Original Research Article

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF MAIZE (*Zea mays*.L)

Abstract

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

Study design: A field experiment was conducted at Agronomy farm, school of agriculture, Lovely Professional University, Punjab during *kharif* season of 2022

Methodology: The experiment trail was laid out in randomized block design consist of three replications with ten treatment combinations *i.e.* T_1- 100% RDF + FYM 15 t ha^{-1}, T_2- 100% RDF + Vermicompost 7.5 t ha^{-1}, T_3-100% RDF + seed priming with Biofertilizers (*Azotobacter*), T_4- 75% RDF + FYM 11 t ha^{-1}, T_5- 75% RDF + seed priming with biofertilizers (*Azotobacter*), T_6- 75% RDF + vermicompost 5.6 t ha^{-1}, T_7- 50% RDF basal dose + Nano urea spray 0.15% PPM (25 and 50 DAS), T_8- 50% RDF + Nano urea spray 0.3% PPM (25 and 50 DAS), T_9- Vermicompost 3.5 t ha^{-1} + seed priming with Biofertilizers (*Azotobacter*) T_{10}- control.

Result: The results showed that application of T_2 100% RDF + FYM @ 7.5 t ha^{-1} had significant effect on growth and yield of maize. The plant height, number of leaves per plant and dry matter accumulation were significantly higher in T_2 100% RDF + FYM @ 7.5 t ha^{-1} The highest grain yield (64.36 q ha^{-1}) was obtained in T_2 followed by T_1 (63.6 q ha^{-1}), T_3 (57.92 q ha^{-1}), T_8 (56.16 q ha^{-1}).

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, FYM, Vermicompost, Recommended dose, Nano urea.

Introduction

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 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 nearly190 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 inthe country.[1]

Developing new techniques and varied cropping practices around the world has led to massive production ofthe 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 usethe 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 yield 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 aims to maintain or soil fertility by suppling 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 but lack of information about integrated nutrient management in different cropsand its various practices, is posing restrictions for its adoption and expansion so keeping in view the INM as need has present research was structured. The information about the importance and need of INM needs to be properly addressed and simplified so that ordinary farmers can understand and use it as much as possible.

Material and methods

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 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_1- 100% RDF + FYM 15 t ha^{-1}, T_2- 100% RDF + Vermicompost 7.5 t ha^{-1}, T_3-100% RDF + seed priming with Biofertilizers (*Azotobacter*), T_4- 75% RDF + FYM 11 t ha^{-1}, T_5- 75% RDF + seed priming with biofertilizers (*Azotobacter*), T_6- 75% RDF + vermicompost 5.6 t ha^{-1}, T_7- Basal dose RDF basal dose + Nano urea spray 0.15% PPM (25 and 50 DAS), T_8- Basal dose RDF + Nano urea spray 0.3% PPM (25 and 50 DAS), T_9- Vermicompost 3.5 t ha^{-1} + seed priming with Biofertilizers (*Azotobacter*) T_{10}- control. The experimental area was 450 square meters with 30 plots (5m*3m) 15m^2 and PMH 13 Maize variety as sown in the field with spacing 60 (row to row) *20 (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. Data reveals that significantly highest plant height at harvest (191.13cm) was recorded in T_2 100 RDF + vermicompost @7.5 t ha^{-1} followed by T_1 100% RDF + FYM @ 15 t ha^{-1} (191.07 cm) and lowest plant highest (130.87 cm) was recorded in T_{10} control. T_3 (175.63 cm) and application of T_8 basal dose RDF + nano urea 2 sprays plant height (176.80) is are statistically par with T_1 and T_2 similar plant height were observed by [5]. (fig.1)

