Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 8, Issue, 01, pp.24891-24893, January, 2016

ISSN: 0975-833X

RESEARCH ARTICLE

ECONOMIC EVALUATION OF GRAIN MAIZE (*ZEA MAYS* L.) UNDER VARIED PLANT DENSITIES AND NITROGEN LEVELS

***Mahesh, N., Leela Rani, P., Sreenivas, G. and Madhavi, A.**

Department of Agronomy, College of Agriculture, Professor Jayashanar Telangana State Agricultural University, Rajendra Nagar, Hyderabad - 500 030, India

ARTICLE INFO

Article History:
Received 21st October, 2015
Received in revised form
11th November, 2015
Accepted 30th December, 2015
Published online 31st January, 2016

Key words:

Nitrogen levels,
Plant population,
Grain yield,
Economics.

ABSTRACT

A field experiment was conducted during *kharif*, 2013 at College farm, Rajendranagar, Hyderabad with three plant densities 66,666 plants ha-^{1}, 88,888 plants ha-^{1} and1,11,111 plants ha-^{1} and four nitrogen levels 120 kg ha-^{1}, 180 kg ha-^{1}, 240 kg ha-^{1} and 300 kg ha-^{1}. The results revealed that population density of 88,888 plants ha-1 was found to be economical with higher grain yield (7597 kg ha-^{1}), stover yield (9929 Kg ha-^{1}) with high net return (Rs. 65,476 ha-^{1}) and B:C ratio (2.9) but it was onpar with 1,11,111 plants ha-^{1}. However population density of 66,666 plants ha-1 recorded more dry matter production per plant. Application of 300 kg N ha-^{1} recorded significantly higher grain yield (8, 425 Kg ha-^{1}), stover yield (10,638 Kg ha-^{1}), net return (Rs 75,982) and B:C ratio (3.2) over 120 kg N ha-1 and 180 kg N ha-^{1}. However, grain (8349 Kg ha-1) and stover yield (10525 Kg ha-^{1}), net return (Rs 75233) and B:C ratio (3.2) obtained at 240 kg N ha-^{1} were on par with 300 kg N ha-^{1}.

Citation: **Mahesh, N., Leela Rani, P., Sreenivas, G. and Madhavi, A. 2016.** "Economic evaluation of grain maize (*Zea mays* L.) under varied plant densities and nitrogen levels", *International Journal of Current Research,* 8, (01), 24891-24893.

INTRODUCTION

Maize (*Zea mays* L.) is the world's widely grown highland cereal and primary staple food crop in many developing countries. It is the third most important cereal after rice and wheat as human food, contributing almost nine per cent to India's food basket and five per cent to world's dietary energy supply. It has got immense yield potential and is therefore called as "miracle crop" and also "queen of cereals".

There are a number of biotic and abiotic factors, which affect maize yield considerably. However, it is more affected by variations in plant density than other members of the grass family (Vega *et al*., 2001). At low densities, many modern maize varieties do not tiller effectively and quite often produce only one ear per plant. Whereas, the use of high population increases interplant competition for light, water and nutrients, which may be detrimental to final yield because it stimulates apical dominance, induces barrenness and ultimately decreases the number of ears produced per plant and kernels set per ear (Sangoi, 2001). Corn yields increased in a quadratic fashion with increased applied N to a plateau level (Cerrato and Blackmer, 1990).

****Corresponding author: Mahesh, N.,***
Department of Agronomy, College of Agriculture, Professor Jayashanar Telangana State Agricultural University, Rajendra Nagar, Hyderabad - 500 030, India.

Reduction in nitrogen rates reduced the grain yield by 43-74% and number of kernel per plant by 33-65% (Andrea *et al*., 2006). Due to continuous cropping of cereal based cropping systems the native soil fertility is getting exhausted, in turn the crop nutrient demand is increasing year by year in order to achieve the target yields. Getting maximum benefits from cereals do not lie in reducing N-rate and its number of splits but lowering cost per unit cereal production through higher yields. Therefore, economic analysis is required for making recommendation for farmers from agronomic experiments.

Efficient use of N for maize production is important for increasing grain yield, maximizing economic return and minimizing NO_3 leaching to ground water (Gehl *et al*., 2005). The maize growing farmers of Telangana are using nearly 11 plants m^{-2} instead of recommended 6.6 plants m^{-2} and applying more than 200 kg N ha^{-1} and harvesting good yields. Efficient use of N for maize production is important for increasing grain yield, maximizing economic return and minimizing NO_3 leaching to ground water (Gehl *et al*., 2005). The preceding limited literature suggests that planting density and N fertilizer affect growth and yields of maize. However, research information is lacking on the interactive effects of plant density x N rates on agronomic and economics efficiency of hybrid maize in regions of Telangana State. So, under these circumstances it is imperative to study the various plant densities and nitrogen levels to better understand the resource use efficiencies particularly of economic efficiency.

