Annals of Plant and Soil Research 18(4): 353-356 (2016)

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY AND ECONOMICS OF RABI MAIZE

M.V. SINGH, NEERAJ KUMAR, BHAGWAN SINGH AND VED PRAKASH

Crop Research Station, Bahraich - 271 801 (U.P.)

Received: March, 2015; Revised accepted: April, 2016

ABSTRACT

The Field experiment was conducted during rabi season of 2012-13 and 2013-14 at Crop Research Station, Bahraich, N.D. University of Agriculture & Technology (U.P.), to study the effect of integrated nutrient management on growth, yield and economics of rabi maize. The experiment was laid out in randomized block design with 7 treatments and three replications. The results revealed that the farmer practice (120 kg N + 30 kg P_2O_5 +30 kg K_2O ha^{-1}) proved significantly superior to control in respect of growth and yield of maize. There was a significant increase in growth, yield attributes and yield of maize with increasing levels of NPK and maximum values of plant height (184.8cm), cobs/plot (170.5), cob length (20.4cm), cob girth (14.8 cm) grain row/cob (18.6) grain/row (38.8), test weight (242.8 g), grain yield (68.4 q ha^{-1}) and stover yield (74.7 q ha^{-1}) were recorded at 100% NPK (250 kg N + 80 kg P_2O_5 + 60 kg K_2O ha^{-1}). The maximum net returns (` 76230 ha^{-1}) and B:C ratio (3.82) were recorded with 100% NPK application. The minimum net returns and B:C ratio were recorded under control treatment. Combined application of inorganic fertilizers along with FYM proved superior to inorganic fertilizers alone with respect of yield of maize. Among all the treatments, application of 100% NPK proved superior In respect of growth and yield of the crop. The maximum values of total uptake of N (1530 kg ha^{-1}) P (35.9 kg ha^{-1}) and K (67.7 kg ha^{-1}) were recorded with 100% NPK followed by 75% NPK + 6t FYM ha^{-1} and minimum under control.

Keywords: Nutrients levels, economics, maize, yield

INTRODUCTION

Maize is most versatile emerging crop having high yield potential wider adaptability to diverse ecologies and adverse environment. Amongst various agricultural inputs, fertilizers play a chief source enhancing the food production target. Introduction of high yield hybrids of maize with the assured supply of the inputs enhanced the productivity of crop. Among the different inputs, nutrients play a vital role in enhancing the crop productivity nitrogen; phosphate and potash are the most limiting maize production. Kumar *et al.,* (2005) and Singh *et al.* (2013) recorded maximum yield of maize when 100 % NPK was applied with FYM @ 10 ton ha^{-1}. Fertilizers played a vital role in agricultural production and productivity in India but continuous and imbalanced use of chemical fertilizers creates problem in the production potential and deterioration of soil health. Use of chemical fertilizers in combination with organic manures is required to improve the soil health. It is well documented that FYM is complimentary source of nutrients and improves the efficiency of the applied mineral nutrients on one hand and improves soil physical and biological properties on the other hand. Hence, the integrated nutrient management is need of the hour to increase the productivity by maintain the soil health. Moreover, soil and crop management practices that utilize organic manure have the potential to increase the organic carbon and microbial activities in the soil besides increasing crop productivity and sustainability. Farmers generally use low and imbalanced dose of chemical fertilizers in rabi hybrid maize which results in low yield of maize. Therefore an experiment was under taken to evaluate the effect of levels of nutrients with and without FYM for higher yield of rabi maize at Bahraich, Uttar Pradesh.

MATERIALS AND METHODS

Field experiments were conducted during the winter season of 2012-13 and 2013-14 at Crop Research Station, Bahraich (N.D. University of Agriculture and Technology). The experimental sail was sandy loam having pH 7.5. The soil was low in nitrogen (250 kg ha^{-1}) medium in available phosphorus (15 kg ha^{-1}) and available K (210.8 kg ha^{-1}). The Treatments consisted T_1 – 50% NPK (125:40:30 kg ha^{-1}), T_2 – 75% NPK (187:60:45 kg ha^{-1}), T_3 – 100 % NPK (250:80:60 kg ha^{-1}), T_4 – 50 % NPK + 12 t FYM ha^{-1}, T_5 – 75 % NPK + 6 t FYM ha^{-1}, T_6 – Farmer's practice (120:30:30

kg ha^{-1}) and T_7 – Control. The randomized block design was used and treatments were replicated three times. The crop variety HM7705 was sown on 10th Nov. in both the years. The doses of FYM were used in field before 15 days of sowing as per treatments. Half dose of N and full dose of Phosphorus ad potash was applied as basal as per treatments through urea, single superphosphate and muriate of potash, respectively. Remaining half dose of nitrogen was applied as topdressing in two equal doses first at knee height stage and second at silking stage of the crop. The crop was irrigated as per requirements of crop and other cultural operations and weed control was done as per need of crop from time to time. The growth and yield attributing characters were recorded at full growth stage of crop and yield of grain and stover at harvest. The crop was harvested at completion of 168 days from sowing date. The N, P and K contents in grain and stover were determined by adopting standard methods (Jackson, 1973). The economics of the treatments was calculated on the basis of prevailing market price of the inputs andproduce. The data collected for different parameters were statistically analysed as per procedure given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Yield attributes and yield:

