treatment and 3 replications the treatments are followed through T<sub>1</sub>- 100% (recommended dose of fertilizer) RDF + FYM 15 t ha<sup>-1</sup>, T<sub>2</sub>- 100% RDF + Vermicompost 7.5 t ha<sup>-1</sup>, T<sub>3</sub>-100% RDF + seed priming with Biofertilizers (*Azotobacter*), T<sub>4</sub>- 75% RDF + FYM 11 t ha<sup>-1</sup>, T<sub>5</sub>- 75% RDF + vermicompost 5.6 t ha<sup>-1</sup>, seed priming with biofertilizers (*Azotobacter*), T<sub>6</sub>- 75% RDF + seed priming with biofertilizers (*Azotobacter*), vermicompost 5.6 t ha<sup>-1</sup>, T<sub>7</sub>- Basal dose RDF basal dose + Nano urea spray 0.15% ppm PPM (applied 25 and 50 days after sowing (DAS)), T<sub>8</sub>- Basal dose RDF + Nano urea spray 0.3% ppm PPM (25 and 50 DAS), T<sub>9</sub>- Vermicompost 3.5 t ha<sup>-1</sup> + seed priming with Biofertilizers (*Azotobacter*) T<sub>10</sub>- control. The experimental area was 450 square meters with 30 plots (5m\*3m) 15m<sup>2</sup> and 'PMH 13' Maize variety as sown in the field with spacing 60cm (row to row)\*20cm (plant to plant) cm spacing. Throughout the experiment different growth and yield parameters were recorded.

## Result and Discussion

### Growth Parameters

**Plant height:** Plant height is the important growth parameter in maize which relates with crop growth and knows time to maturity and related with maize life span. In Fig. 1, data reveals that significantly highest plant height at harvest (191.13cm) was recorded in T<sub>2</sub> 100% RDF + vermicompost @ 7.5 t ha<sup>-1</sup> followed by T<sub>1</sub> 100% RDF + FYM @ 15 t ha<sup>-1</sup> (191.07 cm) and lowest plant height (130.87 cm) was recorded in T<sub>10</sub> control. T<sub>3</sub> (175.63 cm) and application of T<sub>8</sub> basal dose RDF + nano urea 2 sprays plant height (176.80 cm) are statistically at par with T<sub>1</sub> and T<sub>2</sub>. Similar plant height were observed by [5]. (fig.1)

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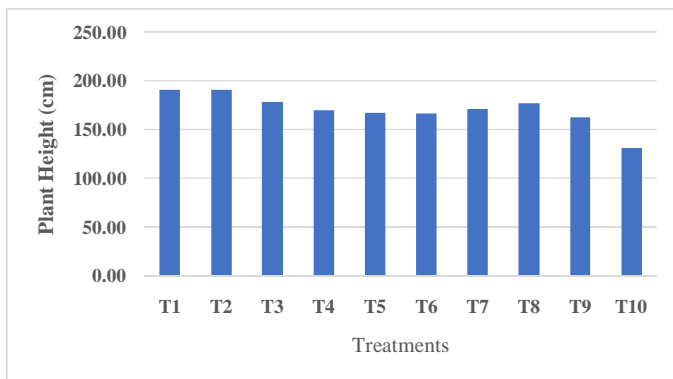
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**Figure1:** Effect of plant height at different integrated nutrient management (INM) treatments in maize (*Zea mays*).