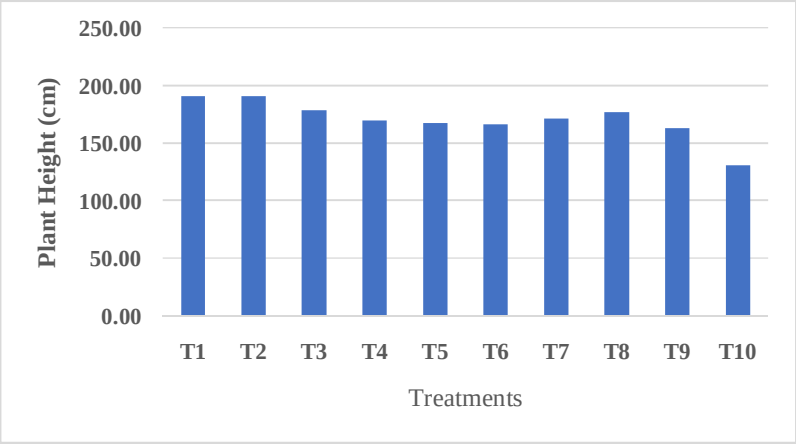

Figure1: Effect of plant height at different INM treatments

Stem girth: Stem girth is an important parameter to evaluate the growth and development of maize crop. Results showed that significantly similar stem girth was observed in T_1 and T_2 (6.81 cm) followed by T_8 basal NPK + Nano urea @ 0.3% PPM two sprays (6.67 cm) and lowest stem girth was observed in T_{1O} control (4.69 cm). similar results were finding with[13]. The presence of growth hormones, and other earthworm secretions in vermicompost that promotes plant growth and development. [13] (fig.2)

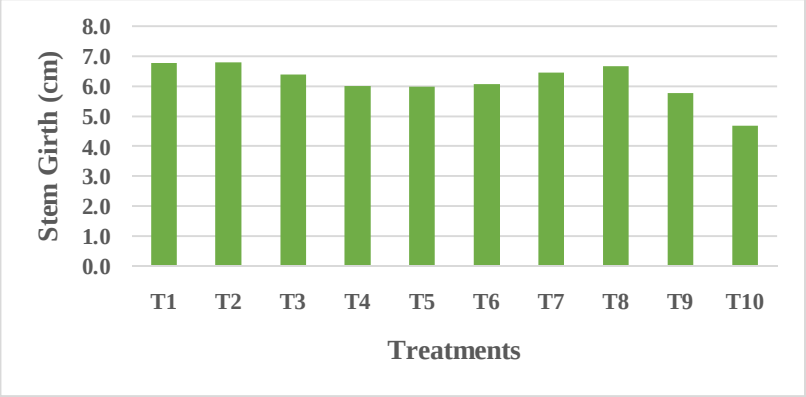

Figure2: Effect of Stem Girth at different INM treatments

Dry matter accumulation: Plant dry matter is an important parameter that reflects overall productivity of maize crop. Significantly higher dry matter accumulation for T_1 (313.33 g p^{-1}) and T_2 (315 g p^{-1}) followed by T_3 100% RDF + Seed priming with *Azotobacter* (290 g p^{-1}) and basal dose NPK + nano urea 2 sprays 0.15 and 0.3% PPM are T_7 (278.33 g p^{-1}) and T_8 (283.33) are par with T_3 and lowest had 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)

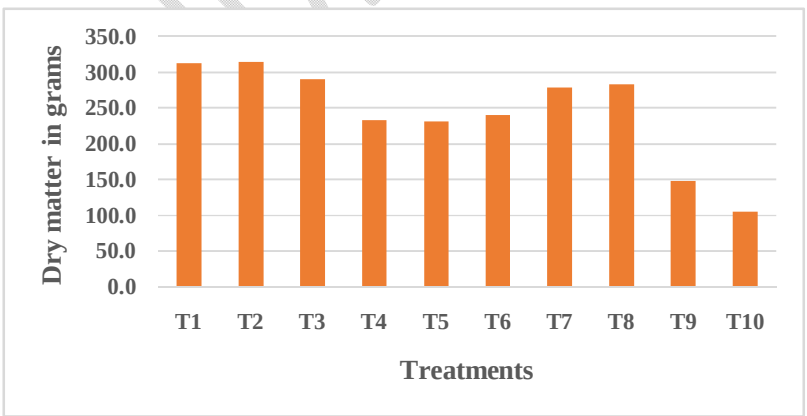

Figure3: Effect of Dry matter accumulation at different INM treatments

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. 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 with application of 100% + Vermicompost @ 7.5 t ha^{-1} followed 100% RDF + FYM @ 15 t ha^{-1} (16.4 cm) and (13.04 cm), test weight (31 g)and basal NPK + Nano urea 0.30% ppm two sprays (15.1 cm) and (12.90 cm) test weight (29.67 g) and lowest cob length (10.3 cm) and cob grith (9.45 cm) and test weight was recorded in control (10.3 cm). (fig.4 and 5) [14] reported that maize yield attributes have positive impact by using organic sources like FYM, vermicompost combined with inorganic sources of nutrients. Th use of integrated nutrient management nutrients are balanced in soil for plant growth, yield and sustainability. similar results were observed by [4], [9]