The different levels of nutrients expressed significant effect on plant height, cob length, cob girth, grain row/cob, grain per row and test weight at harvest, (Table 1). The highest plant height (184.8 cm) cobs plot^{-1} (170.5), cob length (20.4 cm), cob girth (14.8 cm), grain row/cob (18.6), grains / row (38.8) and test weight (242.8 q) were noted with 250:80:60 kg NPK ha^{-1}. This increase in yield attributes may be ascribed to higher availability of nutrients leading to higher productivity and translocation of photosynthates, Similar findings were reported by Singh *et al.* (2013) and Avasthi (2011). Yield attributes were also significantly influenced by integrated use of NPK and FYM (Table 1). The value of yield attributes gradually increased with increasing dose of nutrients alongwith FYM. The response of FYM along with chemical fertilizer to the crop was more in comparison to chemical fertilizer alone. This might be due to improvement in physico-chemical properties of soil and also supply of secondary as well as micronutrients by the application of FYM. Similar finding were reported by Singh and Singh (2006) and Parmasivan *et al.,* (2011). The lower values of plant growth and yield attributes were recorded under control plot which might be due to supply of low quantity of nutrients to plants from the soil. The treatment farmer's practice (120:30:30) produced dwarf plant and yield attributes in comparison to other levels of nutrients. This might be due to less application of nutrients than the need of hybrid maize. The response of chemical fertilizer along with FYM in maize crop was also reported by Meena *et al.* (2007), Meena *et al.,* (2012), Nagar and Kumar (2012) and Singh *et al,* (2013).

Table 1: Effect of integrated nutrient management on growth and yield of rabi hybrid maize (means of 2 year)

Treatments	Plant height (cm)	Cobs /plot	Cobs length (cm)	Cobs girth (cm)	Grains row/cob	Grain /row	Test weight (q)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})
T_1- 50 % NPK	162.8	154.2	16.5	10.4	14.5	27.5	220.8	45.8	54.6
T_2- 75 % NPK	174.5	162.3	17.8	12.8	16.8	31.5	234.8	55.6	62.8
T_3- 100 % NPK	184.8	170.5	20.4	14.8	18.6	38.8	242.8	68.4	74.7
T_4- 50 % NPK + 12 t FYM ha^{-1}	168.6	158.7	16.8	12.5	15.5	29.5	228.7	58.5	68.4
T_5- 75 % NPK + 6 t FYM ha^{-1}	178.5	165.7	18.2	13.8	17.5	26.7	236.5	62.8	72.5
T_6- Farmer's Practice	160.2	153.5	15.4	10.2	12.5	26.7	218.5	35.8	44.5
T_7- Control	125.2	148.5	10.2	7.8	8.2	12.8	150.7	12.5	18.7
CD (P=0.05)	5.5	4.8	1.5	1.25	1.5	2.5	4.8	3.5	4.5

Different levels of NPK produced significantly higher maize grain yield which increased progressively up to the higher applied doses of NPK fertilizers. The highest maize grain yield (68.4 q ha^{-1}) and stover yield (74.7 q ha^{-1}) were recorded under 250 kg N + 80 kg P_2O_5 + 60 kg K_2O ha^{-1}. As regard the grain yield, this treatment was significantly superior over other treatments.

It might be due to availability of more nutrients as well as producing more growth and yield attributes in comparison to other treatments. The treatment having chemical fertilizer along with FYM performed better in comparison to chemical fertilizer alone. The lowest grain yield (12.5 q ha^{-1}) was noted under the control plot. This might be due to the reason that nutrients were not applied in this treatment.

Nutrient Uptake

Pooled mean data for total N,P and K uptake by maize are ptrsented in Table 2. Total nutrient uptake varied from 28.1 to 153.0, 8.6 to 35.9 and 15.8 to 67.7 kg N, P a d K ha^{-1} ,respectively. Highest uptake of N, P and K by maize crop were recorded with 100% NPK alone. Higher biomass production may be ascribed as the most pertinent reason for higher uptake of nutrients. The lower values of nutrient uptake (28.1, 8.6 and 15.8 kg NPK ha^{-1}, respectively) was noted in the control plot which might be due to the lowest yield.. The uptake of nutrients with farmer's practice was also lower than other treatments except control due to relatively lower yield as a result of less amounts of fertilizer against need of the crop. Combined application of 75% NPK + 6t FYM ha^{-1} also improved the uptake of nutrients compared with other treatments except 100% NPK. This increase may be due to combined application of FYM and inorganic fertilizers. FYM improved physic-chemical properties of soil and develops favourable condition for higher nutrient absorption by the plants.