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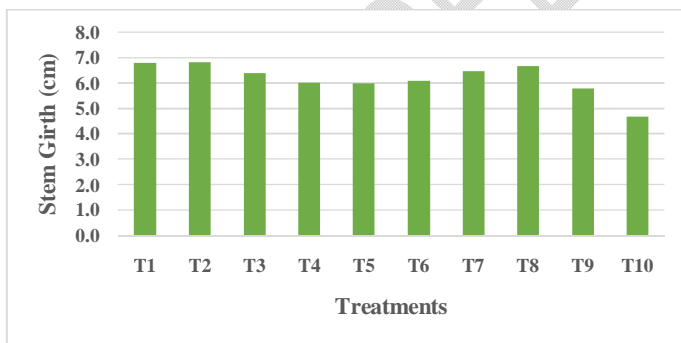
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**Stem girth:** Stem girth is an important parameter to evaluate the growth and development of maize crop. Results (Fig. 2) showed that significantly similar stem girth was observed in T<sub>1</sub> and T<sub>2</sub>(6.81 cm) followed by T<sub>8</sub> basal dose RDF (NPK) + Nano urea @ 0.3% ppm two sprays (6.67 cm). The and lowest stem girth was observed in T<sub>10</sub> control (4.69 cm). Similar results were finding with [13], who reported that- The presence of growth hormones, and other earthworm secretions in vermicompost that promotes plant growth and development. [13] (fig-2)

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**Figure2:** Effect of Stem girth at different INM treatments in maize (*Zea mays*)

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**Dry matter accumulation:** Plant dry matter is an important parameter that reflects overall productivity of maize crop. In Fig. 3 is shown data on sSignificantly higher dry matter accumulation for T<sub>1</sub> (313.33 g p<sup>-1</sup>) and T<sub>2</sub>(315 g p<sup>-1</sup>) followed by T<sub>3</sub> 100% RDF + Seed priming with *Azotobacter* (290 g p<sup>-1</sup>) and with the basal dose RDF (NPK) + nano urea 2 sprays at 0.15% (T7), and 0.3% ppm (T8), ppm the data are T<sub>7</sub> (278.33 g p<sup>-1</sup>) and T<sub>8</sub> (283.33) are par with T<sub>3</sub>. The and lowest washad found in control. The results suggest that applying of organic fertilizers such as FYM and Vermicompost

along with inorganic fertilizers may have a positive impact on plant growth and development.

Similar findings were observed by [2]. (fig.3)

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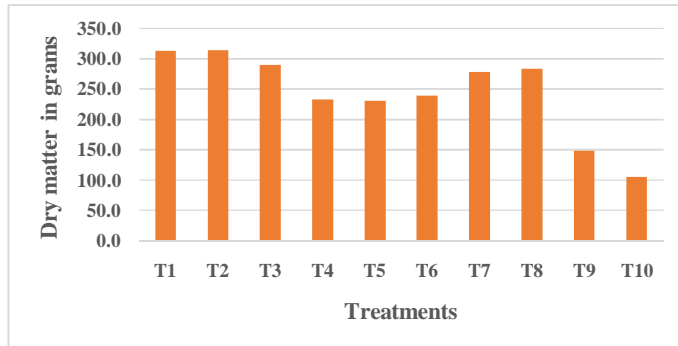


Figure3:Effect of dDry matter accumulation at different INM treatments in maize (*Zea mays*).

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#### Yield attributes:

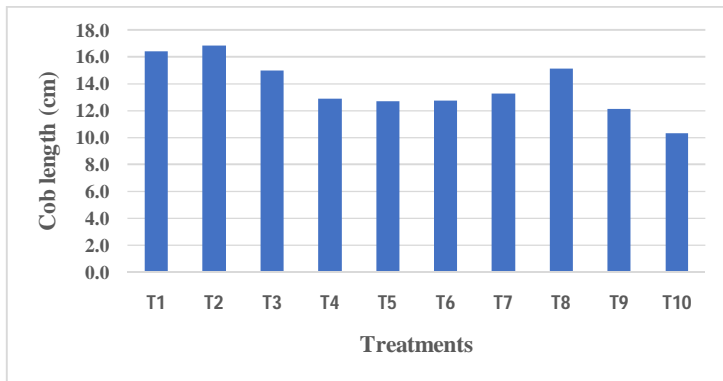
Yield attributes are yield characters which directly influence the maize crop yield. Yield attributes like cob length (cm), cob girth (cm), number of grains per row, test weight (g), stover yield and biological yield. In Figs. 4 and 5 Data revealed that maximum cob length (16.8 cm) and cob girth (13.05 cm), 100 grain weight (test weight) (31.67 g) was recorded in T2 with application of 100% RDF + Vermicompost @ 7.5 t ha<sup>-1</sup> followed by T1 (100% RDF + FYM @ 15 t ha<sup>-1</sup>) (cob length of 16.4 cm) and (cob girth of 13.04 cm), test weight (31 g) and T8 basal dose RDF (NPK) + Nano urea 0.30% ppm two sprays (15.1 cm) and (12.90 cm) test weight (29.67 g). The and lowest cob length (10.3 cm) and cob girth (9.45 cm) and test weight was recorded in control. (10.3 cm). (fig.4 and 5) Sujatha *et al.* (2008)<sup>[14]</sup> reported that maize yield attributes have positive impact by using organic sources like FYM, vermicompost combined with inorganic sources of nutrients. The use of integrated nutrient management produces nutrients are balanced in soil for plant growth, yield and sustainability. Similar results were observed by [4, 9]. [9]

