ISSN 2250-3153

Study of Economics of Maize as influenced by different levels of Nitrogen, Phosphorus and Zinc

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Abstract- This paper summarizes the economics of maize production under different treatment combinations of nitrogen, phosphorus and zinc. A field experiment was conducted during the *rabi* season of the year 2009- 10 at Pulse Research Station, Anand Agricultural University, Model Farm, Vadodara, Gujarat. Results revealed that highest B:C ratio was found to be significant under application of N_3 (160 kg N ha^{-1}), P_3 (80 kg P_2O_5 ha^{-1})and Z_2 (5 kg Z ha^{-1}) over other treatments. The gross realization in terms of rupees per hectare was worked out separately for each treatment by taking the average maize grain yield into consideration of the respective treatments on the basis of their prevailing market prices.

Index Terms- Benefit cost ratio, Economics, Nitrogen, Phosphorus, Zinc, Maize and Yield

I. INTRODUCTION

Maize has been widely cultivated as a rain fed crop in India. Recent studies have shown that maize can be successfully grown during *rabi* in many part of the country due to evolution of new genotypes. The yield level of maize during *rabi* season is considerably higher than that of *Kharif* due to its timely water availability and higher fertilizer use efficiencies (Singh, 1974). Nitrogen is the key element in crop growth and is the most limiting nutrient in Indian soil. The paramount importance of nitrogen for increasing the yield has been widely accepted. Nitrogen influences the quality of product by improving the level of protein, succulence and palatability.

Application of micronutrient also play significant role in improvement of grain yield of maize. Among, micronutrient zinc plays an important role in photosynthesis, nitrogen metabolism and regulates auxin concentration in the plant. The Zn deficiency was found wide spread in Indian soil. The availability of phosphorus and the micronutrients like zinc and manganese can be limiting factors for plant growth especially in the young maize plant with a small root soil interface. Therefore, if mineral elements readily available to the young plant are provided before the root system is fully developed; they are likely to enhance the growth, particularly at low temperatures. In maize zinc deficiency appears during the early growth stage and the plants exhibit stunted growth. Dangarwala et al. 1994 reported that zinc deficiency has been observed in middle and north Gujarat regions at the extend of 25 percent in maize crop.

But the benefit and cost ratio have been also taken into consideration for best combination of fertilizers to be used under specific location. With this background a field trial was undertaken to study the "Response of Maize (Zea mays L.) to the Levels of Nitrogen, Phosphorus and Zinc during rabi season under middle Gujarat conditions." at Pulse Research Station, AAU, Model Farm, Vododara during rabi of the year 2009-10.

II. MATERIALS AND METHOD

A field experiment was conducted at Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara, Gujarat during the *rabi* season of the year 2009- 10. Soil of the experimental field was sandy loam with pH 7.5. It was very deep and fairly moisture retentive, low in available nitrogen, zinc and organic carbon and high in available phosphorus and potash. Eighteen treatment combinations consisting of three levels of nitrogen (80, 120 and 160 kg N ha^{-1}), three levels of phosphorus (40, 60 and 80 kg P_2O_5 ha^{-1}) and two levels of zinc (0 and 5 kg Z ha^{-1}) were tested in factorial randomized block design with three replications. Furrows were opened manually in each plot 60 cm apart in dry conditions after through preparation of land. The full dose of phosphors and zinc and 1/3rd quantity of nitrogen according to treatments were applied at the time of sowing. Remaining 2/3rd quantity of nitrogen was applied in two equal split i.e. at knee high stage and at tesseling stage. Eight irrigations were given as when required. The experiment was sown with single cross hybrid maize 'HQPM-1' on 8 Nov 2009 and harvested on 10 March 2010.

The gross realization in terms of rupees per hectare was worked out separately for each treatment by taking the average maize grain yield into consideration of the respective treatments on the basis of their prevailing market prices. The cost of cultivation for each treatment was worked out considering the cost of all the operations and the inputs used. The current rate of agricultural operations and market price of inputs were used for calculation. The total cost of cultivation was subtracted from the gross realization to obtain net income per hectare for the individual treatments and recorded accordingly.

