

Effect of Organic and Inorganic Nitrogen Management and Planting Technique on Nutrient Uptake by Maize Crop

Abstract

Maize production is affected by many factors including climate and soil parameters. Soil parameters may include nutrient availability and management. Maize crop production may also be highly affected by the planting techniques involved in its cultivation. These may in the long run have an impact on the yield realised from a particular enterprise. The research was conducted in 2019-20, at Chhapang Experimental Farm, Dr. KSG Akal Faculty of Agriculture, Eternal University, Baru Sahib, to analyze the effects of organic and inorganic nitrogen management and planting strategies on the nutrition of crops. Experiments were conducted in a split-plot design for 3 replications with 2 main applications (i.e. flatbed and raised bed) and 5 minor treatments (i.e. 100% IO, 100% FYM, 50% IO + 50% FYM, 75% IO + 25% FYM, 100% IO + 25% FYM) and observed at 25, 50 and 75 days after sowing. The results showed that T3 treatment (50% IO + 50% FYM) showed the highest yield from corn and straw. Therefore, the integration of T3 (50% IO + 50% FYM) with organic and inorganic in the raised bed resulted in the best maize. A litter mix of 50% IO + 50% FYM is recommended for maize growth and quality management.

Keywords: Inorganic fertilizer, integrated nutrient management, Nutrient uptake, Organic manure and Planting ways.

Introduction

Corn (*Zea mays* L.) has been called the "Queen of Grains" (Shirk, 2007) for its high productivity and adoption in many parts of the world, even in tropical climates or hot. The United States is the largest corn producer, followed by China and Brazil, while India ranks sixth in the list of the world's largest corn producers (K Ullah, 2015). In terms of consumption, maize is the third largest grain after wheat and rice (Majamanda et al., 2022a). Besides the use of maize for human consumption and animal feed (Majamanda et al., 2022b), there are other uses such as starch, silage, oil production and biofuel. It also contains vitamins, carbohydrates, fiber and minerals such as magnesium, phosphorus, zinc, copper and iron (Majamanda et al., 2022b).

In the list of maize growing areas in India, Himachal Pradesh ranks second after Karnataka, Telangana and Bihar with an area of 294.3 million hectares and a production of 644.4 million tons in 2017-18 (NCoMM report, 2017). The Sirmour region is located in the central mountains of Himachal Pradesh and its unique climate and agro-ecological conditions directly affect the productivity of crops. The soil in this area is made of sandstone and has a slightly acidic-to-neutral reaction. The area also gets a lot of rain in the summer, which

combined with poor drainage renders plants ineffective, making them suitable for nutrient-poor crops in the area.

Maize is a C4 plant with the potential to increase yields, but inconsistent agronomic technologies and inadequate technology of state farmers are some of the barriers to achieving high yields for this crop. In today's agricultural management system, the cultivation of paddy fields has an advantage over bed cultivation because it is easy to change and replace as-Ham in nutrients for growing crops while allowing for effective rainfall management. Raised bed planting also protects crops from soil crusts and saves 20-30% of irrigation water for better crops. In the bed, the water moves horizontally from the furrow to the bed surface, passing through the capillaries, which will prevent excessive moisture. Corn planted in raised beds captures more solar radiation from the border effect than the crop shade and has the benefit of crop protection.

Corn is a very nutritious crop (150-200 Kg N ha⁻¹) that requires a lot of fertilizer to meet the crop. Farmers do not want to use a combination of nutrients (inorganic + organic) to reduce the cost of cultivation by reducing the use of expensive inorganic fertilizers, depending on the cultivation. Natural fertility according to the practice and soil law to use organic and inorganic materials in the village as nutrients will help as nutrient of low-cost harvested crop. Thanks to the combined fertilization of organic and inorganic fertilizers, the stability of crops can be maintained for a long time and soil fertility can be improved with additional benefits (Ponnusamy et al., 2017). Therefore, organic fertilizer (farm manure) and inorganic fertilizers should be used proportionally to improve the hardness and density of the soil in the area. The use of agricultural fertilizers not only improves the physical and chemical properties of the soil, but also acts as a simple replacement to replace excess chemical fertilizers.

MATERIALS AND METHODS

The study was conducted during the kharif season of 2019 at Chhapang Research Farm of Dr Khem Singh Gill Akal College Agriculture, Buru Sahib. The variety used is Shakti 1001, the

QPM variety rich in lysine and methionine, planted on a nice and slightly acidic (pH 6.34) clay loam soil. The experiment consists of 2 main applications and 5 sub-plot applications and is carried out with 3 replications, and the processes are designed according to the split-plot design. Treatment data includes flatbed and raised bed and the following combination of treatment: - T1 = 100% N from urea, T2 = 100% N from FYM, T3 = 50% N from Urea + 50% N from FYM, T4 = 75% N from Urea + 25% N from FYM, T5 = 100% N from Urea 25% N from FYM. From this experimental setup, data was collected and recorded after harvesting of grains and straw.

