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Studies on Economic Return to the Farmer with varying Levels of Nitrogen and Plant Growth Regulators in Maize (*Zea mays* L.) Crop in Sandy Loam Soil

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A B S T R A C T

Cost of cultivation for each treatment was worked out separately taking into consideration all the cultural practices followed and cost of inputs used in the cultivation in rupees. The experiment was carried out at department of Agronomy, SHUATS, Naini, Prayagraj in sandy loam soil during Rabi season of 2019-20 taking high yielding variety of maize i.e. K-27 recommended for U.P. The experiment was planned in RBD having 12 treatments with three replications. Three levels of nitrogen and three PGRs were used at various stages of maize growth. Perusal of table -1 revealed that gross return was maximum i.e. Rs. 96930.40/ha in treatment 10 (120 kg nitrogen /ha+NAA@40PPM),closely followed by treatment 12 (120kg nitrogen/ha +Putrescine@50ppm) i.e. Rs95849.91. Similar pattern was discernible from treatment 6 (100 kg nitrogen /ha+NAA @40ppm) with Rs.92311.71 and treatment 8 (100g nitrogen/ha+Putrescine@50ppm) i.e. Rs.91043.43. Net return (Rs/ha) of Rs 52172.80 was also maximum in treatment 10 which followed similar pattern as in gross return in treatment12 and closely followed in treatment 6 and 8 i.e. Rs 50232.31, 47836.21 and 45707.93, respectively. Benefit to cost ration when calculated, it also recorded maximum i.e. 2.17 in treatment 10 and followed the same pattern as in net return in treatment 12 and treatments 6 and 8 i.e. 2.10, 2.08 and 2.01, respectively. Thus it could be concluded that benefit to cost ratio to the farmer in terms of rupees/ha was maximum when nitrogen was used @120 kg/ha with PGR, NAA @40ppm in sandy loam soil in K-27 variety of maize compared to other doses of nitrogen with Putrescine and Mepiquat Chloride plant growth regulators.

Introduction

Maize is critical and versatile raw material that finds extensive application in food, textile, pharmaceutical and paper industries. Maize constituted about 60%of poultry feed, therefore became very critical raw material. International trade is now larger than the international rice trade. India is one of the beneficiaries of the booming international maize trade as it has exported maize worth Rs 35000 crores of rupees in 2016-17, became

fourth largest maize exporter after USA, Brazil, and Ukrane. In the last five years, exports have doubled and by 2025, maize will be the developing into world's largest crop area and it is expected that the demand for maize in developing world will be doubled by 2050. It is estimated that nearly one fourth of the stock in a modern grocery store contains maize in one form or the other.

Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. In India, it is cultivated over an area of 9.43 million ha with production of 24.35 million tonnes and productivity of 2583 kg/ha (Anon, 2015).

In spite of several important uses, maize has an inbuilt drawback of being deficient in two essential amino acids i.e. lysine and tryptophan. This leads to poor protein utilization and low biological value of traditional maize genotypes.

To overcome this problem, maize breeders have developed quality protein maize by incorporating Opaque -2 gene, which is particularly responsible for enhancing lysine and tryptophan contents of maize endoderm protein. Quality Protein Maize (QPM) looks and taste like normal maize with same or higher yield potential, but it contains nearly twice the quantity of essential amino acids lysine and tryptophan which makes it richer in quality protein (Anon, 2009).

Economic return to the farmer i.e. gross and net return would depends on level of fertility in soil, plant population, seed, variety and management practices of crop during growth and maturity.

In several studies, it has been demonstrated that the level of nitrogen, phosphorus and potash along with plant population /ha would determine the overall return to the farmer (Mahajan, 2017; Maurya *et al.*, 2020; Sharanabasappa *et al.*, 2017; Elahi *et al.*, 2016; Mahesh *et al.*, 2016; Jain *et al.*, 2019).

Materials and Methods

Present experiment was designed in RBD having 12 treatments with three replications consisting of three levels of nitrogen (80, 100, 120 kg/ha) and three Plant Growth Regulators (NAA@40 ppm, Mepiquat Chloride@200 ppm and Putrescine@50 ppm), maize variety K-27 was selected for sowing which takes about 170 days to mature.

Seeds were sown on 16th of November 2019. The spacing adopted was 60 cm x 20 cm at a depth of 4-5 cm at SHUATS, Naini, Prayagraj, U.P.. Foliar application of 3 PGRs was done at 55days post sowing when crop reached knee height. The crop research farm is situated at 25.57 ^{0}N latitude, 87.19 ^{0} longitude and at an altitude of 98 M above mean sea level.

The area is situated on the right side of the river Yamuna. Prayagraj has subtropical and semi-arid climatic condition with both extremes of winter and summer.

The soil of the experimental field constituting a part of central gang tic alluvial. Pre sowing samples were taken from a depth of 15 cm and composite samples were used for the chemical and mechanical analysis.

The soil was sandy loam in texture, low in organic carbon and medium in phosphorus and low in potassium. Cost of cultivation for each treatment was worked out separately, taking into consideration all the cultural practices followed and costs of inputs used in the cultivation in rupees. The gross return from each treatment was calculated by considering market price of grain @Rs 20/kg. The net return from each treatment was calculated by using following formula;

Net return= Gross return (Rs)- Cost of cultivation (Rs)

The benefit: cost ratio was calculated using following formula;

B:C ratio = Net return (Rs)/ Total cost of cultivation (Rs).

