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Short Communication

Economical Level of NP-fertilizers for Growing Maize Crop in Pakistan

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ABSTRACT

In view of getting maximum return, response of maize crop to various levels of NP fertilizers was studied. Results showed that NP levels affected the grain yield and its components significantly. Grain yield, cobs plant^{-1}, grains cob^{-1} and 1000 grain weight, were maximum at 140:70 followed by 120:60 kg ha^{-1} but the highest level of NP (160:80) showed decline in all of these parameters. Economic analysis showed that NP levels of 140:70 and 120:60 gave maximum net income and maximum marginal rate of return, which support the superiority of these levels. Because marginal rate of return was highest in 120:60 level with comparatively less cost than 140:70 NP levels, it was better option to use this dose of NP for growing maize crop in Pakistan.

Key Words: Maize; NP-levels; Grain yield; Economics

INTRODUCTION

Maize (*Zea mays*) being the highest yielding cereal crop in the world is of significant importance for countries like Pakistan as it has productive land and irrigation water. Majority of the farmers is not using inputs like fertilizers, weedicides and pesticides of maize crop. Consistent and high productivity of any crop remained a problem in the areas, where majority of the farmers is un-aware of modern crop production technology. Improved production technology of maize needs some refinement according to the soil environment, and farmer's needs and socio-economic conditions. The ultimate target of the farmers is to increase productivity and profitability (Firebaugh, 1990). The seed of improved variety and fertilizers are very important parameters of the modernization process (Dowswell et al., 1996; Black, 1993; Muleba, 1999).

The present study was designed to generate useful information to optimize NP levels for enhancing maize yields in Pakistan under the agro-ecological conditions at Peshawar.

MATERIALS AND METHODS

The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. Gauher variety of maize was used to evaluate its response to NP levels viz. 0:0 (control), 100:50, 120:60, 140:70 and 160:80 kg ha^{-1}. Each plot comprised of 4 rows of 3 m length with row to row distance of 0.75 m and plant-to-plant distance 0.25 m. Complete dose of phosphorus and half of Nitrogen was applied at sowing. The remaining N-fertilizer was applied at knee height of plants. All other inputs and cultural operations were same for all treatments. The observations were recorded on days to 50% silking, plant height, fresh ear weight, grain moisture, cobs plant^{-1}, grains cob^{-1} and 1000-grain weight. The grain was computed using the following formula at 15% grain moisture. All the data were subjected to statistical analysis by using MSTAT software on computer to see the significance of the differences among various levels of fertilizer. The grain yield was also subjected to economical analysis on the basis of marginal analysis for net benefit and marginal rate of return keeping in view the minimum rate of return should be 100% (CIMMYT, 1988).

Standard formula for grain yield calculation

$$\text{Grain yield (kg ha}^{-1}) = \frac{FEW \times 100 - M\% \times 0.8 \times 10{,}000}{85 \times 7.5}$$

FEW: Fresh ear weight in field at harvest.
M%: Grain moisture %age at harvest with moisture tester.

$\frac{100-M}{85}$: *Conversion of grain moisture at 15% level.*

0.8: Grain/cob ratio (shelling %age) i.e. for the variety planted, shelling % is 80% grains.

$\frac{10{,}000}{7.5}$ *: Conversion of grain yield per plot (7.5 m^2) on hectare basis.*

RESULTS AND DISCUSSION

Results in Table I show that grain yield increased up to NP level of 140:70 kg ha^{-1}. Further increase in fertilizer levels decreased the grain yield. This level increased the grain yield by 124% over the control. Increase in yield was 96% and 85% by NP levels of 120:60 and 160:80 kg ha^{-1}, respectively. It is clear from the results that NP level of 140:70 kg ha^{-1} is the optimum fertilizer level for higher grain yield. Tisdale *et al.* (1993) observed that an optimum supply of nitrogen is therefore, important for proper plant growth and development. Black (1993) also observed that nitrogen has been regarded as the most influential plant

element in the growth and development of plants. Grain yield, 100 grain weight and quality of the grains improved with phosphorus fertilizer upto 80 kg ha^{-1} when applied as NP (Farha & Ravi, 2002). The top two levels of fertilizer produced taller plants followed by the other two NP levels, while smallest plants were found in control treatment. Among the tallest plants producing levels, the top most level (160:80) could not produce the plants taller than second top level (140:70). Similarly, grains per cob and 1000-grain weight were increased upto NP-level of 140:70 and then declined in 160:80 NP-level. Plant height, grains per cob and 1000 grain weight having the same trend as in case of grain yield. However, cobs per plant increased only upto NP level of 120:60 kg ha^{-1}. Maturity as measured by days to 50% silking delayed with increase in NP levels without any decline, which means that fertilizer delayed crop maturity. According to Kruczek (1998), the agronomic and physiological effectiveness of nitrogen decreased as the rate increased.

