GRAIN YIELD, NUTRIENT UPTAKE AND ECONOMICS OF *RABI* MAIZE UNDER DIFFERENT FERTILIZER LEVELS AND ORGANIC SOURCES IN SOUTH GUJARAT CONDITION

***MAKWANA, N. D.; THANKI, J. D.; DER, P. B. AND NANDANIYA, J. K.**

DEPARTMENT OF AGRONOMY
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI, GUJARAT – 396 450, GUJARAT, INDIA

****E-mail- nileshdmakwana@gmail.com***

ABSTRACT

A field experiment was conducted during rabi season of 2012-13 to study the effect of various levels of fertilizer and organic sources on growth, yield attributes and yield of rabi maize (Variety: GM 6) under south Gujarat condition. The experiment comprising six treatment combinations viz., T_1= 100% RDF, T_2= 100% RDF + FYM @ 10 t/ha, T_3= 75% RDF + Bio compost @ 5 t/ha, T_4= 75% RDF + vermicompost @ 3 t/ha, T_5= 75% RDF + FYM @ 10 t/ha and T_6= Control were tested in a randomized block design with four replications. Application of 100% RDF + FYM @ 10 t/ha recorded significantly higher grain (4.18 t/ha) and straw yields (8.99 t/ha), while lower grain and straw yields were recorded with control. Different treatments were failed to express any significant influence on harvest index in maize. The maximum net realization of 37187 ₹/ha with benefit: cost ratio of 1.37 was obtained under treatment 100% RDF + FYM @ 10 t/ha.

KEY WORDS: Benefit: cost ratio, bio compost, economics, FYM, maize, nutrient uptake, RDF, vermicompost, yield

INTRODUCTION

Among the cereals, maize (*Zea mays* L.) ranks third regarding total world production after wheat and rice and it is principal staple food in many countries, particularly in the tropics and subtropics (FAI, 1999). Maize is considered as the "Queen of Cereals". Being a C_4 plant, it is capable to utilize solar radiation more efficiently even at higher radiation intensity. Cultivation of maize in India is mostly confined to the states of Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, Karnataka, Madhya Pradesh, Andhra Pradesh and Jammu - Kashmir. Gujarat occupies an area of 0.50 million ha with a production of 0.82 million tonnes and productivity of 1640 kg/ha (Anon. 2011-12). Nitrogen is indispensable for increasing crop production as a constituent of protoplasm and chlorophyll and is associated with the activity of every living cell. Similarly, phosphorus also plays an important role in energy storage and transfer in the plant system. In addition, phosphorus is an important constituent of nucleic acids, phytins, phospholipids and enzymes. Several workers have reported the beneficial effects of NPK fertilization on productivity of maize (Mehta *et al.*, 2005 and Rajanna *et al.*, 2006).

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season of 2012-13 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat. The soil was clayey (13.17 % sand, 19.39 % silt and 66.56% clay), slightly above neutral in reaction (pH 7.8), having available nitrogen, phosphorus and potassium was 169.43, 31.73 and 359.53 kg/ha, respectively. One hand weeding and interculturing was carried out during the crop growing season. Besides pre-sowing irrigation, 5 irrigations were applied as per requirement of crop using furrow method. Phorate 10 G @ 10 kg/ha was applied to protect the crop against stem borer. The experiment comprising six treatment combinations *viz.*, T_1= 100% RDF, T_2= 100% RDF + FYM @ 10 t/ha, T_3= 75% RDF + Bio compost @ 5 t/ha, T_4= 75% RDF + vermicompost @ 3 t/ha, T_5= 75% RDF + FYM @ 10 t/ha T_6= Control were tested in a randomized block design with four replications with a spacing of 60 x 20 cm. The seed of maize variety GM-6 was used for this experiment. The observations were recorded on grain yield (t/ha), straw yield (t/ha) and harvest index (5). The nutrient (, P and K content) uptake (kg/ha) was also estimated from seed and straw. The data were analyzed statistically as per the method suggested by Panse and Sukhatme (1985). A net return was calculated by subtracting cost of cultivation from gross returns.

