Original Research Article

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

ABSTRACT

The experiment was laid out at the experimental farm chhapang of Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib during 2019-20 to evaluate the effect of organic and inorganic nitrogen management and Planting Technique on Nutrient uptake of maize. The experiment was laid out in split plot design with three replications of two main plot treatments viz., Flat bed and Raised bed and five sub plot treatments viz., 100% IO, 100% FYM, 50% IO + 50% FYM, 75% IO + 25% FYM, 100% IO + 25% FYM and were observed at 25, 50 and 75 days after sowing. The results revealed that treatment T_3 (50% IO + 50% FYM) showed highest nutrient uptake by grain and stover of maize. Hence integration of organic and inorganic in T_3 (50% IO + 50% FYM) with Raised bed resulted in best performance of maize. The combination of Raised bed with 50% IO + 50% FYM can be recommended for sustainable maize growth and appropriate nutrient management.

Keywords: Inorganic fertilizers, Integrated nutrient management, Nutrient uptake, Organic manure and Planting techniques.

INTRODUCTION

Maize (*Zea mays L.*) is known as "Cereal Queen" due to its higher production potential and adoption over large area in the world, both under temperate and tropical regions. United States is the largest producer of corn followed by china and Brazil while India comes on 6th position on the list of main corn producing countries of the world. On the basis of consumption, maize is third most important cereal after wheat and rice. The maize apart from human consumption and animal feed also possesses other multiple uses in the form of starch, silage making, oil production and biofules. It also contains ample quantities of vitamins, carbohydrates, dietary fibers and minerals like magnesium, phosphorous, zinc, copper and iron.

Himachal Pradesh comes next to Karnataka, Telangana and Bihar in the list of corn growing states of India with an area of 294.3 thousand hactares and production of 644.4 thousand tons during the year 2017-18 (NCoMM report, 2017). The sirmaur district falls in mid hill region of Himachal Pradesh with its unique climate and agro ecological situation having direct bearing on productivity of this crop. The soils of region are developed on

sandstone with slight acidic to neutral in reactions. The tract is also accompanied with frequent shower of rain during kharif season coupled with improper drainage which cause considerable losses of plant nutrients, otherwise remained available to this nutrient exhaustive crop of the region.

Maize being C4 plant have potential to yield more but due to the lack of matching agronomic technologies along with poor technology adoption capacity of the state farmers are some of the bottle necks to achieve higher yield from this crop. Among modern agro management techniques, raised bed planting has advantages over flat bed sowing by way of easy translocation and conversion of soil nutrient to available plant nutrient for its uptake, along with meaningful rain water management. Raised bed planting also protect the crop from soil encrusting along with 20-30% saving of irrigation water to attain better growth of the crop. In raised bed system water moves horizontally from the furrow to bed surface through capillaries, which otherwise cause an excessive soil moisture impact. Maize sown on raised bed trap more solar radiation through crop canopy by border effect along with its additional advantages to prevent the crop from lodging

Maize is very nutrient-intensive crop (150-200 Kg N ha^{-1}) and requires a relatively large amount of fertilizer to meet the crop needs. The resource poor farmers, dependent on corn farming, prefer to use the integration of nutrient (inorganic+ organic) to cut down its cost of cultivation through reduction in use of expensive inorganic fertilizers. The use of locally available organic with inorganics as applied nutrient sources along with inherent fertility status of soil helps to meet the harvest needs of the crop for nutrition at relatively lower costs. This mechanism of mixing organic and inorganic fertilizers, the sustainability of crop production is maintained for longer time and the soil fertility is improved through its complimentary effects (Ponnusamy et al., 2017). It is therefore imperative to ameliorate the hard and compact soils of this region with proportionate use of organic manures (Farm Yard Manure) along with inorganic fertilizers. The use of farm yard manure not only improves the physio-chemical properties of the soil but also act as vulnerable amendments to replace the excessive use of chemical fertilizer.

MATERIALS AND METHODS

The trail was conducted during *kharif* season 2019 at Chhpang Research Farm of Dr Khem Singh Gill Akal Collage Agriculture, Buru Sahib. Variety used was Shakti 1001, QPM

variety rich in lysine and methionine and was sown on soil with clay loam texture and slightly acidic in nature (pH 6.34). The trial had 2 main plot treatment and 5 sub plot treatments with 3 replications and treatments were designed under split plot design. The treatment detail includes raised bed and flat beds on integration combinations as follows:- T_1= 100% N by Urea, T_2= 100% N via. FYM, T_3= 50% N via. Urea + 50% N via.FYM, T_4= 75% N via. Urea + 25% N via.FYM, T_5= 100% N via Urea 25% N via FYM. The data were recorded after harvesting from grains and straw.

