Original Research Article

Growth and productivity of Maize (Zea mays L.) hybrids under agro-climatic conditions of Prayagraj, U.P., India

Abstract

A field experiment was conducted during *Kharif* season of 2022 at Crop Research Farm (CRF), Departmentof Agronomy, SHUATS, Prayagraj (UP) to investigate the "**Growth and productivity of Maize(Zea mays L.) hybrids under agro-climatic conditions of Prayagraj, U.P., India**". The treatments consist of 10 hybrids. The experiment was laid out in Randomized Block Design with ten hybrids replicated thrice. The study obtained that significant maximum plant height (168.71 cm), number of leaves (13.8), dry weight (132.14 g/plant), relative cobs/plant (2.41/plant), rows/cob (15.03), gross returns (Rs. 157360.00), net returns (Rs. 103765.00) and benefit cost (1.94) were recorded with hybrid M-400.

Key words*: Hybrid maize, varietal response, yield, Zea mays* L., *kharif*

INTRODUCTION

"Among the cereals, maize (*Zea mays* L.) ranks third in total world production after wheat and riceand it is principle staple food in many countries, particularly in the tropics and sub – tropics" [Kumar et al.2023]. Maizeis considered the "Queen of Cereals". Being a C4 plant, it is capable to utilize solar radiation more efficiently even at higher radiation intensity. It is one of the most versatile crops which can be grown in diverse environments and geographical ranges. "Along with rice and wheat, maize provides at least 30 % of the food calories to more than 4.5 billion people in 94 developing countries. Maize provides over 20 % of total calories in human diets in 21 countries and over 30
% in 12 countries that are home to a total of more than 310 million people" (**Shrestha *et al.* 2016**). "Major maize producing states are Andhra Pradesh (20.9 %), Karnataka (16.5 %), Rajasthan (9.9
%), Maharashtra (9.1 %), Bihar (8.9 %), Uttar Pradesh (6.1 %), Madhya Pradesh (5.7 %) and Himachal Pradesh (4.4 %). Madya Pradesh ranks first in maize production. In Uttar Pradesh maize accounts for a 0.736-million-hectare area with a production of 1.53 million tons and productivityof 2082 kg/ha" (**Agricultural Statistics at a Glance, 2020**). Maize grain contains about 10% protein, 4% oil, 70% carbohydrates, 2.3% crude fibre, 10.4% albuminoides and 1.4% ash. Maize grain has significant quantities of vitamin A, nicotinic acid, riboflavin, vitamin E and is low in calcium but fairly high in phosphorus.

The progress achieved on hybrid maize in the United States led to the initiation of hybrid research all over the maize world. The Indian Council of Agricultural Research (ICAR) launched the first All India Coordinated Research Project on Maize in 1957 to develop improved cultivars of maize. "Moreover, local varieties of Uttar Pradesh failed to give higher yields in comparison with hybrids.Consequently, there was a great need for replacing local varieties with hybrids of different groups. Hybrid maize cultivars possessed a prominent role in enhancing the production and quality of maize which is used for feed, fiber, and aesthetic value. These not only help with their direct contribution but also created a way for the adoption of other components of production. These single cross hybrids possess certain advantages like increased grain yield potential, abiotic and biotic stress tolerance, early maturity, etc. These advantages had led to the cross many barriers faced by farmers in past" [Naveena et al.2021] .

"The adoption of high yielding variety seed helped to accelerate the growth rate of production andyield of maize from 1965 to 1978, the 40-year period taken for the study In Punjab, Pakistan

from1951-52 to 1994-95" **(Wasim *et al*. 2007). "**In recent years, farmers started and continue to replace traditional cultivars with newer higher yielding hybrid varieties because the traditional maize

varieties are having 3 times low productivity than hybrid maize. The introduction of hybrid maize varieties among farmers will help them to increase the income of the farmers" (**Anonymous, 2015**). "The non-traditional maize growing southern states had a noticeable presence of hybrids compared to the traditional northern states, especially in pockets of Madhya Pradesh and Rajasthan, where hybrid cultivation is at a significantly lower level. Hybrid maize varieties are popular mostly in Andhra Pradesh and Karnataka" (**CIMMYT,2005**).

Keeping an eye on the above aspects the present study entitled "**Growth and productivity of Maize (Zea mays L.) hybrids under agro-climatic conditions of Prayagraj, U.P., India**" was carried out at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences. Prayagraj during 2022 *Kharif* Season.

Objectives:

i. To evaluate the growth and yield of maize hybrids under agroclimatic conditions of U.P.
ii. To calculate the economics of maize hybrids.

MATERIALS AND METHODS:

A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) during *Kharif*, 2022. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), organic carbon (0.75%), available N (269.96 kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The experiment was laid out in Randomized Block Design with 10 hybrids *viz.* M-400, M-410, M-502, M-512, M-600, M-608, M-612, M-618, M-702 and M-710 each replicated thrice. The observations were recorded on different growth parameters at harvest *viz.* plant height(cm), plant dry weight, test weight, seed yield, stover yield and harvest index. were analyzed statistically to test their significance and the experimental findings have been summarized in the light of scientific reasoning and have beendiscussed below under the following heading:

