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APPLICATION OF ORGANIC AND INORGANIC NUTRIENT SOURCES FOR IMPROVING GROWTH AND YIELD ATTRIBUTES OF MAIZE (*ZEA MAYS* L.) UNDER CLIMATIC CONDITIONS OF PAKISTAN

Aqeel Ahmed¹, Nabil Ahmed¹, Uzma Arif², Sadaf Khalid¹, Lubna Zafar³, Raees Ahmed⁴, Jahanzaib Shahzad¹, Raza Mustafa¹, Qamar Ali khan¹, Hassan Farid⁵

¹ Department of Agronomy, University of Poonch Rawalakot, Azad Jammu Kashmir, Pakistan.

² Horticultural Research Institute, National Agricultural Research Centre, Islamabad, Pakistan.

³ Department of Computer Sciences, University of Poonch Rawalakot, Pakistan.

⁴ Department of Plant Pathology, University of Poonch Rawalakot, Azad Jammu Kashmir, Pakistan.

⁵ Department of Food Science and Technology, University of Poonch Rawalakot, AJK, Pakistan.

*Corresponding Author's Email: raees@upr.edu.pk

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ABSTRACT

The research was conducted under rain fed conditions of Rawalakot to check the effect of different organic and chemical fertilizers on yield and yield components in maize. Eight different treatments were evaluated by using regular arrangement of randomized complete block design (RCBD) with three replications. Sheep manure (SM), farm yard manure (FYM), and poultry manure (PM) were used as organic sources of nutrients while NPK was used inorganic sources. The test variety of maize was Pioneer-30Y87. The data was subjected to analysis of variance (ANOVA) to analyze the difference amongst different means using least significance difference (LSD). Results revealed significant effect of different nutrient treatments on the yield and morphological growth of maize. Maximum number of plants (11.00), plant height (212.80 cm), number of grain rows per cob (15.60), 1000 grains weight (188.90 g), grain yield (6836.7g) were recorded for Treatment T7 (Half recommended NPK fertilizer + farm yard manure. tons ha⁻¹). This study showed that mixed use of inorganic and organic sources of nutrients could be a better soil nutrient amendment when applied at a ratio of 50% dose of farm yard manure (FYM) + 50% dose of NPK in the cultivation of maize under rain fed conditions of Rawalakot.

Keywords: Maize, Farmyard manure, Poultry manure, NPK, Yield

INTRODUCTION

Maize (*Zea mays* L.) is the 3rd most important crop among the cereals after rice and wheat. Maize ranked 4th largest crop following cotton, rice and wheat in Pakistan. Maize occupied 1.334 million hectares of cultivated land with an average production of 6.13 million kg ha⁻¹ (FAO, 2020). About 10 percent of maize produced was used as food remain maize grains were used to extract important products like glucose, oil, starch and many other products. Maize seeds are used as industrial raw material in oil, alcohol, flakes, syrup, and in leather industry as tanning material. Its grains contains protein (10 %), oil (4.80 %), starch (72 %), Sugar (3 %), fiber (9.5 %), and ash (1 %) (Shanker et al., 2005). Inorganic sources of nutrients are important to boost the crop yield, but complete dependency on chemical fertilizers may adversely affects the important soil properties and crop productivity by time and results in soil degradation and other serious problems to the soil health (Hepperly et

al., 2009). Use of organic source i.e. Manures, Compost, And crop residues positively effect on improvement of soil health and crop productivity through improvement of the chemical, physical and microbiological properties of the soil and nutrient supply to crops. The organic matter content in tropical soil is more important than any other property of soil excluding moisture. Organic fertilizers has been not explored sufficiently. Use of integrated organic and chemical fertilizers a sustainable method for use of nutrient efficiently which improves effectiveness of the inorganic fertilizers while minimizing the nutrient losses (Schoebitz and Vidal, 2016).

Maize ranks 1st among all cereal crops in Azad Jammu and Kashmir and it is considered most important staple and fodder crop of the region. Overall more than 80 % of the cultivated land is allocated to maize crop during kharif. Hence, there is a need to adopt an integrated nutrient management approach to sustain food security without damaging the soil health and quality. Keeping

all these aspects in view, current experiment was designed with the objectives: To assess the efficiency of inorganic and organic nutrient sources on yield and physical growth of maize (*Zea mays* L.) crop. To determine the best integrated nutrient management practice for the study area.

