Original Research Article

Effect of Organic and Inorganic Nitrogen Management And Planting Technique on Yield 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 Yield 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) gave maximum number of cobs/plant, Diameter of cob, number of grain/cob, cob weight per plant, length of cob, test weight, harvest index, grain yield, straw yield. Hence integration of organic and inorganic in T_3 (50% IO + 50% FYM) with Raised bed resulted in good yield performance of maize. The combination of Raised bed with 50% IO + 50% FYM can be recommended for sustainable maize growth.

Keywords: Integrated nutrient management, Organic and inorganic fertilizers, Planting techniques, Yield attributes.

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 require 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 at harvesting and after it from five randomly selected plants which were tagged from each plot and average of every parameter was recorded at different stages i.e., no. of cobs/plant, diameter of cob, ear length, no. of grain/cob, cob weight/plant, length of cob, test weight, harvest index, straw yield and grain yield.

RESULT AND DISCUSSION

Organic matter applied in addition to RDF on raised bed of maize crop had positive effects which improves yield attributes of plants raised on raised beds that has experienced substitution of nutrients through organic sources. The values of various yield attributing characters like cob/plant, diameter of cob, grain/cob, cob weight/plant, length of cob, test weight, harvest index, straw yield and grain yield statistically differed for residual effects for various treatment imposed in maize crop under kharif experimentation. Treatment T_5 recorded lowest values in among all the attributes under study. T_3 evinced significantly higher values in almost all yield attributing characters than the first two best treatments i.e. T_1 and T_4, It may be due to presence of highly persistence material i.e. cellulose in FYM which required longer time for complete decomposition. Thus nutrient released from FYM for longer period had noticeable benefits on the succeeding 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 of integrated nutrient management 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 organic matter content affects 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 due

to remarkable improvement in yield attributes such as number of cob/plant, cob length, diameter of cob, number of grain/cob (Table 1 and 2). Similar results were reported by Amanullah et al., (2015) that the integration of N (150 kg ha^{-1}) with compost (2 t ha^{-1}) had significantly affected straw yield (9294 kg ha^{-1}) and grain yield (3097 ka ha^{-1}) of maize. Singh et al.,(2017) also concluded that the experiment had eight INM treatments, T_2 – 100% RDF + vermicompost (5 t ha^{-1}) and T_4 – 75% RDF + vermicompost (5 t ha^{-1}) statistically gave the best result in terms of grain yield. Gundlur et al., (2015) results revealed that the recommended dose of fertilizer (RDF) + biofertilizer (Azospirillium + PSB at 350 g ha^{-1}) produced the highest grain yield (77.60 q/ha), forage yield (122.69 q ha^{-1}) because of more intake of NPK by corn plants followed by treatment with 100% RDF. Kumar (2015) results shows that application of 100% RDF+30 kg N ha^{-1} via. vermicompost shows higher grain yield (4158 kg ha^{-1}) and straw yield (7066 kg ha^{-1}) over control (100% RDF+ 0 kg N ha^{-1} vermicompost). Kesarwani et al., (2017) also stated same that the integration of 50%RDF + 5 t ha^{-1}Poultry manure + 5 t ha^{-1} FYM (T_6) resulted in maximum corn yield (10.56 t ha^{-1}) and straw yield (12.56 t/ha).

Hence, the study concluded that the treatment T_3 comprising 50% N via inorganic + 50% N via. FYM gave significantly better results with raised bed treatment in terms of yield attribute of maize. Integrated nutrient management also enhance the soil structure and gave better environment for plant to grow as compared to sole inorganic or organic treatment. Application of balanced integrated nutrient management leads to higher nutrient uptake and raised bed planting technique gave effective management to sustain resources. Therefore, for getting higher yield and yield attributes, combination of raised bed treatment with T_3 (50 % IO + 50 FYM) was found to be best among other treatment combinations.

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

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