RESULTS AND DISCUSSION

A. Growth Attributes:

At harvest significantly highest plant height was observed in the treatment M-400 (167.71.18). However, M-410 (164.27) and M-512 (162.47 cm) were statically at par with M-400. Ali et al. (1994) revealed the difference in plant height in different hybrids. This was due to the fact that plant height is a genetically regulated factor, so the height of different varieties does not remain equal. During harvest, significantly the highest number of leaves/plant was recorded in the hybrid M- 400 (13.80). However, the hybrid M-410 (12.80), M-502 (12.50) and M-612 (13.04) were found statistically at par with M-400. The differences observed in the number of leaves of maize may be attributed to differences in growth characteristics which are influenced by the genetic makeup of the plants. **Pradeep andPatil, 2018** revealed that "the number of leaf whorl expansion varies with hybrid and the rateof development and number were determined primarily by temperature and leaf development rates which were linearly related to accumulated heat units expressed as growing degree days". At harvest significantly highest dry weight was observed in the treatment M-400 (132.14). However, M-512 (130.73 g/plant) and M-410 (128.96 g/plant) were statically at par with M-

400. "The differential growth concerning plant dry weight among the hybrids may be attributed to differences in genetic characterization of the individual varieties, including rapid growth rates, tallness, or shortness of species". **Pal *et al.*, 2012**.

B. Yield Attributes

No. of cob per plant data was found non-significant. However maximum no of cob per plant was recorded in M-400 (2.41 cob per plant). Number of cobs per plant depends upon genetic character of the hybrid and is a vital yield contributing parameter, which is affected by environmental conditions. Similar results have also been reported by **Asghar and Mehdi (2010).** As seen in table 2 significantly highest seeds/row (19.24 Seeds/row) was observed in the M-612. However, hybrid M-410 (18.75 Seeds/row), M-400 (19.17 Seeds/row), M-608 (18.75 Seeds/row) and M-618 (19.00 Seeds/row) were found to be statistically at par with treatment M-612. From the observations significantly highest row/cob (15.03) was observed in the M-400. However, treatments M-410 (14.73) and M-502 (14.57) were found to be statistically at par with M-400. **Zamir *et al.* (2011)** reported that the number of grains/rows of corn had significantly affected by maize hybrids. significantly highest seed yield (5.62 t/ha) was observed in the treatment M-400. However, treatments M-410 (5.48 t/ha) and treatment

M-

502 (5.24 t/ha), were found to be statistically at par with treatment M-400. The significant difference in grain yield and other agronomic traits among various hybrids were probably due to the diverse background from which the hybrids were developed. The higher grain yield of the above genotypes could be correlated to the higher number of grains per row and cob weight. Similar results have also been reported by **Manjunatha *et al*. (2018)**. From the observations significantly highest Stover yield (11.50 t/ha) was observed in the treatment M-400. However, treatment M-512 (11.22 t/ha) was found to be statistically at par with treatment M-400. Maximum harvest index was found in treatment M-600 (36.11). M-608 (36.10 %) and M-612 (35.22 %) were statistically at par with M-600.

C. Yield

Data in respect to different treatments on economics like cost of cultivation, gross returns, net returns and benefit:cost ratio was calculated and has been presented inTable 3.

The maximum gross returns (Rs. 157360/ha) was noticed in M-400. The highest net returns (Rs. 103765/ha) was recorded in M-400. The treatment M-400, Which obtained higher gross return and net returns led to attain higher B:C ratio (1.94).

Table.1 Field evaluation of hybrid maize on growth parameters of maize hybrid

Sl. no	Hybrids	Plant height (cm)	Number of Leaves per Plant	Dry weight (g/plant)
1.	M-400	168.71	13.8	132.14
2.	M-410	164.28	12.8	128.96
3.	M-502	157.25	12.5	123.08
4.	M-512	162.47	11.6	130.73
5.	M-600	157.24	12.33	124.06
6.	M-608	156.27	11.8	121.39
7.	M-612	159.85	13.04	126.90
8.	M-618	154.85	12.47	123.40
9.	M-702	148.24	11.87	117.76
10.	M-710	147.17	11.63	116.02
	F-test	S	S	S
	SEm±	2.87	0.42	1.20
	CD (P=0.05)	8.55	1.42	3.60

Table.2 Field evaluation of maize hybrids on yield attributes and yield

Sl. no	Hybrids	No of cob per plant	No. of seeds/row	No. of rows/cob	Grain Yield (t/ha)	Straw yield (t/ha)
1.	M-400	2.41	19.17	15.03	6.01	11.23
2.	M-410	2.27	18.75	14.73	5.28	10.61
3.	M-502	2.34	17.16	14.57	5.99	12.65
4.	M-512	2.14	18.25	13.47	4.75	10.81
5.	M-600	1.57	18.13	13.07	7.24	13.04
6.	M-608	1.97	18.75	14.00	5.95	10.71
7.	M-612	1.49	19.24	13.13	6.36	11.81
8.	M-618	1.45	19.00	13.80	5.15	10.91
9.	M-702	1.94	16.24	13.07	6.64	12.01
10.	M-710	1.02	15.40	12.40	4.75	10.54
	F-test	NS	S	S	S	S
	SEm±	0.37	0.32	0.32	0.40	0.30
	CD (P = 0.05)	-	0.98	0.99	1.23	1.43

Table.3 Evaluation of maize hybrids on economics

Sl. no	Hybrids	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	(B:C) ratio
1.	M-400	53595	157360	103765	1.94
2.	M-410	53595	153440	99845	1.86
3.	M-502	53595	146720	93125	1.74
4.	M-512	53595	151760	98165	1.83
5.	M-600	53595	146720	93125	1.74
6.	M-608	53595	145880	92285	1.72
7.	M-612	53595	149240	95645	1.78
8.	M-618	53595	144480	90885	1.70
9.	M-702	53595	138320	84725	1.58
10.	M-710	53595	137480	83885	1.57

CONCLUSION

The results of the experiment indicate that hybrid M-400 was highly remunerativeregistering higher productivity and thereby realizing a higher monetary advantage.

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