Benefit cost ratio was worked out from the total income accrued from total grain yield obtained over total expenditure incurred considering the prevailing market rates for produce and each inputs required for different treatments.

$$\text{Benefit: cost ratio (BCR)} = \frac{\text{Total income (Rs. ha}^{-1}\text{)}}{\text{Total expenditure (Rs. ha}^{-1}\text{)}}$$

III. RESULTS AND DISCUSSION

Economics the crop as influenced by nitrogen, phosphorus and zinc levels are presented in Table 1 and also graphically presented in Fig.1.

Effect of nitrogen levels on B: C ratio:

The data given in Table 1 indicated that treatment N_3 (160 kg N ha^{-1}) recorded the highest net realization (Rs. 41079 ha^{-1}) with maximum BCR value of 2.21. It was closely followed by N_2 (120 kg N ha^{-1}), which realized the net income of Rs. 38262 ha^{-1} with the BCR value of 2.17, while the lowest net return was noticed under treatment N_1 (80 kg N ha^{-1}) Rs. 32631 ha^{-1} with the BCR value of 2.03. Similar results were also reported by (Singh *et al.*, 2000a).

Effect of phosphorus levels on B: C ratio:

Effect of phosphorus levels on B: C ratio given in Table 1 indicated that treatment P_3 (80 kg P_2O_5 ha^{-1}) recorded the highest net realization (Rs. 38855 ha^{-1}) with BCR value of 2.14. The next best treatment was P_2 (60 kg P_2O_5 ha^{-1}), which realized the net income of Rs. 38705 ha^{-1} with the highest BCR value of 2.19. The lowest net return was noticed under treatment P_1 (40 kg P_2O_5 ha^{-1}) Rs. 34412 ha^{-1} with the BCR value of 2.09.

Effect of zinc levels on B: C ratio:

The results regarding economics as influenced by various levels of zinc presented in Table 1 indicated that the highest level of Zn_2 (5 kg Zn ha^{-1}) registered maximum net realization (Rs. 39992 ha^{-1}) with BCR of 2.21 than application of Zn_1 (0 kg Zn ha^{-1}) registered the lowest net realization of Rs. 34,656 ha^{-1} with BCR value of 2.06. The results are in line of the results reported by Sawarkar *et al.* (1999).

Table 1: Economics of maize as influenced by different levels of nitrogen, phosphorus and zinc

Treatments	Yields (kg ha^{-1})		Gross realization (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net Realization (Rs. ha^{-1})	BCR
	Grain	Stover				
Nitrogen levels, kg ha^{-1} (N)						
N_1:80	4678	6959	56022	25106	32631	2.03
N_2:120	520	7628	62137	25625	38262	2.17
N_3:160	5550	7742	65436	26144	41079	2.21
Phosphorus levels, kg ha^{-1} (P)						
P_1:40	4838	7137	57816	25120	34412	2.09
P_2:60	5272	7568	62579	25625	38705	2.19
P_3:80	5328	7625	63199	26129	38855	2.14
Zinc levels, kg ha^{-1} (Zn)						
Zn_1:0	4896	7165	58392	25476	34656	2.06
Zn_2:5	5396	7721	64005	25774	39992	2.21

Input cost
Rs. 12.09 per kg of N
Rs. 23.50 per kg of P_2O_5
Rs. 55.55 per kg of Zn
Rs. 130 kg^{-1}

Selling price
Grain @ Rs 9 kg^{-1}
Stover @ Rs 2 kg^{-1}
Cost of maize seeds:

IV. CONCLUSIONS

- In light of the results obtained from this investigation, it can be concluded that for securing maximum seed yield and net profit, it is advisable to apply 120 kg N ha-1 and 60 kg P2O5 ha-1 in addition to 5 kg Zn ha-1 to *rabi* maize crop var. HQPM-1 under middle Gujarat Agro-climatic conditions.
- The experiment should be repeated for at least two or three seasons for evaluating consistency and applicability of the treatments to arrive at conclusive recommendations.
- Different sources of fertilizer and methods of application should be tested through judging the fertilizer use efficiency in order to minimize the load of increasing cost of fertilizers on farmer.
- It is worthwhile to include different organic sources as a part in the nutrient management of the crop considering the soil sustainability in long run as well as to minimize the cost of cultivation which ultimately results in increased B: C ratio.
- Similar economics studies should be generated for other Agro climatic zones where the maize is cultivated.