RESULTS AND DISCUSSION

Effect on seed yield, straw yield and harvest index

The effect of various levels of fertilizer and organic source treatments on grain and straw yields was found significant. Significantly the highest grain yield of maize (4.18 t/ha) was recorded in the treatment receiving 100% RDF + FYM @ 10 t/ha over control. Significantly higher straw yield (8.99 t/ha) was registered under treatment 100% RDF + FYM @ 10 t/ha, being remained at par with treatment 75% RDF + Vermicompost @ 3 t/ha (8.40 t/ha). The results of the present study are in accordance with those reported by Jadhav *et al.* (2012) and Joshi *et al.* (2013) in *kharif* maize; Lingaraju *et al.* (2010) and Kannan *et al.* (2013) in winter maize; and Ravi *et al.* (2012) in summer maize. Different treatments were failed to express any significant influence on harvest index in maize.

Effect on nutrient uptake

The uptake of N, P and K by grain and straw in different treatments was found significant. Application of 100% RDF + FYM @ 10 t/ha recorded significantly higher uptake of N, P and K content by grain and straw and it was at par with treatments 75% RDF + Vermicompost @ 3 t/ha. The nutrient uptake is a function of yield and nutrient concentration in plant. Thus, improvement in uptake of N, P and K might be attributed to their concentration in grain and straw and associated with higher grain and straw yields. The results of present investigation are in close agreement with the findings of Panwar (2008), Tetarwal *et al.* (2011) and Singh *et al.* (2012) in maize.

Effect on economics

The gross returns, net returns and benefit: cost ratios of the maize were influenced significantly by different levels of fertilizer and organic source treatments. The highest net realization of (37187 ₹/ha) with BCR value of 1.37 was obtained with treatment 100% RDF + FYM @ 10 t/ha (T_2) followed by 75% RDF + Bio compost @ 5 t/ha (T_3) which realized net realization of (36500 ₹/ha) and BCR value of 1.92. This was due to

comparatively better increase in yield over other treatments. These results are in accordance with the findings of Lingaraju *et al.* (2010), Shanwad *et al.* (2010), Ravi *et al.* (2012) and Joshi *et al.* (2013).

CONCLUSION

From the results and discussion, it can be concluded that application of 100% RDF + FYM @ 10 t/ha was found effective in *rabi* maize, as it gave that the highest grain and straw yield with highest net realization of (37187 ₹/ha) with BCR value of 1.37.

REFERENCES

Anonymous (2011-12). Area and production of maize in India. Directorate of economics and statistics. Govt. of India.

FAI (1999). Quarterly Bulletin of Statistics. Fertiliser Association of India, New Delhi, **2**: 25-26.

Jadhav, K. L.; Bhilare, R. L. and Kunjir, N. T. (2012. Influence of integrated nutrient management on growth and yield of maize. *J. Agril. Res. Tech.,* **37**(2): 344-346.

Joshi, E.; Nepalia, V.; Verma, A. and Singh, D. (2013). Effect of integrated nutrient management on growth, productivity and economics of maize (*Zea mays*). *Indian J. Agron.,* **58**(3): 434-436.

Kannan, R. L.; Dhivya, M.; Abinaya, D.; Lekshmi, R. K. and Kumar, S. K. (2013). Effect of integrated nutrient management on soil fertility and productivity in maize. *Bull. Env. Pharmaco. Life Sci.,* **2**(8): 61-67.

Lingaraju, B. S.; Parameshwarappa, K. G.; Hulihalli, U. K. and Basavaraja, B. (2010). Effect of organics on producti- vity and economic feasibility in maize-bengal gram cropping system. *Indian J. Agril. Res.*, **44** (3): 211- 215.

Mehta, Y. K.; Shaktawat, M. S. and Singhi, S. M. (2005). Influence of sulphur, phosphorus and farmyard manure on yield attributes and yield of maize (*Zea mays*) in southern Rajasthan conditions. *Indian J. Agron.,* **50**: 203-205.

Panse, V. G. and Sukhatme, P. V. (1985). "Statistical Methods for Agricultural Workers". Indian Council of Agricultural Research, New Delhi.

Panwar, A. S. (2008). Effect of integrated nutrient management on maize (*Zea mays* L.) - mustard (*Brassica compestris* var *toria*) cropping system in mid hills altitude. *Indian J. Agron.,* **78**(1): 27-31.

Rajanna, A. E.; Ramachandrappa, B. K.; Nanjappa, H.V. and Soumya, T.M. (2006). Soil plant water status and yield of maize (*Zea mays* L.) as influenced by irrigation and fertility levels. *Mysore J. Agril. Sci.,* **40**: 74-82.

