Karnataka J. Agric. Sci.,25 (3) : (395-396) 2012

Effect of integrated nutrient management on growth and yield of quality protien maize*

Maize (*Zea mays* L.) is the third most important cereal in India after wheat and rice. Currently it is cultivated over 8.33 million ha. with 16.68 million tonnes production having an average productivity of 2002 kg ha^{-1}. In Karnataka, maize occupies an area of 1.07 million ha with an annual production of about 3.03 million tonnes and an average productivity of 2833 kg ha^{-1}, contributing nearly 8 per cent in the national food basket. Chemical fertilizers cannot be avoided completely since they are the potential sources of high amount of nutrients in easily available forms. Most of the crops respond quickly to chemical fertilizers and give higher yield and maize is more responsive. But, continuous application of chemical fertilizers alone is not desirable as it has been reported to deteriorate soil health. At the same time, application of organic manures alone do not produce required yields due to their low nutrient status. Sustainable yield levels could be achieved only by applying appropriate combination of green manures or organic manures and chemical fertilizers (Verma, 1991 ; Obi and Ebo, 1995). Keeping these points in view, a field experiment was conducted to evolve a viable nutrient management system for quality protein maize in summer.

A field experiment was conducted during summer 210 at Agricultural Research Station, Arabhavi of Belgaum district, which lies in northern dry zone (Zone-3) of Karnataka and region II of agroclimatic zones of India. The soil type was clay loam with a pH of 7.89. The available nitrogen (231 kg/ha) and phosphorus (22.98 kg/ha) were low and potassium (250 kg/ha) was medium. The experiment was laid out in randomized block design with three replications. There were 12 treatments consisting sunnhemp green manure, biofertilizers (*Azospirillum* and PSB), Liquid manures (*Panchagavvya* and *Jeevamrutha*) and three levels of fertilizers (50, 75 and 100% RDF). FYM @ 10 t /ha is applied to each treatment. quality protien maize genotype HQPM-1 was sown in comparison with DMH-2 at spacing of 60 cm x 20 cm on 7th Jan. 2010. The seeds were treated with biofertilizer (*Azospirillum* +PSB) to use in respective treatments for sowing. Green manure crop (Sunnhemp) was sown simultaneously between two rows of QPM. Further green manuring crop was incorporated into soil, 40 days after sowing. Jeevamrutha @ 500 l/ha^{-1} soil application was carried out at 40 and 60 DAS. Panchagavya @ 3% concentration foliar spray @ 500 l/ ha^{-1} was carried out at tasseling and silking stage.

The recommended of fertilizer dose for maize is 150 kg N, 75 kg P_2O_5 and 37.5 kg K_2O ha^{-1}. Fertilizer doses were calculated as per treatment and applied to each plot using urea, diammonium phosphate and muriate of potash. Entire dose of phosphorus and potassium and 33.33 per cent of nitrogen were applied at the time of sowing. The remaining 2/3 of the nitrogen was top dressed @ 33.3 per cent each at 30th and 45th day after sowing in the form of urea. Crop was harvested on 4th may 2010.

Significantly higher growth components such as plant height (187.8 cm), leaf area index (4.7) and total dry matter production (309.4 g $plant^{-1}$) were recorded in T_1 (FYM 10 t ha^{-1} + 100 per cent RDF) over rest of the treatments but T_{10} was on par with T_1 (Table 1). The treatments for followed by T_8 and T_6 . Increase in growth components with the application of FYM, green manuring, biofertilizer and liquid manuring in T_{10}, T_8 and T_6 might be due to higher amount of available major and micro nutrients in the plots treated with these organics. Besides, liquid manures (*Jeevamrutha* and *Panchagavya*) with rich population of microbes might have helped in degradation and mobilization of the nutrients from

Table 1. Growth and yield components of quality protein maize as influenced by nutrient management practices

Treatment	Plant height (cm) at harvest	Dry matter production (gm) at harvest	Cob girth (cm)	Cob length (cm)	Weight per cob (g)	100 seed weight (g)
T_1: FYM 10 t ha^{-1} +100 % RDF	187.8	309.4	11.52	15.8	122.2	29.1
T_2: FYM 10 t ha^{-1} + 75 % RDF	168.7	269.8	10.32	14.2	104.8	25.7
T_3: FYM 10 t ha^{-1} + 50 % RDF	145.9	241.1	9.3	13.4	96.9	24.8
T_4: FYM 10 t ha^{-1} + 75 % RDF + S	181.8	288.4	11.09	14.9	111.8	28.4
T_5: FYM 10 t ha^{-1} + 50 % RDF + S	153.6	252.2	9.7	13.5	101.3	25.6
T_6: FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB	182.9	290.7	11.19	15.2	112.4	28.5
T_7: FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB	155.2	258.0	10.02	13.9	105.1	26.2
T_8: FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB + P	184.7	292.7	11.28	15.2	114.1	28.6
T_9: FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB + P	157.3	262.8	10.43	14.2	107.1	26.8
T_{10}: FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB + P + J	186	301.7	11.31	15.4	115.3	28.8
T_{11}: FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB + P + J	162.7	266.5	10.62	14.6	108.5	27.2
T_{12}: DMH-2 (RPP)	182.4	276.1	10.85	14.3	113.4	28.5
S. Em ±	2.9	4.5	0.15	0.22	0.1	0.3
C.D. (P= 0.05)	8.5	13.2	0.44	0.63	0.3	0.89

Note : RDF = 150 :75:37.5 kg NPK/ha + 25 kg $ZnSO_4$ / ha
S= Sunnhemp *insitu* incorporation at 40 DAS
A = *Azospirillum*, PSB = Phosphate solubilising bacteria
P= *Panchagavya* @ 3 per cent foliar spray at tasseling and silking stage
J = *Jeevamrutha* soil application at 40 and 60 DAS
RPP = Recommended package of practices

*Part of M. Sc. (Agri.) thesis submitted by the first author to the University of Agricultural Sciences, Dharwad - 580 005, India.

unavailable form to available form as reported by Balyan *et al.* (2006), Verma *et al.* (2006) and Balai *et al.* (2011).

