Original Research Article

Growth and yield 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), Department of Agronomy, SHUATS, Prayagraj (UP) to investigate the "**Evaluation of Maize (*Zea mays* L.) hybrids under agro-climatic conditions of Prayagraj, U.P**". The treatments consists of 10 hybrids. The experiment was laid out in Randomized Block Design with ten treatments replicated thrice. The significantly highest plant height (196.65 cm), dry weight (157.25 g/plant), number of cobs/plant (2.65), cob length (19.87 cm), number of grains/row (31.73 /row), seed yield (8.64 t/ha), stover yield (19.45 t/ha) and biological yield (28.09 t/ha) were recorded in hybrid M-400.

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

INTRODUCTION

Maize (*Zea mays* L.) is one of the most versatile crops grown throughout the tropical as well as temperate regions of the world. A crop of maize is sown and harvested somewhere in the world in every month of the year. There is no cereal on the earth which has so immense potentiality and that is why it is also called "Queen of cereals". It is most important cereal crop which ranks third after wheat and rice in the world. Globally, India stands 5th rank in acreage and 8th rank in production of maize.

Maize belongs to poaceae (or) Graminae family. **De candolle (1986)** assumed that corn must have originated in New Granada, now Colombia. **Reeves (1994)** postulated that maize had its origin in the lowlands of South America primarily because of historical references to pod corn in that area. Maize is one of the most important cereal crop in the world grown over an area of 132 Mha with a production of 57MT. Being a C4 plant, Maize is capable of utilizing solar radiation more efficiently compared to other cereals. It requires higher amount of nutrient through out the crop growing period, but due to heavy utilization of chemical fertilizer as to maintain the crop health. To maintain the soil health we have to go for organic fertilizer management.

Maize grains contain about 9% protein, 4% oil, 70%starch and 2.7%crude fiber. Maize protein. "Zein" is rich in tryptophan and lysine, the two essential amino acids. Most of cereals have been the staple human diet from prehistoric times because of their wide cultivation, good keeping quality, blend flavor and great variety. Maize is an important staple food in many parts of the world. In addition to staple food for human being and quality feed for animals, maize serves as basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetics, film, textile, gum, package and paper industries etc.

Maize is mainly cultivated as rainfed crop and water stress affects both the productivity and yield stability of the crop. The productivity of maize mainly depends on its nutrients management (**Kumar *et al.*, 2007**). Maize should be sown in moist soils to provide the necessary moisture for proper germination and inoculation. Maize is very sensitive to drought and water logging condition.

India has produced 30 million tons in an area of 9.9 million hectares in 2020-21. Maize is a largely cultivated crop in north India. 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 %). Madhya Pradesh ranks first in maize production. In Uttar Pradesh maize accounts for a 0.736-million-hectare area with the production of 1.53 Million Tons and productivity of 2082 kg/ha (**Agricultural statistics at a Glance 2020**).

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Yield advantage ranged from 12 to 25% across the 2 years, suggesting effective genetic gains in QPM breeding. QPM hybrids CZH132044Q, CZH142238Q and CZH142236Q were stable and high yielding. Promotion of such QPM hybrids may help reduce protein energy malnutrition. Maize is the third most important food grain in India after wheat (*Triticum aestivum* L.) and rice (*Oryza sativa* L.). It has a very high yield potential (22 t/ha) (**Anonymous, 2013**). The rapid climate changes are imperative to evaluate and find ways that suite to maize-specific varieties either hybrids or varieties with appropriate sowing dates to avoid the critical growth stages from the stresses due to climate condition. Sowing at proper time and selection of good variety are the most important factor cropping system. Its grain has high nutritive value containing 66.2% starch, 11.1% protein, 7.12% oil and 1.5% minerals. Moreover, it contains 90 mg carotene, 1.8 mg niacin, 0.8 mg thiamin and 0.1 mg riboflavin per 100 g grains (**Hasan *et al.* 2018**). In general, local varieties of Uttar Pradesh failed to give higher yields in comparison with hybrids. Thus, there is 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 helped with their direct contribution but also created a way for 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 cross many barriers faced by farmers in past (**Anonymous, 2015**). Adoption of modern and various varieties of maize, characterized by higher genetic potential, and adoptability to various climatic changes with a view of enhancing yield level of maize. There is no specific kind of organized system or well structured system for documenting the proper crop varieties and their area coverage in India. Various attempts are done to fulfill such knowledge gaps by documenting the major maize varieties and estimating the adoption rates of certain genotypes to different agro- climatic zones. Adoption of high yielding suitable hybrids not only improves the grain yield and its quality but also leads to higher income per hectare as compared to conventional varieties of maize (**Abbas, 2001**). Modern maize hybrids have greater potential as compared with older hybrids (**Russel, 1986**). Since the yield potential of our existing varieties is deteriorating day by day, so the selection of good varieties with high potential and wide range of adoptability is highly essential. Besides tolerance to abiotic and biotic stresses, the likely cause for high yield in modern hybrids has been more ear bearing plants per unit land area without reduction in kernels per year.