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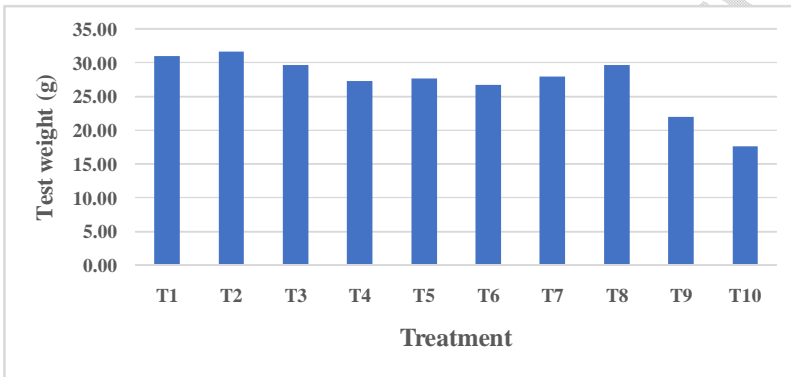
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**Figure4:** Effect of cCob length at different INM treatments in maize (*Zea mays*).

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**Figure5:** Effect of tTest weight on different INM treatments in maize (*Zea mays*).

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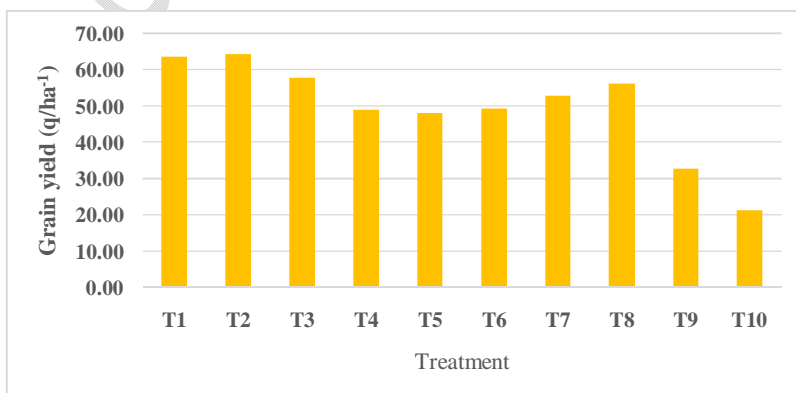
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**Grain yield:** In Fig. 6, The data showed the effect of integrated nutrient management of different treatments on maize grain yield. Maximum grain yield (64.36 q ha<sup>-1</sup>) was resulted in T2 with application of 100% RDF + Vermicompost 7.5 t ha<sup>-1</sup> followed by T1 (63.66 q ha<sup>-1</sup>) with application of 100% RDF + FYM @ 15 t ha<sup>-1</sup>, and The lowest grain yield was recorded in control (21.28 q ha<sup>-1</sup>). Similar findings were observed [10]. (Fig.6)