RESULT AND DISCUSSION

Organic matter applied in addition to RDF on raised bed of maize crop had positive effects which improves nutrient uptake from soil. Nutrient uptake refers to the total amount of nutrient taken up by the crop during the growing period. Nutrient removal by crops depends on the plant parts harvested, their composition and their share in total dry matter production. Actual removal will vary with crop yield, crop variety, soil fertility and level of management. Intake values would therefore provide a reliable estimate of nutrient requirement under varying soil and climatic condition. However, precise samples can only be determined by laboratory analysis. In general, nutrient uptake by maize increases with increasing nutrient levels applied through integration of organic and inorganic fertilizers, same concluded by Prajapati et al., (2015) during their research that highest nutrient uptake of N, P_2O_5 and K_2O was observed under treatment where integration of organic and inorganic source is applied i.e. 25% RDF + 50% FYM + Bio fertilizer over sole application of either organic or inorganic material.

The data in table 1 revealed that there was significant effect of various source 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 treatment (50% RDF + 50% N via compost) as compared to RDF treatment solely. Highest uptake of N, $P_2O_5$and K_2O was observed in application of T3 (50% N via. Urea + 50% N via.FYM). In case of N uptake treatment T1 and T2 found at par with T3 (50% N via. Urea + 50% N via.FYM) the uptake of N, P_2O_5 and K_2O 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 combined effect and rapid release of nutrient by decomposition of FYM and also due to availability of N and P_2O_5 which added in soil through organic and inorganic resources by urea, SSP. Satish et al. (2011) has been also

reported that the combination of organic and inorganic fertilizer showed increased uptake values of all three nutrients, which is in close conformity with the result obtained in present investigation. Even Muhammad et al., (2012) reported same results in their study on maize productivity and nutrient uptake that highest N uptake was observed with 50% + 50% (chemical fertilizer + FYM) as compared to sole application of organic or mineral fertilizer.

Effect of nutrient uptake on soil after harvest:-

Significantly higher values of organic carbon percent, available N, P_2O_5 and K_2O content in soil were recorded in application of T3 (50% N via. Urea + 50% N via.FYM). FYM was rich source of organic carbon, nitrogen, phosphorous and some other micronutrient also. These all the source of organic fertilizers was found to be effective for addition of various nutrients onto soil in available form. The percentage availability of organic carbon, N, P_2O_5 and K_2O under T3 treatment was found higher. The lowest availability of these nutrients was observed in treatment T5 (100 % IO + 25 % FYM). The similar effects of different organic and inorganic source of nutrients on the nutrient status of soil after harvest at the crop were revealed by Tetarwal et al., (2011) in rainfed maize. The numerical data in table 1 reveals that, application of 50% N via IO + 50% N via organic made maximum addition amongst all the other treatment of available N & P_2O_5 by over the initial status of soil available nutrients. Dasog et al., (2011) stated same in their study of nutrient management practise on soil fertility that nutrient uptake of N, P and K was highest under treatment where organic and inorganic fertilizers applied combinedly, this is due to additional nutrients provided by FYM as steady supply throughout the season. Highest decrease values in organic carbon and soil available N, P_2O_5 and K_2O over initial soil status were recorded in T5 which were 1.23, 0.19 and 0.54 respectively. Quansah (2010) in his study reported that higher NPK uptake was observed when poultry manure (60 kg/ha N) is applied with NPK (60-40-40 kg/ha) fertilizer rather than sole application of either fertilizer or manure. Results showed that integrating both organic and inorganic source resulted high nutrient uptake value.

CONCLUSION

Hence it is concluded that integrated nutrient management of nutrients sums up in better soil quality and easy and fast nutrient availability 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 uptake of maize.

T. No.	Treatment	N %	P %	K%
Main Plot Treatment				
P_1	Flat Bed	1.24	0.20	0.53
P_2	Raised Bed	1.33	0.21	0.54
Sem±		0.041	0.005	0.005
CD(0.05)		NS	NS	NS
Sub Plot Treatment				
T_1	100% IO	1.32	0.20	0.53
T_2	100% FYM	1.30	0.22	0.54
T_3	50% IO + 50% FYM	1.35	0.22	0.55
T_4	75% IO + 25% FYM	1.24	0.19	0.54
T_5	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: Effect of integrated nutrient management with planting techniques on Nutrient uptake of maize straw.

T. No.	Treatment	N%	P%	K%
	Main Plot Treatment			
P_1	Flat Bed	1.15	0.15	1.05
P_2	Raised Bed	1.16	0.16	1.07
Sem±		0.005	0.003	0.005
CD(0.05)		NS	NS	NS
	Sub Plot Treatment			
T_1	100% IO	1.16	0.16	1.08
T_2	100% FYM	1.16	0.16	1.06
T_3	50% IO + 50% FYM	1.18	0.18	1.07
T_4	75% IO + 25% FYM	1.16	0.15	1.05
T_5	100% IO + 25% FYM	1.13	0.14	1.06
Sem±		0.011	0.008	0.008
CD(0.05)		NS	NS	NS

REFERENCES

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.

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.

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.

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-

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.

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.

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 andmaize cropping system. *International Journal of Science and Nature*, **2**(1): 84-88.

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.