Ravi, N.; Basavarajappac, R.; Chandrashekars, C. P.; Harlapurm, S. I.; Hosamani, M. H. and Manjunatha, M. V. (2012). Effect of integrated nutrient management on growth and yield of quality protein maize. *Karnataka J. Agril. Sci.,* **25**(3): 395-396.

Shanwad, U. K.; Aravindkumar, B. N.; Hulihalli, U. K.; Surwenshi, A.; Reddy, M. and Jalageri, B. R. (2010). Integrated nutrient management (INM) in Maize-Bengal gram Cropping System in Northern. Karnataka. *J. Agril. Sci.,* **1**(3): 252-254.

Singh, G.; Sharma, G. L.; Golada, S. and Choudhary, R. (2012).

Effect of integrated nutrient management on quality protein maize (*Zea mays* L.). *Crop Res.*, **44**(1 & 2): 26-29.

Tetarwal, J. P.; Ram, B. and Meena, D. S. (2011). Effect of integrated nutrient management on productivity, profitability, nutrient uptake and soil fertility in rainfed maize (*Zea mays*). *Indian J. Agron.*, **56**(4): 373-376.

Table 1: Effect of various levels of fertilizer and organic sources on grain yield and straw yield and harvest index in maize.

Treatment		Grain Yield (t/ha)	Straw Yield (t/ha)	Harvest Index (%)
T_1	100% RDF	3.42	7.83	30.31
T_2	100% RDF + FYM @ 10 t/ha	4.18	8.99	31.73
T_3	75% RDF + Bio compost @ 5 t/ha	3.55	8.00	30.67
T_4	75% RDF + Vermicompost @ 3 t/ha	3.60	8.40	30.02
T_5	75% RDF + FYM @ 10 t/ha	3.42	7.84	30.49
T_6	Control	2.08	5.27	28.55
S. Em ±		0.17	0.32	1.44
C.D. (P=0.05)		0.51	0.97	NS
C.V. %		8.72	7.22	8.21

Table 2: Effect of various levels of fertilizer and organic sources on N, P and K uptake by grain and straw at harvest.

Treatment		Nitrogen Uptake (kg/ha)		Phosphorus Uptake (kg/ha)		Potassium Uptake (kg/ha)	
		Grain	Straw	Grain	Straw	Grain	Straw
T_1	100% RDF	51.94	41.19	9.84	13.51	15.39	70.18
T_2	100% RDF + FYM @ 10 t/ha	67.97	54.77	12.58	16.60	21.10	83.41
T_3	75% RDF + Bio compost @ 5 t/ha	54.19	43.55	10.27	13.94	15.67	71.39
T_4	75% RDF + Vermicompost @ 3 t/ha	57.05	47.85	10.70	15.00	16.73	75.91
T_5	75% RDF + FYM @ 10 t/ha	51.84	41.99	9.84	13.63	15.08	69.41
T_6	Control	30.17	27.20	5.44	8.73	9.11	45.38
S.Em±		3.48	2.99	0.70	0.92	1.03	2.80
C.D. (P=0.05)		10.50	9.00	2.11	2.77	3.12	8.45
C.V. %		11.56	12.09	12.43	11.73	11.54	7.00

Table 3: Economics as influenced by various levels of fertilizer and organic sources treatments in maize.

Treatments	Yield		Gross realization (₹/ha)	Total Cost of Cultivation (₹/ha)	Net Realization (₹/ha)	Benefit : Cost Ratio
	Grain (t/ha)	Straw (t/ha)				
T_1	3.42	7.83	53775	17088	36687	2.15
T_2	4.18	8.99	64275	27088	37187	1.37
T_3	3.55	8.00	55500	19000	36500	1.92
T_4	3.60	8.40	57000	28000	29000	1.04
T_5	3.42	7.84	53800	26000	27800	1.07
T_6	2.08	5.27	33975	12738	21237	1.66

Note: T he following prices were considered for calculating benefit: cost ratio

10 ₹/kg of maize grain 2.5 ₹/kg of maize straw 1 ₹/kg of FYM, 0.6 ₹/kg of Bio compost 4 ₹/kg of Vermicompost 6.1₹/kg of Urea 23.6 ₹/kg of DAP

[MS received: November 10, 2015] *[MS accepted: November 24, 2015]*