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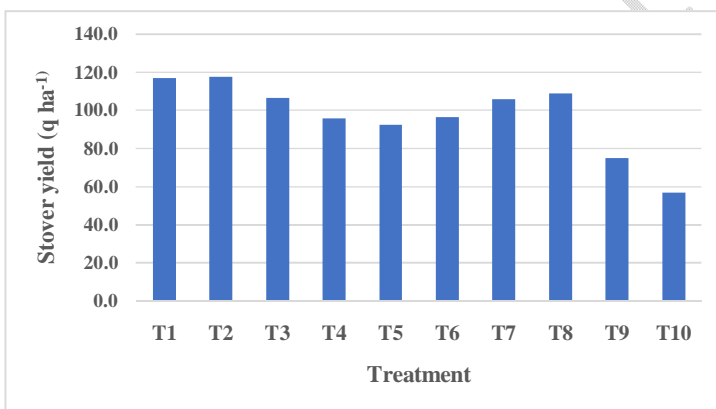
**Figure6:** Effect of **g** Grain yield on different INM treatments **in maize (*Zea mays*)**.

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**Stover yield:** Stover yield is related with **total dry yield of** maize stalks and stem **total** dry matter which usually used as animal fodder after grain has been harvested. Results showed that maximum stover yield ( $117.8 \text{ q ha}^{-1}$ ) was recorded **in T2** with application of 100% RDF + Vermicompost @  $7.5 \text{ t ha}^{-1}$  followed by ( $116.9 \text{ q ha}^{-1}$ ) by applying 100% RDF + FYM @  $15 \text{ t ha}^{-1}$  (**T1**). **The** lowest stover yield ( $56.9 \text{ q ha}^{-1}$ ) in control (**T10**). Similar results were observed by [7]. (fig-7)

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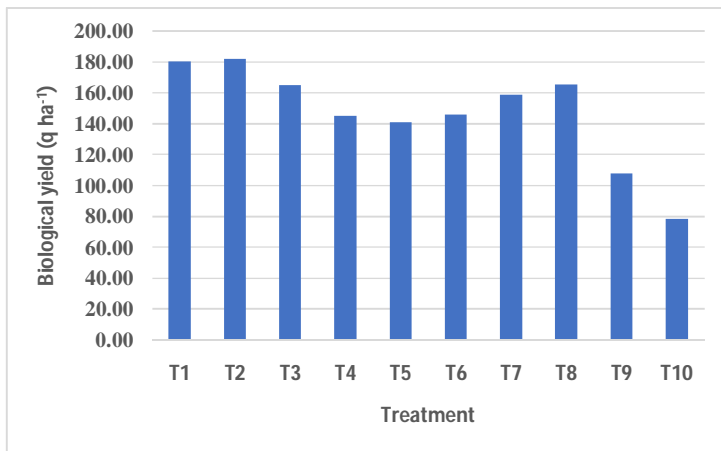
**Figure7:** Effect of **s** Stover yield on different INM treatments **in maize (*Zea mays*)**.

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**Biological yield:** Biological yield is an important parameter in maize cultivation which refers the total amount of dry matter produced by the crop including grain and vegetative parts. Higher biological yield indicates higher plant productivity. **In Fig. 8,** results shown in maximum biological yield ( $182.13 \text{ q ha}^{-1}$ ) was resulted by applying 100% @ RDF + Vermicompost  $7.5 \text{ t ha}^{-1}$  (**T2**) followed by applying 100% RDF + **FYM**  $15 \text{ t ha}^{-1}$  (**T1**), and **the** lowest biological yield was resulted in control ( $78.20 \text{ q ha}^{-1}$ ). Similar results were observed by [8]. (fig-8)

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**Figure8:**Effect of Biological yield on different INM treatments in maize (*Zea mays*).

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## Conclusion

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Based on results of the experiment conducted at Agri farm lovely professional university, Punjab, it can be concluded that application 100% RDF + Vermicompost @ 7.5 t ha<sup>-1</sup> had higher plant growth parameters and yield attributes and higher grain yield of maize. The study shows that the application of organic manures in combination with chemical fertilizers had positive impact on maize yields and enhancing soil quality and promoting sustainable crop production. Hence, the adoption of integrated nutrient management can be an effective approach to improving maize productivity while maintain the soil health and reducing the use of chemical compounds.

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