Table 2: Effect of integrated nutrients management on economics and nutrient uptake of rabi maize (mean of 2 years)

Treatments	Net profit (Rs ha^{-1})	B:C ratio	Total Nutrient Uptake (Kg ha^{-1})		
			N	P	K
T_1- 50 % NPK (125:40:30 kg ha^{-1})	45580.00	2.89	103.1	23.5	44.6
T_2- 75 % NPK (187:60:45) NPK kg ha^{-1}	58620.00	3.29	125.1	27.8	52.0
T_3- 100 % NPK (250:80:60) NPK kg ha^{-1}	76230.00	2.82	153.0	35.9	67.7
T_4- 50 % NPK (125:40:30)+12 ton FYM ha^{-1}	63740.00	3.54	131.6	29.8	40.5
T_5- 75 % NPK (187:60:45) + 6 ton FYM ha^{-1}	68670.00	3.59	143.3	32.2	55.8
T_6- Farmer's Practice (120:30:30) NPK ha^{-1}	31570.00	2.37	80.5	18.6	37.6
T_7- Control (No NPK)	4370.00	1.29	18.1	8.6	15.8
CD (P=0.05)	850.0	0.015	8.5	3.5	6.4

Grain cost Rs. 1400/ quintal
Stover cost Rs. 100/ quintal

Economics

Pooled data on net return and benefit:cost ratio were affected by nutrient management practices (Table 2). The maximum net return of Rs. 76230.00 was recorded with 100% NPK (250:80:60 kg NPK ha^{-1}) which was due to higher grain and stover yield. The highest B:C ratio (3.82) was recorded with 250:80:60 kg NPK ha^{-1} which proved significantly superior over the other treatments. The net returns and B: Cratio with chemical fertilizer + FYM application in various combinations were more in comparison to same dose of chemical fertilizer applied to the crop. This might be due to more grain yield recorded under chemical fertilizer + FYM in comparison to chemical fertilizer alone.

It may be concluded from the results that maize hybrid fertilized with 250:80:60 kg N + P_2O_5 + k_2O ha^{-1} produced maximum yields and net profit followed by 75% NPK + 6t FYM ha^{-1}. Thus it may be recommended for the successful cultivation of rabi maize in eastern Uttar Pradesh.

REFERENCES

Avasthi, R. (2011) Response of rainfed maize (*Zea mays L.*) to nitrogen management in mid hill acidic soil of Sikkim. *Indian Journal of Agricultural Sciences 56:232-236*

Jackson, M. L. (1973) *Soil chemical analysis*. Prentice *Hall of India , Pvt. Ltd. New Delhi.*

Gomez, K.A. and Gomez, A.A. (1984) *Statistical Procedures for Agricultural Research* edn. 2, Johan Wiley & Sons, New York.

Kumar, A., Gautam, R.C.; Singh, R. and Roma, K.S. (2005). Growth yield and economicas of maize (*Zea Mays L.*) – wheat (*Triticum aestivum*) cropping sequence as influenced by integrated nutrient management. *Indian Journal of Agricultueral Sciences 75(11):709-711*

Meena, K.N.; Kumar, A.; Jat, S.N.; Shivdher; Parihar, C.M.; Meena, B.P. and Singh, A.K. (2012) Production potential and profitability of maize (*Zea mays L.*), wheat (*Triticum aestivum*). *sequence under varying source of nutrients Maize Journal 1(1): 54-57.*

Meena, O. Khafi, H. R.; Shekh, M. A.; Mehta, A. C. and Davda, B. K. (2007) Effect of vermicompost and nitrogen on content, uptake and yield of rabi maize (*Zea mays L.)* Crop Res. *Hisar 33(1/3) : 53-54.*

Nagar, N. and Kumar, V. (2012) Effect of organic matter and phosphorus on the performance of oat irrigated with industrial effluent. *Annals of plant and soil research 14(1):46-49.*

Parmasivan, M.; Kumaresan, K.R. and Maravizhi, P. (2011) Effect of balanced nutrients on yield, nutrient uptake and soil fertility of maize *(Zea mays L.)* in vertisol of Tamil Nadu. *Indian Journal of Agronomy 56(2):133-137.*

Singh, M.V.; Kumar, N. and Mishra, B.N. (2013) Integrated use of nitrogen and FYM on yield, nutrient uptake and economics of maize in eastern Uttar Pradesh. *Annals of plant and soil research 15(2):128-130.*