Application of 10 t FYM + 100 per cent RDF ha^{-1} (T_1) recorded significantly higher grain yield (71.79 q ha^{-1}) over rest of the treatments (Table 2) but it was on par with T_{10}, T_8, T_6 and T_4 (70.75, 68.84, 68.00 and 67.25 q ha^{-1}, respectively). Increase in the grain yield of quality protein maize with integration of organic and inorganic fertilizers might be due the improvement in the yield components like cob length, cob girth, weight per cob and test weight, which had direct influence on the grain yield. Other factors which indirectly influenced the grain yield are growth attributes like plant height, leaf area index and total dry matter production.

Higher gross returns (₹ 98727 ha^{-1}), net returns (₹ 69100 ha^{-1}) and B:C (3.33) were noticed in T_1 (FYM 10 t ha^{-1} + 100 per cent RDF) over rest of the treatments, but it was on par with T_{10}, T_8, T_6 and T_4 (Table 2). The higher gross returns, net returns and B:C obtained with these treatments were ultimately due to higher productivity in terms of yield in these treatments. These results are supported by the findings of Patra *et al.* (1998) and Ashok Kumar *et al*. (2005) who reported similar findings.

Thus, it can be concluded that integration of 75 per cent RDF + *in situ* green manuring of sunnhemp, biofertilizers (*Azospirillum* + PSB) and liquid manures like *Panchagavya* foliar spray @ 3 per cent and soil application of *jeevamrutha* helps to save 25 per cent of RDF by producing grain yield on par with that of 100% RDF.

Table 2. Yield and economics of quality protein maize production as influenced by nutrient management practices

	Treatment	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C
T_1:	FYM 10 t ha^{-1} +100 % RDF	71.79	98.28	98,727	69,100	3.33
T_2:	FYM 10 t ha^{-1} + 75 % RDF	63.71	88.59	87,697	59,190	3.08
T_3:	FYM 10 t ha^{-1} + 50 % RDF	58.29	81.21	80,239	52,830	2.93
T_4:	FYM 10 t ha^{-1} + 75 % RDF + S	67.25	90.52	92,424	63,092	3.15
T_5:	FYM 10 t ha^{-1} + 50 % RDF + S	60.51	83.12	83,239	55,005	2.95
T_6:	FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB	68	92.02	93,498	64,066	3.18
T_7:	FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB	62.11	83.96	85,364	57,031	3.01
T_8:	FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB + P	68.84	92.91	94,597	64,215	3.11
T_9:	FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB + P	63.03	85.91	86,658	57,374	2.96
T_{10}:	FYM 10 t ha^{-1} + 75 % RDF + S + A +PSB + P + J	70.75	95.28	97,213	65,731	3.09
T_{11}:	FYM 10 t ha^{-1} + 50 % RDF + S + A +PSB + P + J	63.83	86.61	87,745	57,361	2.89
T_{12}:	DMH-2 (RPP)	65.96	88.51	90,616	61,603	3.12
S.Em ±	1.73	2.1	2410	2406	0.09	0.09
C.D. (P =0.05)		5.06	6.15	7057	7057	0.24

Note : RDF = 150 :75:37.5 kg NPK/ha + 25 kg $ZnSO_4$ ha^{-1},
S= Sunnhemp insitu incorporation at 40 DAS.
A = Azospirillum, PSB = Phosphate solubilising Bacteria.
P= Panchagavya @ 3 per cent foliar spray at tasseling and silking stage.
J = Jeevamrutha soil application at 40 and 60 DAS
RPP = Recommended package of practices.

Department of Agronomy
University of Agricultural Sciences
Dharwad - 580 005, India
Email : rbasavarajappa@yahoo.com

N. RAVI
R. BASAVARAJAPPA
C. P. CHANDRASHEKAR
S. I. HARLAPUR
M. H. HOSAMANI
M. V. MANJUNATHA

(Received: January, 2012 ; Accepted:June, 2012)

References

Ashok Kumar, R. C., Guatam, Ranbir Singh and Rana, K. S., 2005, Growth, yield and economics of maize (*Zea mays* L.) - wheat (*Triticum aestivum*) cropping sequence as influenced by integrated nutrient management. *Indian J. Agric. Sci.*, 75: 709-711.

Obi, M. E. and Ebo, P. O., 1995, The effect of organic and inorganic amendments on soil physical properties and maize production in a several degraded sandy soils. *Bioresource Tech.,* 51(2-3): 117-123.

Patra, A. P., Panda, D., Patra, B. C. and Karnakar, A. J., 1998, Effect of FYM, zinc and NPK fertilizers on yield components and yield of wheat after winter rice in West Bengal. *J. Inter Academica*, 2: 1-6.

Verma, T. S., 1991, Influence of methods of farmyard manure application on maize under rainfed conditions. *Crop Res.,* 4 (1): 161-164.