MATERIALS AND METHODS

Location and Experimental Material: Trail was conducted at the research Farm of the Department of Agronomy, Faculty of Agriculture, and University of the Poonch Rawalakot, Azad Jammu and Kashmir in 2020. The maize variety Pioneer-30Y87 was used in the experiment.

Experimental Design and Treatments: The experiment was laid out in Randomized Complete Block Design (RCBD) with three Replicates. Treatments used in experiment were T1 = no fertilizer (control), T2= Full dose of NPK Recommended (120:60:40 kg ha⁻¹ respectively), T3= (SM) 10 tons of Sheep Manure ha⁻¹, T4= 10 tons of Farm yard manure ha⁻¹, T5= @10 tons ha⁻¹ Poultry Manure (PM), T6= Half dose of NPK recommended +@ 5 tons ha⁻¹ sheep manure, T7=Half dose of NPK recommended + @ 5 tons ha⁻¹ farm yard manure and T8=Half dose of NPK recommended + @ 5 tons ha⁻¹ poultry manure.

Parameters Studied: Growth and yield parameter under study were number of plants (m⁻²), plant height

(cm), cob length (cm), grain rows cob-1, number of grains row-1, number of grains cob-1, 1000- grain weight (g), yield (kg ha⁻¹).

Statistical Analysis

Collected data of different fertilizer treatments were subjected to ANOVA using statistical software Statistix 8.1 whereas, treatment means comparison was done using least significant difference (LSD) test at 5 % probability level (Steel et al., 1997).

RESULTS AND DISCUSSION

Number of Plants/m⁻²: Combined application of farm yard manure and NPK significantly enhanced the number of plants of maize per m². The treatment T7 = (Half NPK fertilizer + farm yard manure@ 5 tons ha⁻¹) produced the highest number of plants (11.00m⁻²) (Figure 1). These results confirmed that mixed application of inorganic fertilizers are better source nutrients as compare to poultry manure and chemical fertilizer. The results due to inorganic fertilizer in mix provides nutrients to crop at early growth stages while during alter stages nutrients are provided by organic component of fertilizer mixture after decomposition. These results were endorsed by finding of Amujoyegbe et al. (2007) and Ahmad et al. (2007), confirming the long-term benefits of integrated nutrient management in sustaining crop growth and productivity.

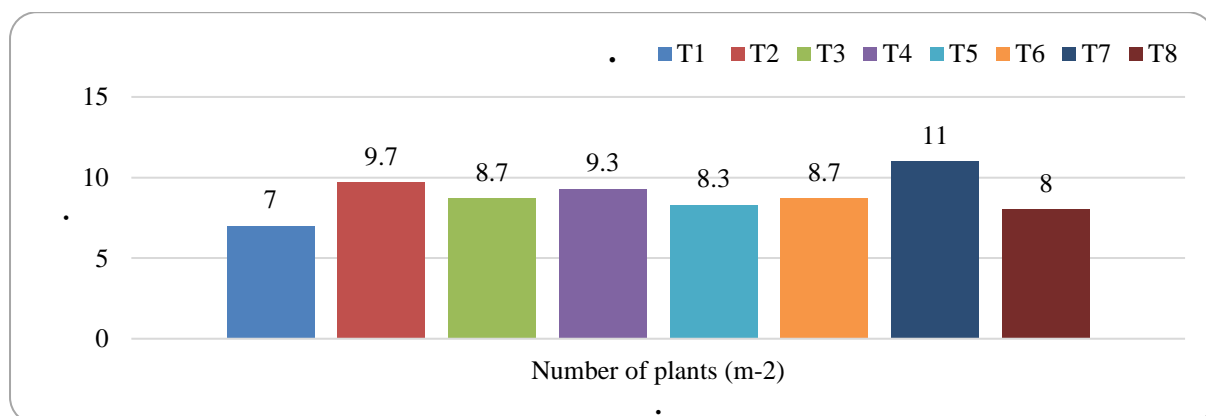


Figure 1. Effect of combined application of FYM and NPK on number of plants (m⁻²) in maize.

Plant Height (cm): Plant height is considered as one the most important characters for yield improvement in fodder crops. High uptake of NPK nutrients by crop results in increased vegetative growth like number and size of leave and plant height. Maximum plant height (212.80cm) was recorded form treatment T7 (50 % FYM+ 50 % NPK) (Figure 2). This may be due to quick release of nutrient from inorganic component at

early nutrient to the crop at initial growth stage, while the organic component slowly release nutrient at the later vegetative growth stages of the crop Ahmad et al. (2007).