MATERIALS AND METHODS

The field experiment was conducted at College farm, Rajendranagar, Hyderabad having 17^0 19' N Latitude, 78^0 23' E Longitude and 542.3 m above mean sea level. The experiment was laid out in randomized block design (factorial) with three plant densities (66,666 plants ha^{-1}, 88,888 plants ha^{-1}, 1,11,111 plants ha^{-1}) as one factor and four nitrogen levels (120kg ha^{-1} , 180 kg ha^{-1}, 240 kg ha^{-1} and 300 kg ha^{-1}) as another factor, replicated thrice. The soil of the experimental site was sandy loam in texture, neutral in reaction (P^H 7.4), low in available nitrogen (175 kg ha^{-1}), high in available phosphorus (36 kg ha^{-1}) and potassium (342 kg ha^{-1}). The other package of practices used recommended for raising the crop.

ha^{-1} recorded the lowest plant height. The increased height might be due to severe competition for light and higher intra row competition for nutrients and water due to overcrowding (Kumar, 2008). Significantly more plant height was observed in 300 kg ha^{-1} over 180 kg ha and 120 kg ha^{-1} (Table 1). However, plant height recorded with 300 kg ha^{-1} and 240 kg ha^{1} were comparable with each other. These results substantiate the findings of Khaliq (2008) and Rani *et al*. (2013) who reported the promotive effects of nitrogen on plant height of maize with increasing levels of nitrogen. Significantly more dry matter per plant was observed in 66,666 plants ha^{-1} over other plant densities of 88,888 plants ha^{-1} and 1,11,111 plants ha^{-1}. the increased plant density increased the total dry matter production due to greater amounts of solar radiation intercepted (Sinclair, 1998).Higher dry matter accumulation was recorded with 300 kg ha^{-1} and was on par with 240 kg ha^{-1} and significantly superior to 180 kg ha^{-1} and 120 kg N ha^{-1} (Table 1).

Table 1. Effect of plant densities and nitrogen levels on growth and yield of maize at Physiological maturity

Treatment	Plant height (cm)	Drymatter (g $plant^{-1}$)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Plant density (Plants ha^{-1})				
66,666 Plants ha^{-1}	164^c	256.6^a	6893^b	8186^b
88,888 Plants ha^{-1}	167^b	231.1^b	7597^a	9929^a
1,11,111 Plants ha^{-1}	169^a	219.3^b	7704^a	10453^a
SEm±	0.6	5.4	136	190
CD (p=0.05)	1.8	15.8	401	558
Nitrogen (Kg ha^{-1})				
120Kg ha^{-1}	152^c	200.6^c	6027^c	8109^c
180Kg ha^{-1}	165^b	221.1^b	6790^b	8862^b
240Kg ha^{-1}	175^a	253.4^a	8349^a	10525^a
300Kg ha^{-1}	176^a	268.4^a	8425^a	10594^a
SEm±	0.7	6.2	158	219
CD (p=0.05)	2.1	18.2	463	644
Interaction				
SEm±	1.2	10.8	273	380
CD (p=0.05)	NS	NS	NS	NS

Note: Means with same letter are not significantly different

Table 2. Gross returns, returns and B:C ratio of maize as influenced by plant densities and nitrogen level

Treatments	Gross returns (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
Plant densities (plants ha^{-1})				
66,666 plants ha^{-1}	90302^b	34547	56497^b	2.6
88,888 plants ha^{-1}	99521^a	35267	65476^a	2.9
1,11,111 plants ha^{-1}	100931^a	35747	66726^a	2.9
SEm±	1793		1742	
CD (p=0.05)	5261		5112	
Nitrogen (kg ha^{-1})				
120 kg ha^{-1}	78966^c	34074	45318^c	2.3
180 kg ha^{-1}	88960^b	34816	55065^b	2.6
240 kg ha^{-1}	109375^a	35558	75233^a	3.2
300 kg ha^{-1}	114371^a	36300	75982^a	3.2
SEm±	2070		2012	
CD (p=0.05)	6075		5903	
Interaction				
SEm±	3586		3485	
CD (p=0.05)	NS		NS	

Note: Means with same letter are not significantly different

RESULTS AND DISCUSSION

Maximum plant height was recorded in 1,11,111 plants ha^{-1} at physiological maturity stage and significantly superior to 88,888 plants ha^{-1} and 66,666 plants ha^{-1}, in turn these two significantly differ with each other and 66,666 plants

