Effects of planting method and a combination of organic and inorganic nitrogen on maize (*Zea mays*) growth.

Abstract

Two lead treatments (flatbed and raised bed) and five nitrogen treatments (100 percent inorganic source, 100% farm yard manure, 50% inorganic source + 50% by farm yard manure, 75% inorganic source + 25% by farm yard manure, and 100% inorganic source + 25% by farm yard manure) were used in the triplicate study, which was conducted using a split plot design. The samples were analyzed 25, 50, and 75 days after sowing. The administration of treatment T3 (50% IO + 50% FYM) produced the tallest number of plants, as well as the most leaves per plant, weight per plant, and dry weight per plant, according to the results. On the shortest day, 50% tasseling was noted; nevertheless, this occurred with T1 (100% IO) application. Therefore, the combination of organic nitrogen sources with inorganic nitrogen sources in T3 (50% Inorganic + 50% Farm yard manure) with litter improved the performance of maize. It is recommended to use beds with 50% Inorganic + 50% Farm yard manure for crop growth.

Keywords: Chemical fertilizers, combined management of nutrients, growth criteria, natural and artificial & planting methods

Introduction

Corn (*Zea*mays L.) also referred as the "queen of cereals" as it has high yielding capacity and widespread use in hot and humid regions of the world. The United States of America is the largest maize producer, followed by China and Brazil, while India is the world's sixth largest maize producer. In terms of consumption, corn ranks third after wheat and rice. Corn has many uses such as starch, silage, gasoline and biofuel, as well as human consumption and animal feed. It also contains vitamins, carbohydrates, fiber and minerals. India produced 31.51 million tonnes in an area of 9.9 million hectares in 2020-21, whereas in kharif 2021-22, maize production was 21.24 milliontonnesin an area of 8.15 million hectares.

The area also receives a lot of rain during the summer, which, combined with poor drainage, results in a massive loss of plant nutrients that would not be available to crops. As a C4 crop, corn has the potential to enhance yields; nevertheless, some of the obstacles to achieving high yields for this crop are the state's farmers' inadequate technological equipment and lack of agronomic innovations. The development of paddy fields has a benefit over bed farming in today's agricultural management system since it is simple to alter and replace as necessary in nutrients for growing crops while allowing for efficient rainfall management.Raised bed gardening also protects crops from soil crusts and saves 25–30% of field applied water for crops that yield more. In order to prevent an excessive amount of moisture, water in the bed moves horizontally through the capillaries from the furrow to the bed surface.

Raised bed corn benefits from crop protection and absorbs more solar energy from the border effect than crop shade. Due to its high nutritional value (160–200 kg N ha^{-1}), corn needs a lot of inorganic fertilizer to grow. Depending on the type of cultivation, farmers do not wish to utilize a combination of nutrients (natural + artificial) to lower cultivation costs by using fewer costly

inorganic fertilizers. Natural fertility will aid as a nutrient of low-cost harvested crop in accordance with soil law and practice, which uses organic and inorganic elements in the village. Combining natural and inorganic fertilizers can boost soil fertility through extra benefits and sustain production stability for an extended period of time (Ponnusamy *et al*., 2017) [5]. Therefore, to increase the hardness and density of the soil in the area, a proportionate amount of organic fertilizer (farm manure) and inorganic fertilizer should be applied. In addition to enhancing the soil's chemical and physical characteristics, the application of agricultural fertilizers can also promote the emergence of fragility, which will eventually take the place of overuse of chemical fertilizers.

Material & Methods

The experiment was carried out at Rama University'sagricultural farm in 2023 Kanpur, 209217, Uttar Pradesh, India. Shakti 1001, a lysine and methionine-rich QPM variety, was the one utilized. The study was conducted with three replications and comprises two primary applications and five sub-plot applications. The procedures were created using the split plot design. Raised and flat beds in the following combinations are included in the data processing: T1 represents 100% nitrogen from urea, T2 represents 100% nitrogen from farm yard manure, T3 represents 50% nitrogen from urea plus 50% nitrogen from farm yard manure, T4 represents 75% nitrogen from urea plus 25% nitrogen from farm yard manure, and T5 represents 100% nitrogen from urea plus 25% nitrogen from farm yard manure.

At 25, 50, and 75 DAS (days after sowing), data were gathered on five plants chosen from each plot. The mean value of each parameter, such as plant height and number of leaves per plant, was noted at various stages along with the leaf index, fresh weight, dry weight, and percentage of 50% tassel information.

Result & Discussion

It has been discovered that mixing artificial and natural nitrogen sources has a positive effect on plant growth, particularly on the height of maize plants. At 25, 50, and 75 days after sowing, treatment T3, which applied 50% nitrogen through integrated organic sources and 50% nitrogen through farm yard manure on raised beds, significantly outperformed the other treatments in terms of plant height (55.80 cm, 78.80 cm, 104.80 cm). Kesarwani*et al*. (2017) [3] and Raman and Suganya (2018) [6] have reported similar results, showing that adding various inorganic nutrients to poultry dung or farm yard manure increased plant height. This suggests that organic matter has a beneficial effect on nutrient buildup and encourages the growth of plants. On the other hand, the treatment T5, which included 25% nitrogen from farm yard waste and 100% nitrogen from integrated organic sources, produced the smallest plant heights (42.20 cm, 64.20 cm, and 94.20 cm) at 25, 50, and 75 days after sowing. For the T3 treatment (50% N of inorganic + 50% N of farm yard manure) with raised bed administrations at 25, 50, and 75 Days after planting (10.03, 11.70, 12.80), the number of leaves per plant demonstrated positive outcomes. The effect of mixing organic and inorganic fertilizers, which supplied the nutrients required for plant growth, was an increase in the number of leaves per plant. Similarly, Amanullah et al. (2016) [9] discovered that the greatest number of leaves resulted from the combination of beneficial bacteria and several environmentally friendly carbon sources, such as plant wastes and manures. Moreover, Singh *et al.* (2017) [7] found that their study covered eight health coordinating systems and that the greatest results were found for T2 - 100%

Recommended dose of fertilizer + vermicompost (5t ha^{-1}) and T4 - 75% Recommended dose of fertilizer + vermicompost. Treatment T3, which administered 50% of the nitrogen through farmyard manure (FYM) and 50% through recommended dose of fertilizer (RDF) on raised beds, had the largest leaf area recorded. Treatment T1, in which 100% of the nutrition supply came from inorganic sources, came next.