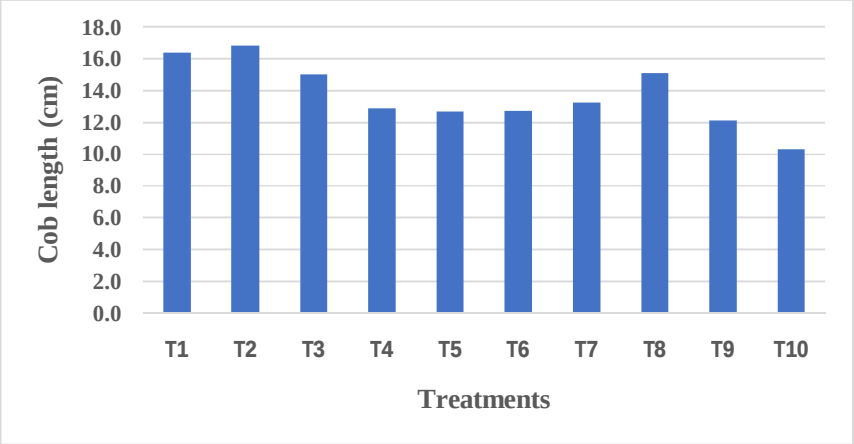

Figure4: Effect of Cob length at different INM treatments

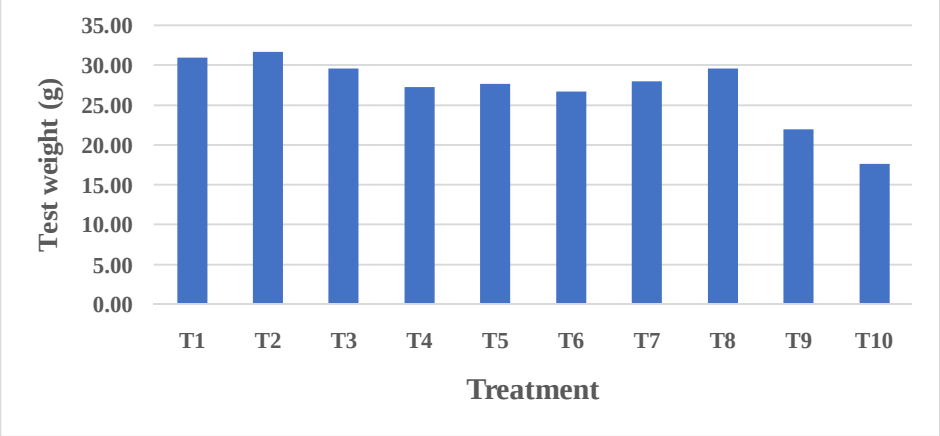

Figure5: Effect of Test weight on different INM treatments

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

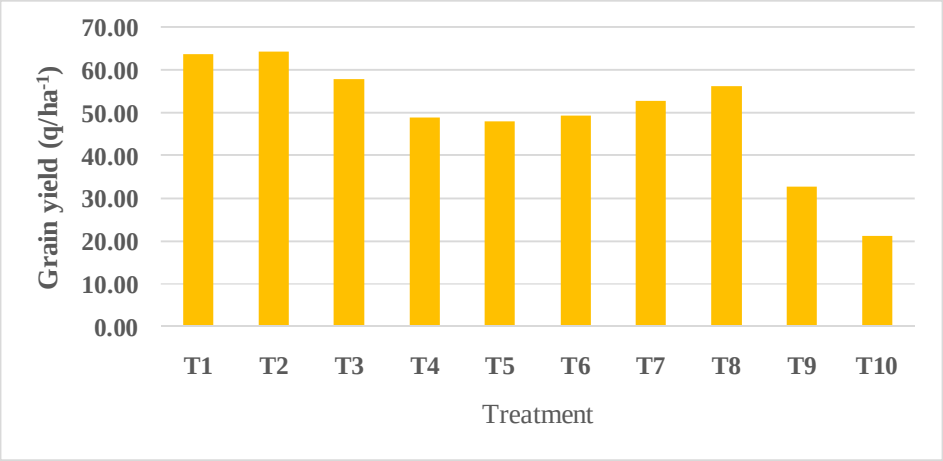

Figure6: Effect of Grain yield on different INM treatments

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

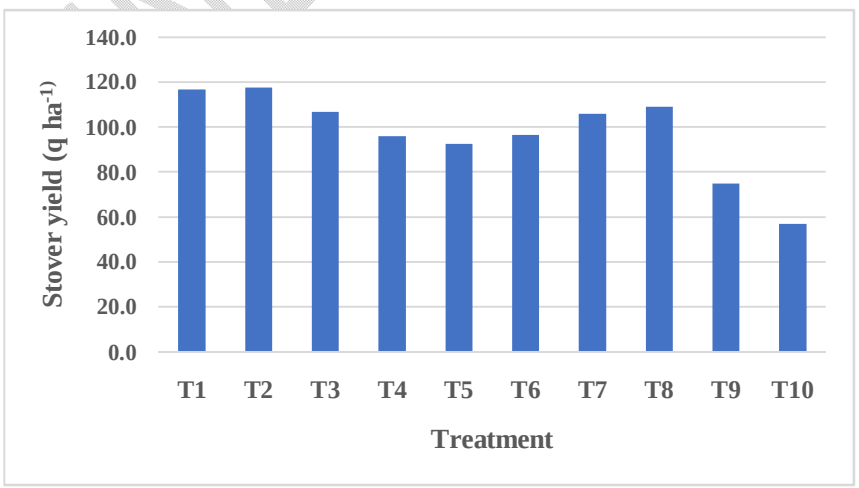

Figure7: Effect of Stover yield on different INM treatments

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. Results shown in maximum biological yield (182.13 q ha^{-1}) was resulted