Effect of Organic and Inorganic Nitrogen Management And Planting Technique on Yield of Maize

ABSTRACT

The experiment was set up at the Dr. Khem Singh Gill Akal College of Agriculture's experimental farm chhapang at the Eternal University in Baru Sahib during 2019–20 to assess the impact of organic and inorganic nitrogen management and planting technique on maize yield. The experiment was designed as a split plot with a total of three replications of each of the two main plot treatments, Flat bed and Raised bed, and five sub plot treatments, 100% IO, 100% FYM, 50% IO + 50% FYM, 75% IO + 25% FYM, and 100% IO + 25% FYM. The observations were made at 25, 50, and 75 days following sowing. According to the results, treatment T3 (50% IO + 50% FYM) produced the highest levels of cobs per plant, cob diameter, cob number of grains per cob, cob weight per plant, cob length, test weight, index of harvest, yield of grain, and straw yield. Therefore, combining organic and inorganic inputs in T3 (50% IO + 50% FYM) with raised beds led to high maize yield performance. For sustainable maize development, the mixture of Raised bed with 50% IO + 50% FYM might be advised.

Keywords: Attributes of Yield, Fertilisers, Integrated Nutrition Management, Organic and Inorganic, Planting methods

INTRODUCTION

Maize (Zea mays L.) is renowned as the "Cereal Queen" because to its great production capacity and widespread acceptance in temperate and tropical locations across the world. The United States is the world's greatest maize producer, followed by China and Brazil, with India ranking sixth on the list of major maize producing countries. Maize is the third most significant cereal after wheat and rice in terms of consumption. Apart from human consumption and animal feed, maize has several other applications such as starch, silage production, oil production, and biofules. It is also high in vitamins, carbohydrates, dietary fibres, and minerals like as magnesium, phosphorus, zinc, copper, and iron..

Himachal Pradesh is the fourth-largest corn-growing state in India, behind Karnataka, Telangana, and Bihar, with an area of 294.3 thousand hectares and a

production of 644.4 thousand tonnes in 2017-18 (NCoMM report, 2017). The Sirmaur district is located in Himachal Pradesh's mid-hill area, and its distinct climate and agro-ecological condition have a direct impact on agricultural output. The region's soils are formed on sandstone and have minor acidic to neutral responses. The tract is also plagued by heavy rains during the kharif season, along with poor drainage, resulting in significant losses of plant nutrients that would otherwise have been accessible to the region's nutrient-depleted crop.

Maize, as a C4 plant, has the ability to yield more, but a lack of matching agronomic technologies, as well as a lack of technological adoption capacity among state farmers, are some of the bottlenecks to achieving better yields from this crop. Raised bed planting provides advantages over flat bed sowing in terms of simple translocation and conversion of soil nutrient to accessible plant nutrition for absorption, as well as relevant rain water management. Raised bed planting also protects the crop from soil encrusting while conserving 20-30% of irrigation water for enhanced crop development. Water travels horizontally from the furrow to the bed surface via capillaries in a raised bed design, preventing excessive soil moisture effect. Maize grown on raised beds traps more solar energy through the crop canopy due to the border effect, as well as providing extra benefits to keep the crop from lodging. (Anisha and Rakesh, 2022)

Maize is a nutrient-intensive crop (150-200 Kg N ha-1) that requires a high quantity of fertiliser to fulfil crop demands. Farmers with limited resources who rely on maize farming choose to employ nutrient integration (inorganic+ organic) to reduce cultivation costs by reducing the usage of costly inorganic fertilisers. The utilisation of locally accessible organic and inorganic nutrient sources as applied nutrient sources, together with the intrinsic fertility state of the soil, aids in meeting crop nutrition harvest demands at comparatively reduced prices. Through this process of combining organic and inorganic fertilisers, crop production is sustained for a longer period of time, and soil fertility is increased due to the complementary effects (Ponnusamy et al., 2017). It is consequently critical to improve the region's hard and compact soils by the proportional application of organic manures (Farm Yard Manure) and inorganic fertilisers. Farmyard manure not only enhances the physio-chemical qualities of the soil, but it also acts as a vulnerable amendment to replace the excessive usage of chemical fertiliser.

MATERIALS AND METHODS

The trail was held in Dr Khem Singh Gill Akal Collage Agriculture, Buru Sahib, during the kharif season of 2019. Shakti 1001, a QPM cultivar high in lysine and methionine, was grown on clay loam soil that was slightly acidic in nature (pH 6.34). The experiment had two main plot treatments and five subplot treatments, each with three replications, and treatments were constructed using a split plot design. The treatment plan incorporates elevated and flat beds in the following integration combinations:- T1 = 100% N by Urea, T2 = 100% N via FYM, T3 = 50% N by Urea + 50% N via FYM, T4 = 75% N by Urea + 25% N via FYM, T5 = 100% N by Urea + 25% N via FYM. The data were collected during and after harvesting from five randomly selected plants from each plot that were tagged, and the average of each parameter was recorded at different stages, including the number of cobs/plant, diameter of cob, ear length, number of grains/cob, cob weight/plant, length of cob, test weight, harvest index, straw yield, and grain yield.