Increase in nitrogen level produced more number of leaves plant-1, there by more LAI resulting in more dry matter accumulation (Bangarwa *et al*., 1988). Significantly higher grain and stover yield was obtained in 1,11,111 plants ha^{-1} over 66,666 plants ha^{-1}. However, grain and stover yield obtained with 88,888 plants ha^{-1} was comparable with 1,11,111 plants ha^{-1}. Grain yield per unit area increases with plant density until the increase in yield attributable to plants is offset by decline in mean yield per plant (Tollenaar and Wu, 1999). The highest grain and stover yield was obtained with 300 kg ha^{-1} and was significantly superior to 180 kg ha^{-1} and 120 kg ha^{-1}. However, grain and stover yield obtained from 300 kg ha^{-1} was comparable with 240 kg ha^{-1} (Table 1).The increase in yield may be owing to the beneficial effect of nitrogen and plant metabolism which affect the plant physiological process of crop (Jeet *et al*., 2012). Gross returns, net returns and B:C ratio decreased consistently with decrease in plant density during the period of study as that of grain yield. The highest gross returns and net returns were observed with 1,11,111 plants ha^{-1}, and was significantly superior to 66,666 plants ha^{-1} however, 88,888 plants ha^{-1} and 1,11,111 plants ha^{-1} were on par with each other. The highest B: C ratio was observed with 1,11,111 plants ha^{-1} followed by 88,888 plants ha^{-1} and 66,666 plants ha^{-1}.

The highest gross returns and net returns were recorded with 300 kg ha^{-1} which was however, comparable with 240 kg ha^{-1} and significantly superior to 180 kg ha^{-1} and 120 kg ha^{-1}.The highest B: C ratio was obtained in 300 kg ha^{-1}, 240 kg ha^{-1} and 180 kg ha^{-1} followed by 120 kg ha^{-1} (Table 2). In similar way higher gross returns, net returns and B:C ratio were observed with 250, 300 kg N ha-^{1} compared to other treaments, because of higher grain yield under Rajendranagar conditions (sampath *et al.,* 2014). Higher level of biomass accrual and efficient translocation to the reproductive parts due to supply of adequate nitrogen levels might be responsible for the production of elevated level of yield which resulted in higher net returns and B: C ratio. The results were in line with the results of Rani *et al*. (2013).

Conclusion

The plant population of 88,888 plants ha^{-1} with application of 240 kg N ha^{-1} was found to be economical to obtain higher grain yield, gross returns, net returns and B:C ratio.

REFERENCES

Andrea, K.E.D., Otegui, M. E., Cirilo, A. G. and Eyherabide, G. 2006. Genotypic variability in morphological and physiological traits among maize inbred lines. Crop Science, 46: 1266-1276.

Bangarwa, A. S., Kairon M. S. and Singh, K. P. 1988. Effect of plant density and level and proportion of nitrogen fertilization on growth, yield and yield component of winter maize. *Indian Journal of Agricultural Science,* 58 (11): 854-856.

Cerrato, M. E. and Blackmer, A. M. 1990. Comparison of models for describing corn yield response to nitrogen fertilizer. *Agronomy Journal,* 82:138–143.

Gehl, R.J., Schmidt, J.P., Maddux, L.D and Gordon, W.B. 2005. Corn yield response to nitrogen rate and timing in sandy irrigated soils. *Agron. J.,* **97,** 1230-1238.

Jeet, S., Singh, J. P., Kumar, R., Prasad, R. K., Kumar, P., Kumari, A. and Prakash, P. 2012. Effect of nitrogen and sulphur levels on yield, economics and quality of QPM hybrids under dryland condition of estern Uttar Pradesh, India. *Indian Journal of Agricultural Science,* 4 (9): 31-38.

Khaliq, T. 2008. Modelling the impact of climate change on maize (*Zea mays* L.) productivity in the Punjab. Ph.D Thesis. University of Agriculture, Faisalabad, Pakistan.

Kumar, A. 2008. Productivity, economics and nitrogen use efficiency of speciality corn (Zea mays) as influenced by planting density and nitrogen fertilization. *Indian Journal of Agronomy,* 54 (3): 306-309.

Rani, P. L., Sreenivas, G., Reddy, D. R., Rao, V. P., Surekha, K. and Shiva Shankar, A. 2013. Influence of dates of sowing and N levels on growth and yield of kharif maize under irrigated conditions in South Telangana agro climatic zone of Andhra pradesh, India. *International Journal of Bio resources and stress management,* 4: 34-42.

Sampath, O., Madhavi, M. and Rao, C. P. 2014. Effect of nitrogen fertilization on economics of hybrid maize genotypes. *The International Journal of Science and Technoledge,* 2(8):22-24.

Sangoi, L. 2001. Understanding plant density effects on maize growth and development: an important issue to maximize grain yield. *Ciencia Rural,* 31(1): 159-168.

Sinclair, T. R. 1998. Historical changes in harvest index and crop nitrogen accumulation. *Crop Science,* Madison. 38 (2): 638-643.

Tollenaar, M. and Wu, J. 1999. Yield improvement in temperate maize is attributable to greater stress tolerance. *Crop Science*, 39: 1597-1604.

Vega, C.R.C., Andrade, F. H. and Sadras, V.O. 2001. Reproductive partioning and seed set efficiency in soybean, sunflower and maize. *Field Crop Research,* 72: 165-173.

****