by applying 100@ RDF + Vermicompost 7.5 t ha^{-1} followed by applying 100% RDF + 15 t ha^{-1} (180.58 q $ha^{-1)}$ and lowest biological yield was resulted in control (78.20 q ha^{-1}). Similar results were observed by [8]. (fig.8)

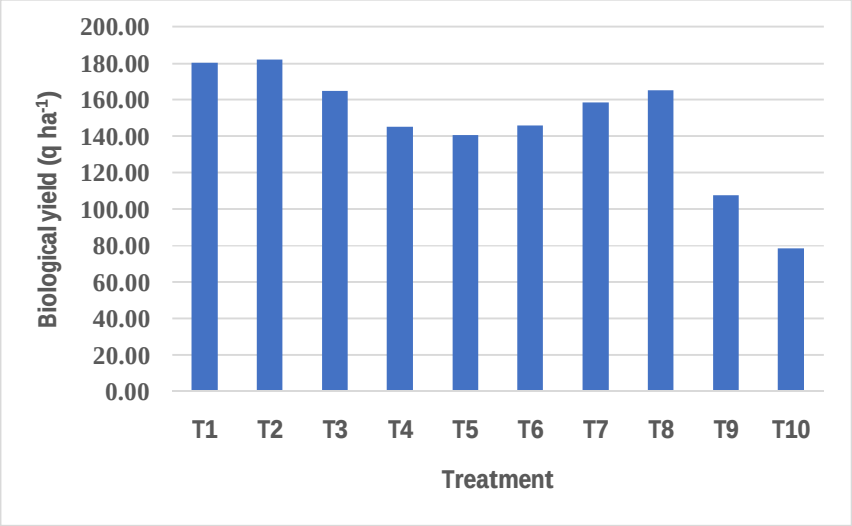

Figure8: Effect of Biological yield on different INM treatments

Conclusion

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^{-1} 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 aa effective approach to improving maize productivity while maintain the soil health and reducing the use of chemicals.

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