RESULT AND DISCUSSION

Organic matter applied in addition to RDF(Recommended Dose of Fertilizer) on raised beds of maize crops had positive effects, which improves nutrient uptake from soil. Nutrient intake refers to all the nutrients absorbed by the crop during growth. Consumption of foods from crops depends on plant material, their composition, and their share in the total dry matter. As shown in table 1, the removal of the maize straw in T₃ would mean the removal higher content of N and P. Actual spacing will vary with crop yield, crop diversity, soil fertility, and management level. Therefore, nutrition can provide a reliable estimate of food availability based on different soils and climates. However, the exact structure can only be determined by laboratory analysis. In general, the nutritional quality of maize increases with the use of feed with a combination of organic and inorganic fertilizers (Prajapati et al., 2015). Prajapati *et al.* 2015, from their research, reported that the highest nutrient uptake of N, P₂O₅, and K₂O was observed under treatment where integration of organic and inorganic source is applied i.e. 25% RDF + 50% FYM + Biofertilizer over sole application of either organic or inorganic material.

The data in Table 1 revealed that there was a significant effect of various sources of nutrients on treatment T3 (50% N via. Urea + 50% N via. FYM) on the nutrient uptake of maize, similar data were observed in the experiment of Krishnakhi et al., (2018) that higher nutrient uptake was found in case of INM(Integrated Nutrient Management) treatment (50% RDF + 50% N via compost) as compared to RDF treatment solely. The highest uptake of N, P₂O₅, and K₂O was observed in the application of T3 (50% N via. Urea + 50% N via. FYM). In the case of N uptake treatment T1 and T2 were found at par with T3 (50% N via. Urea + 50% N via. FYM) the uptake of N, P₂O₅ and K₂O was found higher to the tune of 1.35, 0.22 and 7.0 % in application of T3 (50% N via. Urea + 50 % N via. FYM). This might be due to the

combined effect and rapid release of nutrients by decomposition of FYM and also due to the availability of N, and P₂O₅ which are added in the soil through organic and inorganic resources by urea, SSP(Single Super Phosphate). Satish et al. (2011) reported that the combination of organic and inorganic fertilizers showed an increase in the value of all three nutrients, consistent with the results obtained in this study. Even Muhammad et al., (2012) also reported the same results in their study on maize productivity and nutrient uptake that the highest N uptake was observed with 50% + 50% (chemical fertilizer + FYM) as compared to the sole application of organic or mineral fertilizer.

Effect of nutrient uptake on the soil after harvest:-

Application of T3 (50% N via.Urea + 50% N via.FYM) recorded better results on soil organic carbon percentage, N, P₂O₅ and K₂O content. FYM is also a rich source of organic carbon, nitrogen, phosphorus and many other micronutrients. All organic fertilizers have been found to be effective in adding many nutrients to the soil in usable form. Organic carbon, N, P₂O₅ and K₂O utilization rates were higher in T3 treatment. The lowest concentration of these nutrients was observed at treatment T5 (100% IO + 25% FYM). Tatarwal et al. (2011) reported similar results from organic and inorganic nutrient source differences between crops after planting in rainfed crops. The numerical data in Table 1 show that among all other applications N and P₂O₅, 50% N application IO + 50% N application organic matter, money application is the first state of soils with the greatest nutrients. Dasog et al., (2011) reported similar results, in their study of nutrient management practices on soil fertility that nutrient uptake of N, P, and K was highest under treatment where organic and inorganic fertilizers were applied in combination, and this is due to additional nutrients provided by FYM at steady supply throughout the season. According to the initial state of the soil, the highest decrease in organic carbon and soil nitrogen, P₂O₅ and K₂O values occurred in the T5 period, which was 1.23, 0.19, and 0.54, respectively. Quansah (2010) found that NPK was higher when poultry manure (60 kg/da N) and NPK (60-40-40 kg/da N) were used together. The results showed that the combination of organic and inorganic sources resulted in higher nutritional values.

CONCLUSION

Looking at the result from this study, it can therefore be concluded that integrated nutrient management improves nutrient soil quality and helps in easy and fast nutrient supply to plants, it also manages the balanced supply of nutrients throughout the growing season.

Table 1: Effect of integrated nutrient management with planting techniques on Nutrient Absorption of corn.