RESULT AND DISCUSSION

Organic matter placed on raised beds of maize crop in addition to RDF exhibited favourable impacts on the yield characteristics of plants produced on raised beds that had undergone nutrient replacement through organic sources. The values of different yield attributing features such as cob/plant, diameter of cob, grain/cob, cob weight/plant, length of cob, test weight, harvest index, straw yield, and grain yield statistically varied for residual effects in maize crop experiments during kharif. Treatment T5 had the lowest values in all of the qualities studied. T3 had much higher values in practically all yield attributing features than the initial two best treatments, T1 and T4. This might be attributed to the presence of very persistent material, such as cellulose, in FYM, which took more time to decompose. Thus, nitrogen released from FYM over a longer length of time had a substantial impact on subsequent crops.

Maximum number of cob/plant (8.33) and diameter of cob (5.67cm) was recorded in T_3 treatment. However, it exhibited significantly superior to all the treatments, T_5 (100 % IO + 25 % FYM) recorded the lowest of both the attributes. Observation recorded by

verma et al., (2018) indicated same result as ours, the influence treatment in maize on number of cobs/ plant and diameter of cob showed better nutrient uptake and development of plants and cobs due to combined application of mineral fertilizer and organic manure. Kumar et al., (2020) have similar results with highest diameter of cob on raised bed with integrating nutrients.

The highest value of cob weight per plant (45.77g) was also recorded with treatment T_3 (50 % IO +50 % FYM) here also the presence of organic matter influences nutrient accumulation and promotes increase in weight of individual cobs, resulting in higher weight. However the minimum cob weight observed was in treatment T_5 (100 % IO + 25 % FYM) which was 27.97 g.

More length of cobs were observed under T_3 treatment (50 % IO + 50 FYM) on raised beds which was (17.17cm) compared to rest treatments. T_3 treatments was significantly superior to all the treatments and the same result was found in case of harvest index too. Harvest index of 55.71% was highest and was recorded with treatment T3 (50 % IO + 50 FYM) but in the case T_3 was statistically at par to T_4 and T_5 treatments, The more length of cobs was resultant of integration of organic and inorganic fertilizer which attribute to the rest availability of nutrient during the growth phase of plants. Similarly Raman and suganya (2018) stated that applying RDF + compost (5t ha^{-1}) resulted higher cob length and harvest index which was significantly superior to all.

Weight of thousand grains was observed highest in T_3 treatment where 50% N was applied via. RDF and 50% N via. FYM, similar results were reported by Khalid, S (2016) for weight of thousand grains, as he said the results were significantly affected by integration of nutrients. Number of grain/cob was recorded highest in treatment T_3 (50 % IO + 50 FYM) which was 319 and lowest in the treatment T_5 (100 % IO + 25 % FYM) which was 187, still the treatment had no significant effect on the number of grain/cob.

Data indicated that application of 50% N via inorganic source + 50% N via. FYM in treatment T_3 with raised beds hasten the maize straw yield and grain yield which were respectively 4351.80 kg/ha and 3518.47 kg/ha. The increase in yield might be attributed to significant improvements in yield parameters such as number of cobs/plant, cob length, cob diameter, and number of grains/cob (Tables 1 and 2). Amanullah et al., (2015) found that combining N (150 kg ha-1) with compost (2 t ha-1) significantly

increased maize straw production (9294 kg ha-1) and grain yield (3097 ka ha-1). Singh et al.,(2017) also reported that of the eight INM treatments tested, T2 - 100% RDF + vermicompost (5 t ha-1) and T4 - 75% RDF + vermicompost (5 t ha-1) statistically produced the highest grain production. According to Gundlur et al., (2015), the prescribed amount of fertiliser (RDF) plus biofertilizer (Azospirillium + PSB at 350 g ha-1) provided the maximum grain yield (77.60 q/ha) and forage production (122.69 q ha-1) due to higher NPK absorption by maize plants, followed by treatment with 100% RDF. According to Kumar (2015), using 100% RDF+30 kg N ha-1 vermicompost leads in better grain production (4158 kg ha-1) and straw yield (7066 kg ha-1) than using 100% RDF+0 kg N ha-1 vermicompost. According to Kesarwani et al., (2017), the integration of 50%RDF + 5 t ha-1 Poultry manure + 5 t ha-1 FYM (T6) led in the highest maize yield (10.56 t ha-1) and straw production (12.56 t/ha).

CONCLUSION

As a consequence, the study found that the treatment T3 of 50% N via inorganic + 50% N via FYM yielded considerably superior outcomes than the raised bed treatment in terms of maize yield characteristic. When compared to a solo inorganic or organic treatment, integrated nutrient management improves soil structure and provides a better environment for plant growth. The use of balanced integrated nutrient management results in increased nutrient absorption, and raised bed planting techniques provide excellent resource management. As a result, among different treatment combinations, the combination of raised bed treatment with T3 (50% IO + 50 FYM) was determined to be the best for increasing yield and yield characteristics.

Table 1: Effect of integrated nutrient management with planting techniques on No. of cob/plant, Dia. of cob and No. of grain/cob of maize.

