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ORIGINAL ARTICLE

Effect of various levels of nitrogen and farm yard manure on hybrid maize (*Zea mays* L.) in Gwalior district of Madhya Pradesh

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ABSTRACT
The present experiment was conducted at experimental area, school of Agriculture, ITM University Gwalior (Madhya Pradesh), during Kharif season of 2019 for determine the effect of different sources of nutrients by combination of organic manure (FYM) and inorganic fertilizers (Nitrogen) doses on the growth and yield of hybrid maize (CV. PAC - 740) on sandy loam soil. The experiment consist nine treatment combination included three levels of FYM (0, 5 and 10 t ha^{-1}) with three dose of nitrogen (0, 75 and 100 kg ha^{-1}) in a Randomized Block Design (RBD) in factorial concept with replicated thrice. Root and shoot fresh weight of maize significantly affected by nitrogen and FYM levels. Under different level of nitrogen maximum yield (4.83 t ha^{-1}) was recorded with 100 kg N ha^{-1} treatment which was significantly higher to control and 75 kg N ha^{-1} treatments. Application of nitrogen @ 75 and 100 kg ha^{-1} increased 59.2 and 80.2 percent grain yield as compared to control. Whereas, in different level of FYM, maximum grain yield (4.39 t ha^{-1}) was recorded with 10 t FYM ha^{-1} which was 29.1 and 10.3 percent significantly higher with control and 5 t FYM ha^{-1} treatments. Application of nitrogen and FYM increased the grain protein content significantly as compared to control.
Key words: *FYM, Hybrid Maize, Nitrogen, Root and Shoot weight, Protein content*

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INTRODUCTION

In world agricultural economy, Maize (*Zea mays* L.) is the third most important cereal crop after the rice and wheat, as well as in Indian economy. This crop know as versatile and can be grown in diverse environmental conditions for multiple uses. Maize is also called Corn means literally "that which sustains life" is one of the most crucial and strategic crops in the world. Maize is emerging as an important world cereal crop after wheat and rice, which is "Queen of Cereals", due to easy to process, low cost the high productiveness than other cereal crops [7]. Its also provides nutrients for humans as well as animals, and provided basic raw materials for production of protein, alcoholic beverages, starch, food sweetness oil, and fuel which is more required at present time [13].

Maize is a heavy feeder crop and responded to fertilization, especially where soils are generally poor and low in native fertility. It is generally observed that without fertilizer application maize fails to produce worthwhile grain yield. Soil fertility is a major constraint to productivity and low content of organic matter coupled with imbalance application of maor nutrients limits is the main yield barrier and its full potential yield of any crop. Nitrogen is universally deficient nutrient in most of the Indian soil and research conducted at various agro climatic zones of Indian indicated that nitrogen has beneficial effect on growth, yield attributing characters and yield of maize.

Nitrogen application is known to increase the crude protein and metabolic energy besides making the plant more succulent and palatable. It also governs development of maize, a nitro-positive crop. Nitrogen is the most important and most limiting nutrient for plant growth in soils of Grid Region of Gwalior. Chemical fertilizers are readily available and cheaper source of plant nutrients, hence play an important role in crop production. Farmyard manure plays important role in the cycling of nitrogen and availability

of nutrient in soil. For increasing the production of quality fodder and seed, nutrient management through use of organic and inorganic plant nutrient source is very crucial. Now, it is being undoubtedly realized that maintenance of soil organic carbon is essential not only to supplement plant nutrients but also for efficient utilization of applied nutrients as well as to improve physical condition o the soil, thereby making the soil a real living system. Therefore, present study was conducted.

MATERIAL AND METHODS

The present experiment was carried out on sandy loam soil in *Kharif* season of 2019. The experiment consist nine treatment combination included three levels of FYM (0.0, 5.0 and 10.0 t ha^{-1}) with three dose of nitrogen (0, 75 and 100 kg ha^{-1}). All the treatments replicated thrice in factorial concept of Randomized Block Design (RBD). The experimental soil was low in available nitrogen and medium in phosphorus and potash. After the layout of field, required quantity of FYM (as per treatments) was mix in the soils. The inorganic fertilizers i.e. nitrogen, phosphorus and potash were applied in the form of Urea, Single Super Phosphate and Murate of Potash, respectively. Full dose of phosphorus (60 kg ha^{-1}) and potassium (40 kg ha^{-1}) and half dose of nitrogen (as per treatments) were applied at basal and remaining half dose of nitrogen (as per treatments) was given after weeding at 35 DAS. The seeds of hybrid maize variety PAC-740 was sown on 25 July 2019, using the seed rate of 20 kg/ha. The spacing between rows to row was kept at 45 cm. All other agronomic practices except those under study were kept normal and uniform for all the treatments. The total N content was determined by adopting modified kjeldahl's method as described by [1] and then Protein was computed by multiplying of 6.25 factors in N content of seed of maize.