Keeping in view on the above aspects the present study entitled "**Evaluation of Maize (*Zea mays* L.) hybrids under agro-climatic conditions of Prayagraj, U.P**." was carried out at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture,

Technology and Sciences. Prayagraj during 2022 *Kharif* Season.

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 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 experiment findings have been summarized in the light of scientific reasoning and have been discussed below under the following heading: -

RESULTS AND DISCUSSION

A. Growth Attributes:

At harvest, significantly highest plant height (196.65 cm) was recorded in M-400. However, M-410 (190.43 cm) and M-600 (193.43 cm) were found to be statistically at par with M-400. **Afzal *et al.* (2017)** revealed the difference in plant height in different hybrids. This was due to the factthat plant height is a genetically regulated factor, so the height of different varieties does not remain equal. As for the effect of environmental factors on plant height is concerned it could not be ignored but the selection of proper crop cultivar manages the influence of the environment. At harvest, significantly higher plant dry weight (157.25 g) was recorded in M-400. The hybrids M-305 (151.93 g), M-312 (149.65 g) and M-600 (146.20) recorded statistical parity 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. The result confirmed with **Pal *et al*., (2012).**

B. Yield Attributes

At harvest, the number of cobs/plant (2.65) was recorded highest in the hybrid M-400. However, M-600 (2.04), M-502 (2.12), and M-305 (2.23) were statistically at par with M-400. 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. At harvest, significantly highest cob length (19.87 cm) was recorded in M-400. However, M-207 (17.65 cm), M-210 (18.94 cm), M-305 (18.62 cm) and M-512 (17.67 cm) were found statistically at par with M-400. The probable reason for longer cob length could be due to optimum utilization of solar light, higher assimilated production and its conversion to starches resulted in higher ear length as reported by **Belay and Patil, 2018.** Significantly highest number of rows per cob was recorded in M-400 (13.74). However, the hybrids M-305 (12.73), M-512 (13.62) and M-600 (13.54) were found statistically at par with M-400. Significantly

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higher number of grains per row (24.65) was recorded in M-400. However, the hybrid M-207 (24.54), M-305 (22.78), M-502 (23.54) and M-512 (24.02) were found statistically at par with M-400. At harvest, significantly the highest seed yield (8.64 t/ha) was recorded in M-400. However, the hybrid M-502 (7.70 t/ha) and M-600 (8.20 t/ha) exhibited statistical parity with 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).** It was reported that plant height was positively correlated with grain yield. Significantly higher stover yield (19.45 t/ha) was recorded in M-400. However, M-210 (19.09 t/ha), M-312 (18.48 t/ha), M-410 (17.76 t/ha) and M-512 (18.34 t/ha) were found statistically at par with M-400.

CONCLUSION:

From the above findings it was concluded that among all hybrids, M-400 was found to be more productive, in terms of growth, yield and economics when compared to others hybrids under agroclimatic conditions of Prayagraj. UP.

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

Hybrids	Plant height (cm)	Dry weight (g/plant)
M-207	172.08	142.71
M-210	183.98	145.86
M-305	176.56	151.93
M-312	186.38	149.65
M-400	196.65	157.25
M-410	190.43	132.24
M-502	182.56	136.57
M-512	180.34	141.42
M-600	193.43	146.20
M-608	185.87	142.11
F-test	S	S
SEm±	1.89	3.30
CD (P=0.05)	4.25	11.05

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

Treatments	Number of Cobs/Plant (No.)	Cob Length (cm)	Number of Rows/Cob (No.)	Number of Grains/row (No.)	Seed Yield (t/ha)	Stover Yield (t/ha)
M-207	1.85	17.65	12.26	24.54	6.45	15.67
M-210	1.50	18.94	11.59	22.28	6.53	19.09
M-305	2.23	18.62	12.73	22.78	5.86	13.23
M-312	1.90	15.43	12.55	20.87	5.54	18.48
M-400	2.65	19.87	11.26	24.65	8.64	19.45
M-410	1.74	16.65	13.74	22.93	5.04	17.76
M-502	2.12	15.12	12.54	23.54	7.90	12.90
M-512	1.46	17.67	13.62	24.02	5.32	18.34
M-600	2.04	16.43	13.54	22.24	8.20	15.21
M-608	1.75	15.20	11.04	22.55	5.65	17.34
F-test	S	S	S	S	S	S
SEm±	0.20	0.62	0.41	0.36	0.33	0.56
CD (P=0.05)	0.61	2.70	1.17	1.08	1.80	1.69