Statistical Analysis

The data obtained was subjected to statistical analysis by analysis of variance technique. The significant and non-significant treatment effects were judged by with the help of "F" table. The significant differences between the means were tested against the critical difference at 5% probability level.

Results and Discussion

Results obtained after experimentation in different treatments (table-1) revealed that gross return was maximum in treatment 10 (120kg/ha nitrogen+NAA@40 ppm) i.e. Rs 96930.40 which closely followed treatment 12 (120 kg nitrogen /ha + Putrescine @50ppm) i.e. Rs 95849.91. Similarly, gross return /ha was statistically same in treatment 6 and 8 when 100kg nitrogen /ha with NAA @40 ppm or 100kg nitrogen /ha with Putrescine @50 ppm were used i.e. Rs 92311.71 and Rs. 91043.43, respectively. Jain *et al.,* (2019) have also reported gross return at par with our findings as Rs. 92475.42/ha.

However, Elahi *et al.,* (2016) and Navadkar *et al.*,(2012) have reported lower gross return /ha i.e. Rs 71700.00 and Rs.43580.00, respectively. The variation in gross return has been due to location, type of soil and varieties chosen and by various researcher, further it was also affected by prevailing market prices in locality. Net return also followed same pattern in treatment10 and 12 as it was in gross return i.e. RS 52172.80 and Rs 50232.31, respectively. In treatment 6 and 8, it was Rs 47836.21 and Rs 45707.9, respectively. Mahesh *et al.,* (2016) reported higher net return of Rs. 75982/ha when used 300 kg nitrogen/ha with plant density of 88,888/ha. Further they have stated that this plant density was optimum as plant density 1,11,111/ha was at par in grain yield with 88,888 plants/ha.

Raskar *et al.,* 2013, however, reported net return of Rs.41079/ha when used 160 kg nitrogen/ha and Rs. 38262/ha when used 120 kg nitrogen /ha. Jain *et al.,* 2019 also recorded similar net return of Rs. 42843.76/ha. Sharanabasappa *et al.,* 2017 has realized net return of Rs. 77592/ha. when maize was grown in clay loam soil in Karnataka which is higher net return compared to present findings. Net return of Rs. 29510/acre was reported by Elahi *et al.*,(2016) from Pakistan.

Highest B:C ratio was found in treatment 10 (120 kg nitrogen /ha with NAA@40ppm) i.e.2.17 which was at par with treatment 12 (120 kg nitrogen +Putrescine @50 ppm) i.e. 2.10. Further, it was discernible from the table-1 that treatment 6 and 8 also followed the same pattern in relation to B:C ratio which were almost similar with 2.08 and 2.01, respectively. Elahi *et al.,* (2016), Chaudhary *et al.,* (2018) and Prabhuraj and Mahendran (2019) have also reported B:C ratio of 1.66, 1.70 and 1.171, respectively. However, finding of Raskar *et al.*,(2013) was similar to our findings who have reported B:C ratio 2.10. Mahesh *et al.,* (2016) have recorded better B:C ratio of 3.20 when they used nitrogen level at 300 kg/ha. Lower B:C ratio of 1.29 was also reported by Jain *et al.,* (2019).

Further, lower B:C ratio was revealed in the finding of Patre *et al.*,(2019) i.e. 1.11 which might be due to variety used for fodder cultivation as grain yield recover better market prices compared to fodder varieties of maize.

Table.1 Effect of Nitrogen Level and Plant Growth Regulator on Economics

Treatment Details	Cost of cultivation (Rs. /ha)	Gross return (Rs./ha)	Net return (Rs. /ha)	B:C
1. 80 kg/ha Nitrogen	43553.40	68643.96	25090.56	1.58
2. 80 kg/ha Nitrogen + NAA 40 ppm	44193.40	81658.64	37465.24	1.85
3. 80 kg/ha Nitrogen + Mepiquat Chloride 200 ppm	44753.40	60437.62	15684.22	1.35
4. 80 kg/ha Nitrogen + Putrescine 50 ppm	45053.40	80614.29	35560.89	1.79
5. 100 kg/ha Nitrogen	43835.50	75761.83	31926.33	1.73
6. 100 kg/ha Nitrogen + NAA 40 ppm	44475.50	92311.71	47836.21	2.08
7. 100 kg/ha Nitrogen + Mepiquat Chloride 200 ppm	45035.50	71254.47	26218.97	1.58
8. 100 kg/ha Nitrogen + Putrescine 50 ppm	45335.50	91043.43	45707.93	2.01
9. 120 kg/ha Nitrogen	44117.60	79430.50	35312.90	1.80
10. 120 kg Nitrogen + NAA 40 ppm	44757.60	96930.40	52172.80	2.17
11. 120 kg Nitrogen + Mepiquat Chloride 200 ppm	45317.60	75530.90	30213.30	1.67
12. 120 kg Nitrogen + Putrescine 50 ppm	45617.60	95849.91	50232.31	2.10

On the basis of present findings in sandy loam soil using high yielding variety of maize (K-27) under varying levels of nitrogen and types of Plant Growth Regulator (PGR), it can be concluded that the highest gross return (Rs. 96,930.40), Net return (Rs. 52,172.80) and B:C ratio of 2.17 was found with application of 120 kg nitrogen/ha Naphthalene Acetic Acid (NAA @40 ppm). The above values are quite remunerative to the farmers, hence, recommended to use above package of practices under field conditions or at farmer's field.

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