Cob Length (cm): Cob length is an essentially contributes to yield improvement in maize. It considerably contributed to kernel yield in maize because it influenced both grain on size and numbers

of grains. The maximum cob length (20.667 cm) was obtained in treatment T7 ((Figure 3). Integrated use of inorganic and organic fertilizers. The causes for the improved cob length may be due to the fact that of more photosynthesis occurs maize plants in improved supply of nitrogen because Nitrogen is a crucial

element for crop growth. The probable argument for this may be judicious nutrient to the plant to produce a cob of more grains and length. Therefore, an improved cob length will be the key of the improvement economical yield in maize crop (Khan, 2012).

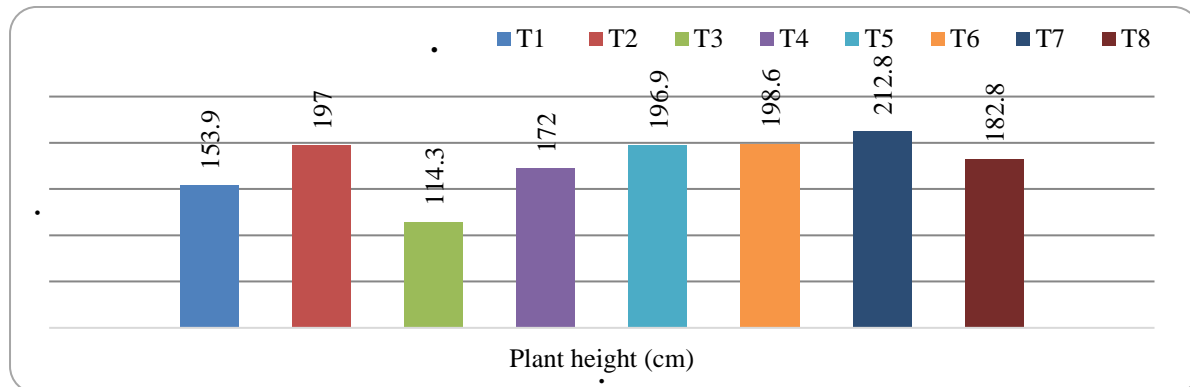


Figure 2. Effect of combined application of FYM and NPK on plant height (cm) in maize.

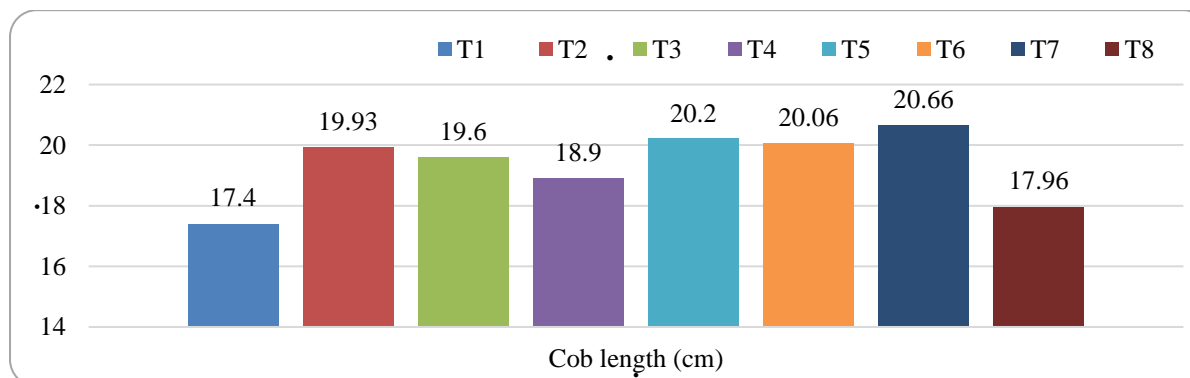


Figure 3. Effect of combined application of FYM and NPK on cob length (cm) in maize.

Number of Grains per Cob⁻¹: Maximum grains/cob were recorded for T7 (652.33 grains) trailed by T8 (593.67 grains) (Figure 4). Theses result showed that IFFYM is a good nutrient source. It may results due to release nutrients for inorganic source at early vegetative crop growth, whereas organic source provides essential nutrient to crop at reproductive stage. The grain yield improvement is positively correlated with number of grains/ cob as and cobs/plant. Our findings are in line with results of Tamayo et al. (1997).