This is because more productive and balanced plant growth is encouraged by balanced nutrient absorption. Similar outcomes, wherein the addition of inorganic fertilizer to FYM increased leaf area, were reported by Kannan *et al.* (2013) [2]. Although raised beds perform somewhat better than flat beds, there doesn't seem to be much of a difference in performance between the two types of beds. In the T3 treatment, where 50% of the nitrogen in the bed came from FYM and 50% from RDF, fresh and dry weight was determined to be the most effective. This can be explained by the fact that farm yard manure grows well and releases nutrients gradually, which causes a greater release of nutrients in the plant and a corresponding loss of fresh and dry weight. Verma *et al.* (2018)[8] also discovered that fresh and dry viability in T4 application was enhanced by the combination of RDF and FYM, wherein FYM provides 25% of the nitrogen while fertilizers provide 75%. Based on the study's findings, it was discovered that both the T1 application of inorganic fertilizers (100% Nitrogen via inorganic) and the T2 application of organic fertilizers (100% Nitrogen via farm yard manure) produced quick results. INM procedure and Tassel process. In their research, Pilar *et al*. (2017) [10] discovered that while a rise in nitrogen content caused sunset in both men and women, the application of 100% inorganic fertilizers resulted in the shortest period (50 days) for male and male development.

Conclusion

When paired with the raised bed, the treatment T3, which contained 50% nitrogen from inorganic sources and 50% nitrogen from farm yard waste, produced noticeably better outcomes in terms of maize growth parameters. In addition, compared to applying only inorganic or organic treatments, the use of INM enhanced soil structure and produced a more favorable environment for plant growth. Raised bed planting efficiently controlled resources and enhanced nitrogen uptake through the application of a balanced INM method. Consequently, among the several applied combinations for attaining optimal growth, the integration of the raised bed treatment and T3 (50% Nitrogen via. Inorganic + 50% Nitrogen via. Farm Yard Manure) was found to be the most successful.

Table 1: Theeffectofcombinationofnitrogenonheight ofplantandcornleafnumber

T.No.	Treatment	PlantHeight (cm)			No.ofleaves/plant			LeafArea(cm^2)		
		25DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
MainPlotTreatment										
P_1	FlatBed	51.50	65.20	93.30	6.51	7.91	9.78	84.5	428.6	465.7
P_2	RaisedBed	51.51	77.12	102.27	10.01	12.24	13.18	85.1	431.4	474.2
Sem±		0.52	1.12	0.34	0.07	0.17	0.14	1.25	3.01	3.23
CD(0.05)		2.14	4.6	1.28	0.33	0.76	0.63	2.11	6.01	6.74
SubPlotTreatment										
T_1	100%IO	57.10	75.65	101.83	7.25	8.40	12.53	83.1	474.5	645.3
T_2	100%FYM	50	70.41	97.50	6.86	8.81	10.27	55.4	382.1	456.3
T_3	50%IO + 50% FYM	55.80	78.80	104.80	10.03	12.80	11.70	80.6	494.2	655.6
T_4	75%IO+ 25%FYM	48.56	66.17	96.65	6.20	7.30	8.92	51.5	453.1	463.2

T_5	100%IO + 25% FYM	42.20	64.20	94.20	7.35	7.95	7.17	79.6	494.2	655.6
Sem±		1.43	0.97	0.55	0.33	0.44	0.37	1.21	3.16	7.71
CD(0.05)		2.93	1.88	1.04	0.70	0.93	0.78	2.71	7.06	17.16

Table 2: Effectofcombinationofnitrogenon Fresh weight & Dry weight,Daysof50% tasseling

T.No.	Treatment	FreshWeight (gm)			DryWeight(gm)			Daysof50%tassel
		25DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	
MainPlotTreatment								
P_1	FlatBed	14.76	92.24	145.24	2.11	15.01	27.41	61.02
P_2	RaisedBed	17.66	103.12	161.40	3.98	22.07	33.53	58.61
Sem±		2.12	4.2	4.04	1.27	4.32	3.43	1.33
CD(0.05)		3.73	5.72	11.7	2.24	NS	NS	NS
SubPlotTreatment								
T_1	100%IO	20.12	93.17	164.11	4.23	23.15	22.67	60.04
T_2	100%FYM	15.20	93.01	154.33	2.51	12.17	33.65	57.33
T_3	50%IO + 50% FYM	21.04	112.65	167.33	6.54	24.67	41.50	61.86
T_4	75%IO + 25% FYM	13.63	96.50	146.50	2.78	17.83	24.33	62.04
T_5	100%IO + 25% FYM	14.03	86.11	133.51	3.51	11.81	30.15	61.31
Sem±		3.70	5.3	5.6	1.40	4.63	7.13	1.61
CD(0.05)		6.6	8.2	12.6	1.85	NS	NS	2.27

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