RESULT AND DISCUSSION

Root and shoot fresh weight

It is clear from results that root and shoot fresh weight was significantly affected by nitrogen and FYM levels. Application of 100 kg N ha^{-1} (N_2) produced heaviest root and shoot parameters which was significantly superior to 75 kg N ha^{-1}. However, 75 kg N ha^{-1} (N_1) also recorded significantly higher root and shoot parameters over control. The increase in root and shoot parameters may be attributed to the increase availability and absorption of applied N, favorable for initiation and development of crown and seminal roots. The results corroborate the work of [18] and [16]. Application of FYM also found to produced heaviest root and shoot parameters which was significantly superior to control. Application of FYM is known as the favourable nutritional status of the soil which resulting in an increased biomass production of the crop. The favourable effect of FYM on microbial and root proliferation was also understood on soil which caused solubilizing process on native phosphorus as well as other nutrient present in the soil [3].

Table 1: Effect of nitrogen and FYM levels on root and shoot fresh weight (g) in maize

Treatments	Shoot fresh weight (g $plant^{-1}$)			Root Fresh weight (g $plant^{-1}$)		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
Nitrogen levels (N)						
N_0: Control (0 kg ha^{-1})	178.0	516.7	932.2	13.46	46.04	67.60
N_1: 75 kg ha^{-1}	202.8	630.4	1133.7	16.68	57.66	76.53
N_2: 100 kg ha^{-1}	234.1	716.4	1212.1	18.20	67.64	82.54
S.E. (m)±	**4.6**	**8.4**	**19.9**	**0.37**	**1.21**	**1.91**
C.D. (5%)	**13.4**	**24.7**	**58.5**	**1.07**	**3.54**	**5.61**
Farm Yard Manure (FYM) levels						
FYM $_0$: Control	185.7	563.0	1021.4	14.16	48.58	65.55
FYM $_1$: 5 t FYM ha^{-1}	207.1	621.9	1096.2	16.43	57.48	77.28
FYM $_2$: 10 t FYM ha^{-1}	222.2	678.5	1160.3	17.75	65.28	83.84
S.E. (m) ±	**4.56**	**8.42**	**19.9**	**0.37**	**1.21**	**1.91**
C.D. (5%)	**13.38**	**24.69**	**58.5**	**1.07**	**3.54**	**5.61**
Interactions (NX FYM)	**N S**	**N S**	**N S**	**N S**	**N S**	**N S**

Yield attributes characters

Application of nitrogen and FYM significantly increased all yield attributes characters (i.e. cob $plant^{-1}$, length and girth of cob, grains cob^{-1}, grain weight of cob (g) and the test weight (Table-2). Application of adequate Nitrogen promotes the grain-filling process as a result of stimulation of many physiological

processes in the plant [2] and highest number of grains per cob with 100 kg N/ha might be due to optimum availability of Nitrogen to the plants. Increased grain weight per cob and test weight of 100-grain suggested a substantial availability and its utilization of Nitrogen by plants throughout their growing period. Similarly, [6] and [8] reported that adequate fertilization of N increased the kernel weight. Similarly, the number of cob plant^{-1}, length and girth of cob, grains cob^{-1}, grain weight of cob and test weight produced by the application 10 t FYM ha^{-1} were found to be significantly higher than the other lower level. The application 10 t FYM ha^{-1} may be provided adequate supply of all the nutrients, resulted in accumulation greater of amino acids, carbohydrates and their translocation in the plant productive organs, which, in-turn improved all the growth and yield attributing characters. Results confirm the finding of [10] and [11].