T. No.	Treatment	N %	P %	K%
Main Plot Treatment				
P₁	Flat Bed	1.24	0.20	0.53
P₂	Raised Bed	1.33	0.21	0.54
Sem±		0.041	0.005	0.005
CD(0.05)		NS	NS	NS
Sub Plot Treatment				
T₁	100% IO	1.32	0.20	0.53
T₂	100% FYM	1.30	0.22	0.54
T₃	50% IO + 50% FYM	1.35	0.22	0.55
T₄	75% IO + 25% FYM	1.24	0.19	0.54
T₅	100% IO + 25% FYM	1.23	0.19	0.54
Sem±		0.059	0.020	0.011
CD(0.05)		NS	NS	NS

Table 2: Shows effect of integrated nutrient management with planting techniques on Nutrient Absorption of maize straw.

T. No.	Treatment	N%	P%	K%
	Main Plot Treatment			
P₁	Flat Bed	1.15	0.15	1.05
P₂	Raised Bed	1.16	0.16	1.07
Sem±		0.005	0.003	0.005
CD(0.05)		NS	NS	NS
Sub Plot Treatment				
T₁	100% IO	1.16	0.16	1.08
T₂	100% FYM	1.16	0.16	1.06
T₃	50% IO + 50% FYM	1.18	0.18	1.07
T₄	75% IO + 25% FYM	1.16	0.15	1.05
T₅	100% IO + 25% FYM	1.13	0.14	1.06
Sem±		0.011	0.008	0.008
CD(0.05)		NS	NS	NS

References

1. Dasog, G. S., Babalad, H. B., Hebsur, N. S., Gali, S. K., Patil, S. G., and Alagawadi, A. R. (2011) Influence of nutrient management practices on crop response and economics in different cropping systems in a vertisol. *Karnataka Journal of Agricultural Sciences*, **24**(4), 455-460.
2. Krishnakhi Borah and Rinjumoni Dutta (2018) Influence of Integrated Nutrient Management on Soil Properties and Plant Nutrient Uptake in Maize. *Int.J.Curr.Microbiol.App.Sci.* 7(12): 2651-2656.
3. Majamanda, J., M. Katundu, V. Ndolo, D. Tembo. 2022a. "Impact of provenance on phytochemical attributes of pigmented landrace maize varieties." *Journal of Science & Technology* 14 (1): 75-82
4. Majamanda, J., M. Katundu, V. Ndolo, D. Tembo. 2022b. "A Comparative Study of Physicochemical Attributes of Pigmented Landrace Maize Varieties." *Journal of Food quality*. Volume 2022, Article ID 6294336, <https://doi.org/10.1155/2022/6294336>.
5. Muhammad Sarwar, Ghulam Jilani, Ejaz Rafique, Muhammad Ehsan Akhtar and Arshad Nawaz Chaudhry, (2012) Impact of Integrated Nutrient Management on Yield and Nutrient Uptake by Maize under Rain-Fed Conditions. *Pakistan Journal of Nutrition*, **11**: 27-33.
6. NCoMM 2017 Special Report-National Collateral Management Services Limited. pp:1-3
7. Ponnusamy V, Shanmugam J, Gopal M and Sundaram S (2017) Perspectives of Plant-
8. Prajapat, K., Vyas, A. K., & Dhar, S. (2015). Effect of cropping systems and nutrient management practices on growth, productivity, economics and nutrient uptake of soybean (*Glycine max*). ICAR.
9. Quansah, G. W. (2010). Effect of Organic and Inorganic Fertilizers and Their Combinations on the Growth and Yield of Maize in the Semi-Deciduous Forest Zone of Ghana.
10. Sathish A, Govinda G V, Chandrappa H and Nagaraja K (2011) Long term effect of integrated use of organic and inorganic fertilizers on productivity, soil fertility and uptake of nutrients in rice and maize cropping system. *International Journal of Science and Nature*, **2**(1): 84-88.
11. Shirk, L. R. (2007). *Wild Women Throw a Party: 110 Original Recipes and Amazing Menus for Birthday Bashes, Power Showers, Poker Soirees, and Celebrations Galore*. Conari Press.
12. Tetarwal, J. P., Ram, B., & Meena, D. S. (2011). Effect of integrated nutrient management on productivity, profitability, nutrient uptake and soil fertility in rainfed maize (*Zea mays*). *Indian journal of Agronomy*, **56**(4), 373-376.
13. Ullah, K., Sharma, V. K., Dhingra, S., Braccio, G., Ahmad, M., & Sofia, S. (2015). Assessing the lignocellulosic biomass resources potential in developing countries: A critical review. *Renewable and Sustainable Energy Reviews*, **51**, 682-698.