T. No.	Treatment	No. of cob/plant	Dia. of Cob	No. of grain/cob
	Main Plot Treatment			
P_1	Flat Bed	1.93	2.45	234.93
P_2	Raised Bed	5.73	4.49	252.87
Sem±		0.11	0.08	11.96
CD(.05)		0.47	0.34	NS
	Sub Plot Treatment			
T_1	100% IO	4.00	3.65	293.17
T_2	100% FYM	3.67	3.08	236
T_3	50% IO + 50% FYM	5.83	4.08	295
T_4	75% IO + 25% FYM	3.50	3.39	206.50
T_5	100% IO + 25% FYM	2.17	3.17	188.83
Sem±		0.26	0.19	43.35
CD(.05)		0.55	0.40	NS

Table 2: Effect of integrated nutrient management with planting techniques on cob weight, length of cob, test weight and harvest index of maize.

T. No.	Treatment	Cob weight(g	Length of cob	Test weight	Harvest index
	Main Plot Treatment				
P_1	Flat Bed	31.73	8.50	219.97	42.20
P_2	Raised Bed	33.15	13.43	220.68	43.84
Sem±		0.59	0.04	0.16	0.72
CD(.05)		NS	0.17	0.68	NS
	Sub Plot Treatment				
T_1	100% IO	36.38	11.08	220.64	48.50
T_2	100% FYM	30.81	10.62	219.41	42.47

T_3	50% IO + 50% FYM	38.89	12.95	221.66	49.59
T_4	75% IO + 25% FYM	29.51	10.48	220.33	35.12
T_5	100% IO + 25% FYM	26.61	9.70	219.59	39.40
Sem±		2.9	0.59	0.65	2.89
CD(.05)		4.2	1.25	1.37	5.6

Table 3: Effect of integrated nutrient management with planting techniques on straw yield and grain yield of maize.

T. No.	Treatment	Straw yield(Kg/ha)	Grain yield (kg/ha)
Main Plot Treatment			
P_1	Flat Bed	1871.27	1021.14
P_2	Raised Bed	3184.21	2345.33
Sem±		218.5	226.4
CD(.05)		939.5	973.09
Sub Plot Treatment			
T_1	100% IO	3194.40	2360.95
T_2	100% FYM	2025.42	1164.32
T_3	50% IO + 50% FYM	3416.63	2569.27
T_4	75% IO + 25% FYM	2398.12	1564.75
T_5	100% IO + 25% FYM	1604.14	756.88
Sem±		229.6	222.8
CD(.05)		482.16	467.8

REFERENCES

Amanullah D R and Shah K (2016) Integrated use of phosphorus, animal manures and biofertilizers improve maize productivity under semiarid condition. **10**.5772:61454.

Gundlur, S. S., Patil, P. L., Rajkumara, S., Ashoka, P., & Neelakantha, J. K. (2015). Influenceof integrated nutrient management on yield and uptake of nutrients by maize and soil fertility under irrigated conditions in Vertisol. *Karnataka Journal of Agricultural Sciences*, ***28***(2), 172-175.

Kesarwani A and Wailare A T (2017) Effect of Integrated Nutrient Management on Growth and Yield Parameters of Maize (*Zea mays* L.) As well as Soil Physico-chemical Properties.

Khalid, S. (2016). Integrated use of phosphorus, animal manures and biofertilizers improve maize productivity under semiarid condition. In *Organic Fertilizers-From Basic Concepts to Applied Outcomes*. IntechOpen.

Kumar, R., Bohra, J. S., Kumawat, N., & Singh, A. K. (2015). Fodder yield, nutrient uptake and quality of baby corn (*Zea mays* L.) as influenced by NPKS and Zn fertilization1. *Research onCrops*, ***16***(2), 243-249.

Methylotrophic Interactions in Organic Farming. In *Microorganisms for Green Revolution* (pp.167-187). Springer, Singapore.

NCoMM 2017 Special Report-National Collateral Management Services Limited. pp:1-3

Ponnusamy V, Shanmugam J, Gopal M and Sundaram S (2017) Perspectives of Plant-

Raman R and Suganya K (2018) Effect of Integrated Nutrient Management on the Growth and Yieldof Hybrid Maize. *Journal of Agricultural Research*, **3**(2): 1-4.

Singh L, Kumar S, Singh K and Singh D (2017) Effect of integrated nutrient management on growth and yield attributes of maize under winter season (*Zea mays* L.). *Journal of Pharmacognosy and Phytochemistry*, **6**(5): 1625-1628.

Verma K, Bindra A D, Singh J, Negi S C, Datt N, Rana U and Manuja S (2018) Effect of integrated nutrient management on growth, yield attributes and yield of maize and wheat in maize-wheat cropping system in mid hills of Himachal Pradesh. *Int. J. Pure App. Biosci*, **6**(3): 282-301.

Anisha M and Rakesh Kumar (2022) Effects of Organic and Inorganic Nitrogen Management and Planting Techniques on the Growth of Maize (Zea Mays). J Adv Agron Crop Sci 1: 1-5.