Number of Grains per Row: Number of grains per row is an important trait that significantly contributes to the yield. Maximum number of grain per row recorded for T7 (41.80 Grains) (Figure 6).

The improvement in number of grains row⁻¹ of maize bay be results due to the prolonged grain filling period, accessibility to the plant to essential nutrients at critical stages and ears length. The increased nitrogen doses results improvement in the grains per row. Grains per row improved with addition of compost @ 5 t ha⁻¹. This improvement may results due to nutrients availability at proper stage from integrated sources helps plant growth and development, increase cob length and diameter and improved seed development. Pandey et al. (2000) and Tamayo et al. (1997) reported that seed weight increase with increase in grains ear⁻¹ and reduces the infertility of ears in maize crop.

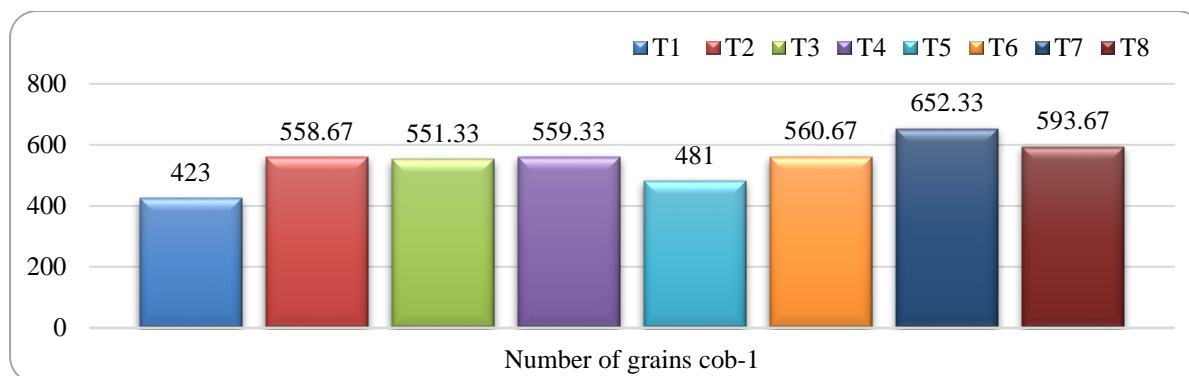


Figure 4. Effect of combined application of FYM and NPK on number of grains/cob in maize.

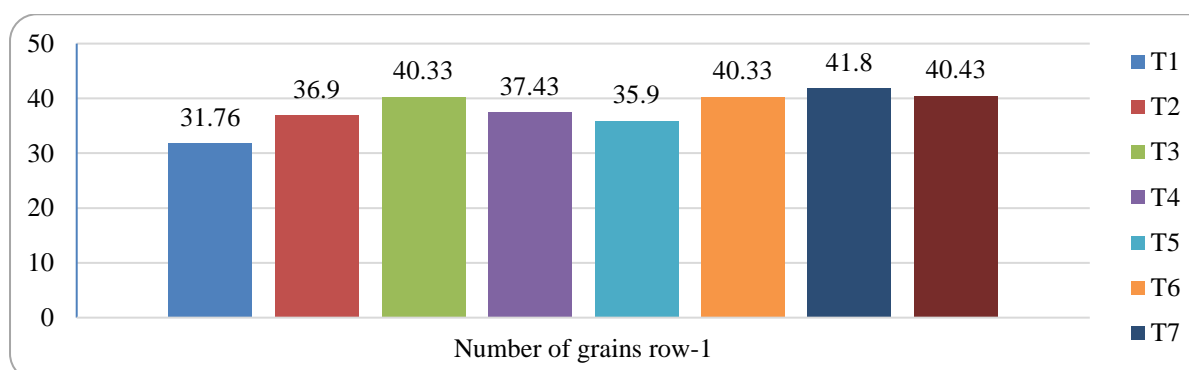


Figure 5. Effect of combined application of FYM and NPK on number of grains/row in maize.

1000- Grain Weight (g): Grain weight is the most important yield contributing character of maize crop. Maximum grain weight recorded for T7 (188.9 g) (Figure 6). Among different traits contributing to the crop yield, 1000 grain weight is most significant. The combined application of inorganic + organic results improvement in grain yield. Shah et al. (2009) reported that integrated

use of inorganic and FYM positively affected on 1000 grain weight. The enhancement in grain weight was results attributable to adequate supply of plant nutrients from both inorganic urea and organic Poultry manure during the period of grain development and Filling. Current findings are at par with findings of Ma et al. (1999).