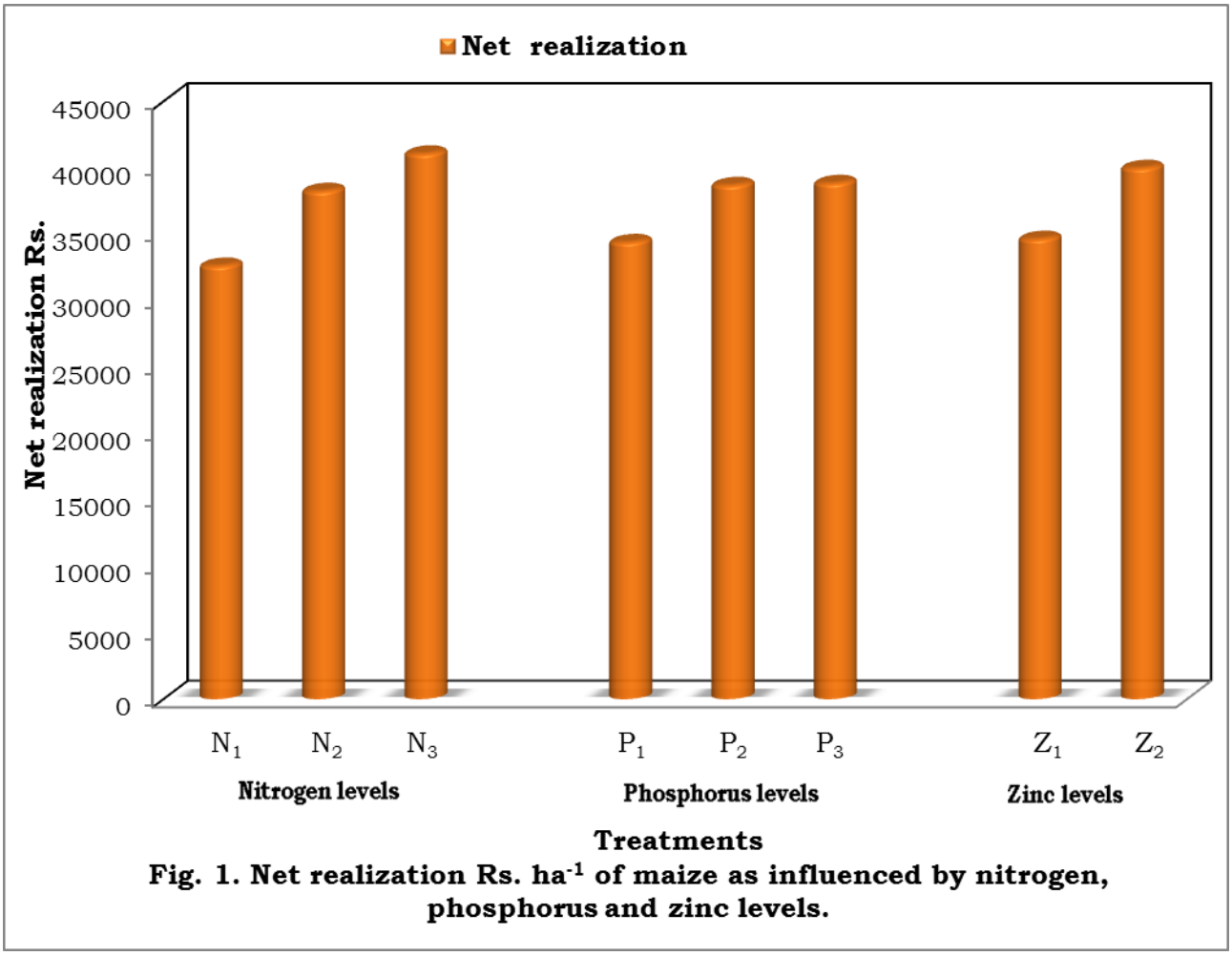

Fig. 1. Net realization Rs. ha^{-1} of maize as influenced by nitrogen, phosphorus and zinc levels.

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