Table 2: Effect of different levels of nitrogen and FYM on yield attributes characters of maize

Treatments	Yield attributes characters			
	Number of cobs (plant^{-1})	Cob length (cm)	Cob weight (g)	100- Grain weight (g)
Nitrogen levels (N)				
N_0: Control (0 kg ha^{-1})	1.29	15.46	163.54	22.97
N_1: 75 kg ha^{-1}	1.44	18.15	194.65	26.21
N_2: 100 kg ha^{-1}	1.67	18.98	218.98	27.61
S.E. (m)±	**0.06**	**0.20**	**4.27**	**0.18**
C.D. (5%)	**0.16**	**0.57**	**12.52**	**0.53**
Farm Yard Manure (FYM) levels				
FYM $_0$: Control	1.30	16.48	177.64	24.50
FYM $_1$: 5 t FYM ha^{-1}	1.50	17.79	192.14	25.79
FYM $_2$: 10 t FYM ha^{-1}	1.61	18.32	207.39	26.51
S.E. (m) ±	**0.06**	**0.20**	**4.27**	**0.18**
C.D. (5%)	**0.16**	**0.57**	**12.52**	**0.53**
Interactions (N X FYM)	**N S**	**N S**	**N S**	**N S**

Table 3 : Effect of different levels of nitrogen and FYM on yield and quality parameters of maize

Treatments	Yield parameters		Quality parameters	
	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Protein content (%)	Protein yield (kg ha^{-1})
Nitrogen levels (N)				
N_0: Control (0 kg ha^{-1})	2.68	8.12	8.62	231.82
N_1: 75 kg ha^{-1}	4.27	12.31	9.69	414.58
N_2: 100 kg ha^{-1}	4.83	14.20	9.95	481.25
S.E. (m)±	**0.08**	**0.18**	**0.07**	**8.69**
C.D. (5%)	**0.24**	**0.54**	**0.20**	**25.49**
Farm Yard Manure (FYM) levels				
FYM $_0$: Control	3.40	10.93	9.08	312.94
FYM $_1$: 5 t FYM ha^{-1}	3.98	11.47	9.46	382.74
FYM $_2$: 10 t FYM ha^{-1}	4.39	12.23	9.72	431.98
S.E. (m) ±	**0.08**	**0.18**	**0.07**	**8.69**
C.D. (5%)	**0.24**	**0.54**	**0.20**	**25.49**
Interactions (N X FYM)	**N S**	**N S**	**N S**	**N S**

Yield and quality parameters

Application of nitrogen increased the grain and biological yield. Maximum grain yield (4.83 t ha^{-1}) was recorded with the application of 100 kg N ha^{-1} (N_2) treatment which was significantly higher to control and 75 kg N ha^{-1} treatments. It is evident from table 3, that application of nitrogen @ 75 and 100 kg ha^{-1} increased 59.2 and 80.2 percent grain yield as compared to control. Better yield of maize always required optimum and timely supply of N [4]. Therefore, more grain yield with he application of 100 kg N ha^{-1} might be due to balanced supply of N at different stages of crop development. [8] and [9] also reported an increase in yield by N fertilization.

The increase in biological yield might be due to better growth and development of plants under balanced supply of Nitrogen at all growth stages. These results was in line with the findings of [2] who reported that an increase in biological yield by application of N in splits at different growth stages.
The beneficial effect of FYM clubbing to adequate nutrient supply from its enhanced decomposition and mobilization of nutrients from the soil by improved physical condition of soil which provided activation of beneficial soil biological activities which increased nutrient availability to the plant. This all consequently led to high crop productivity. The findings confirm the results of [12] and [14].

Quality parameters

It is revealed from results that the application of nitrogen and FYM increased the protein content and its yield significantly as compared to control. Maximum protein content (9.95 %) was found with 100 kg N ha^{-1} treatment which was significantly higher to control and 75 kg N ha^{-1} treatments. It is probably because of the fact that the protein content (N x 6.25) is directly related to N content in grain and application of nitrogen increased N-metabolism, which enhanced accumulation of amino acids and drastically increased the rate of protein synthesis and consequently, protein content in grain. These results are related to the finding of [17] and [5] who reported that N application by different methods and at different timing had significant effect on grain protein content.
It is revealed from table 3, that application of FYM either 5 t or 10 t ha-1 showed significantly higher content of protein and its yield as compared to control. This might be due to that application of FYM supplied micronutrient especially Zn which lead N-metabolism and enhanced accumulation of amino acids and increased the rate of protein synthesis and consequently and finally protein content in grain. FYM application in soil also enhanced availability of Zn and concentration of Zn in the plant which associated with RNA and ribosome induction the result of which accelerates protein synthesis [15].

CONCLUSION AND RECOMMENDATION

From present study it can be concluded that application of 100 kg nitrogen along with 5 to 10 t FYM ha^{-1} produced qualitative higher grain yield of Maize in Gwalior district of Madhya Pradesh.

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