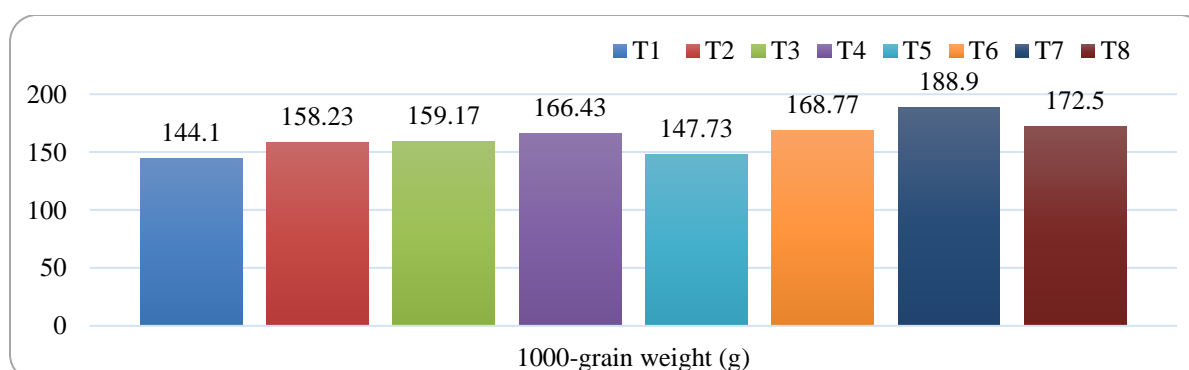


Figure 6. Effect of combined application of FYM and NPK on 1000- Grain Weight in maize.

Grain Yield (kg ha⁻¹): Grain yield is the final result and it is resultant of various complex physiological and processes morphological occurs during the growth and development of plants (Khanh et al., 2005). Maximum yield was produced from treatment T7 produced (6836.7 kg ha⁻¹) trailed by T5 (3813.3

kg ha⁻¹) (Figure 7). The high grain yield is combined with application of nutrient sources batter plant growth attributes, grain development and efficient use of nutrient by plants. Yield is the main goal of any crop grown.

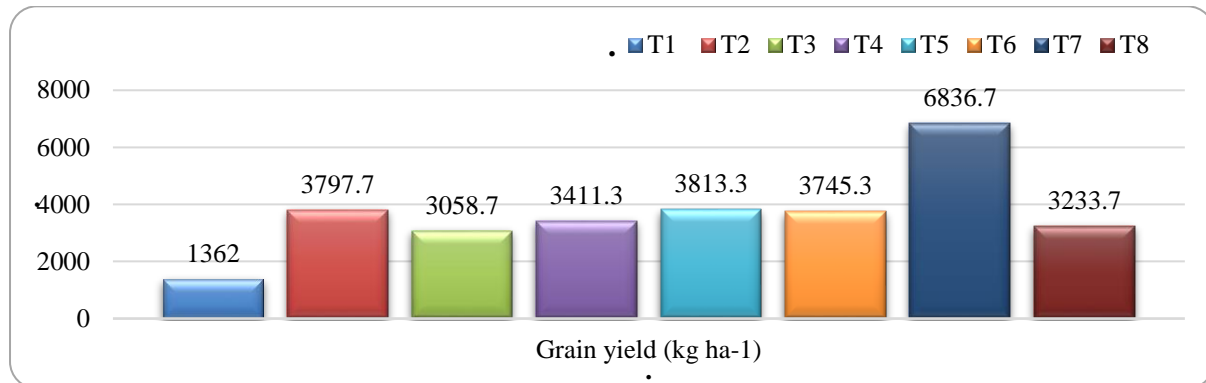


Figure 7. Effect of combined application of FYM and NPK on grain yield in maize.

CONCLUSION

Results obtained from the experiment showed that yield production can be increased by appropriate utilization of the use of fertilizers. The result showed that different combination of fertilizer (organic and inorganic) significantly effects the yield contributing parameter of maize. However, it is recommended that combined application of organic and inorganic fertilizers can be prove a better soil nutrient amendment when applied at a ratio of 50% dose of farm yard manure (FYM) + 50% dose of NPK in the cultivation of maize under rainfed conditions of Rawalakot.

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