It is clear from economic analysis of the data (Table II) that maximum net income was obtained from NP level of 140:70 kg ha^{-1} followed by 120:60 kg $ha^{-1}$and 160:80. The increase in net income over control was 56%, 40% and 7% due to NP-levels of 140:70, 120:60 and 160:80, respectively. The net income obtained by the highest level of 160:80 kg ha^{-1} was even less than 120:60 level of fertilizers. Marginal Rate of Return was maximum for NP level of 120:60 kg ha^{-1} (415%) followed by the NP level of 140:70 kg ha^{-1} (133%). Grain yield and net income were more in the NP level of 140:70 but the marginal rate of return was less due to high cost of fertilizer involved but still more than minimum rate of return. On the basis of grain yield, benefit and marginal rate of return NP-level of 140:70 is the fertilizer levels for growing maize crop. For finding out the best and optimum level of fertilizers, economics must be considered. So that maximum return can be obtained from any crop. For resource poor farmers, who can't afford more cost, they should apply fertilizer with NP-level of 120:60 kg ha^{-1} as this level gave maximum marginal rate of return at minimum cost. Akhter *et al*. (1998) also described that the farmers could not afford very high level of fertilizer due to its high cost. CIMMYT (1988) mentioned that more than 100% marginal rate of return should be accepted.

It is concluded that NP level of 140:70 kg ha^{-1}, as its marginal rate of return is more than the minimum rate of return, is recommended for the farmers, who can afford more cost of production due to high dose of fertilizer. For the farmers, who can't afford much cost and on the basis of maximum marginal rate of return the NP level of 120:60 kg ha^{-1} is recommended for growing maize crop successfully and economically.

Table I. Response of fertilizer levels on yield and yield components of maize

Fertilizer levels (kg ha^{-1})	Grain Yield (kg ha^{-1})	Increase over control (%)	Cobs per plant	Grains per Cob	1000 grain weight (g)	50% silking (Days)	Plant height (cm)
Control	1159		98	364	205	61	159
100:50	1719	48	1.10	382	217	63	168
120:60	2275	96	1.18	396	225	66	175
140:70	2601	124	1.15	413	233	69	198
160:80	2148	85	1.00	389	224	72	191
CV	6.30		7.02	1.78	1.72	1.00	2.57
LSD	192.10		0.12	10.64	5.85	1.01	7.08

Table II. Economic analysis for response of fertilizer levels

Variables	Control	100:50	120:60	140:70	160:80
Grain yield (kgha^{-1})	1159	1719	2275	2601	2148
Gross Income(Rsha^{-1})	8113	12033	15928	18207	15036
*Variable cost(Rsha^{-1})	---	3825	4580	5560	6315
Net Income (Rsha^{-1})	8113	8208	11345	12647	8721
Increase Over Control (%)	-	1 %	40 %	56 %	7 %
**MRR (%)	-	2	415	133	D***

*Variable Cost= Cost that vary is the cost that is incurred on variable inputs in the production of a particular commodity; **Marginal Rate of Return (MRR%) = Change in net benefit/Change in variable cost X100; ***D= Dominated, any treatment that had net benefits that were less than or equal to those of a treatment with lower variable cost was taken to be dominated;

Variable Cost	100:50	120:60	140:70	160:80
UREA @ Rs. 450/bag	1575	1800	2250	2475
DAP @ Rs. 1050/bag	2100	2625	3150	3675
Transportation of bags (@ Rs. 5/bag	30	35	40	45
Application Cost (@ Rs. 120/man day	120	120	120	120
Total Cost	3825	4580	5560	6315

REFERENCES

Akhter, M., H.N. Malik and M. Aslam, 1998. Maize growth and yield as affected by various nitrogen levels in Islamabad Capital Territory. *Sarhad J. Agric*., 14: 339–44

Al-Farhan, H.N. and D.F. Al-Rawi, 2002. The effect of some phosphorus Fertilizer on the quality and yield of Zea mays. *University of Aden J. National and Appl. Sci*., 6: 1, 33–40; 15 ref

Anonymous, 2000. *Economic Survey of Pakistan.* Ministry of Planning, Government of Pakistan

Black, C.A., 1998. *Soil Fertility Evaluation and Control*. Lewis Publisher Ann. Arbor

CIMMYT, 1988. *From Agronomic Data to Farmer Recommendations,* P: 79. An Economic Training Manual. Mexico D.F

Dowswell, C.R., R.L. Paliwal and R.P. Cantrell, 1996. *Maize in the third World*. P: 268. West View Press, USA

Kruczek, A., 1998. Effectiveness of nitrogen fertilizer application on maize grown for grain in the Wielkopolska region. Roczniki nauk Rolniczych Seria. *A, Produkcja Roslinna,* 112: 3–4, 183–98; 15 ref

Maqbool, A. and J.A. Silva, 1998. Growth behavior and contents of sweet corn as affected by nitrogen application and intercropping. *Pakistan J. Soil Sci.,* 15: 130–4

Muleba, N., 1999. Effects of cowpea, crotalaria and sorghum crops and phosphorus fertilizers on maize productivity in semi-arid West Africa. *J. Agric. Sci*., 132: 1, 61–70

Rizvi, S.A., H, Rahman, M.J. Khattak and H. Shah, 1988. Effect of phosphorus on the yield and yield components of maize. *Sarhad J. Agric*., 4: 849–52

Tisdale, S.L., 1993. *Soil Fertility and Fertilizer*. Macmillan Publishers Co., New York

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