Original Research Article

Determination of maize (*Zea mays* L.) hybrids under agro-climatic conditions ofPrayagraj, Uttar Pradesh, India

ABSTRACT

Worldwide Maize (*Zea mays* L.) is referred to as the "Miracle Crop" due to its high genetic yield potential compared to other Gramineae family members. Hybridization plays a vital role in boosting the production and productivity of maize, which is crucial for mitigating food insecurity in developing countries. To find out the best hybrid among the maize hybrids, a field experiment was conducted during the *kharif* season of 2021 at the experimental field of the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India. The study was conducted for "Evaluation of Maize (*Zea mays* L.) hybrids under agro-climatic conditions of Prayagraj, Uttar Pradesh". The experiment was done on 10 maize Hybrids. It was carried out in Randomized Block Design (RBD) with three replications. The report of the study indicates that among different maize Hybrids, UM-12 produced significantly higher plant height (217.05 cm), number of leaves per plant (12.80), dry weight per plant (151.25 g), cob length (16.62 cm), number of rows per cob (14.80), number of grains per row (31.73), seed yield (8.27 t/ha) and stover yield (20.50 t/ha). Hence, it can be concluded that the Maize hybrid UM-12 was found to be the most suitable, productive and economical for the agroclimatic conditions of Prayagraj, Uttar Pradesh.

Keywords: *Hybrid maize, Yield Attributes, Growth Attributes, Kharif and Varietal Response.*

Introduction

Maize (*Zea mays* L.), the "Queen of Cereals" is one of the important cereal crops in the world. It can be grown over a range of agro-climatic zones and this quality makes it a versatile crop. It is used as a key raw material across various sectors such as feed for livestock, starch, food processing and bio-ethanol. Derivatives of corn starch are extensively used in different industries including pharmaceuticals, cosmetics, food processing, textiles and the paper industry. 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.

(Shiferaw *et al.* 2011). It is cultivated on nearly 197 Mha with a production of 1148 MT and productivity of 5823.8 kg/ha all over the globe, contributing 37 per cent of the global grain production (FAO STAT 2019). India has produced 30 MT in an area of 9.9 Mha in 2020-21. India is the world's seventh largest maize producer, with the fourth greatest production area. In 2020-21, India produced 30 million tonnes over an area of 9.9 million hectares.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 %). Madya Pradesh ranks first in maize production. In Uttar Pradesh maize accounts for a 0.74 Mha area with the production of 1.53 MT and productivity of 2082 kg/ha (Farmer Portal).

The progress achieved on hybrid maize in the United States led to the initiation of hybrid research all over the maize world. The adoption of high yielding variety seed helped to accelerate the growth rate of production and yield of maize (Directorate of maize research, 2014, Vision, 2050). In recent years, farmers started and continue to replace traditional cultivars with the newer higher-yielding maize hybrids, because they are having 3 times more productivity than traditional varieties. However, changing environmental conditions have an impact on maize hybrids growth and production, thus it's crucial to test them in specific agro-climatic conditions. The objective of this study was to identify the superior maize hybrid that is suitable for the Prayagraj, Uttar Pradesh conditions based on the performance of maize hybrids in the field condition. Keeping an eye on the above aspects the present study entitled “Evaluation of Maize (*Zea mays L.*) hybrids under agro-climatic conditions of Prayagraj, Uttar Pradesh.” was carried out at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh during 2021 *Kharif* Season.

Materials and Methods

The experiment was conducted during the *kharif* season of 2021 at the Crop Research Farm, Sam Higginbottom Institute of Agriculture, Technology & Sciences Prayagraj, Uttar Pradesh, which is located at 25.24^{o}N latitude, 81.51^{o}E longitude and 86 m altitude above the mean sea level. It was laid out in Randomized Block Design (RBD) with three replications, and it consisted of 10 maize hybrids *viz.*, T_1: UM-11, T_2: UM-12, T_3: UM-13, T_4: UM-14, T_5: UM-15, T_6: UM-16, T_7: UM-17, T_8: UM-18, T_9: UM-19 and T_{10}: UM-20. The maize hybrid

seeds were provided by the Uttar Pradesh Council of Agricultural Research (UPCAR). They were sown at rate 20 kg/ha by maintaining the spacing of 60 cm × 20 cm in net plot area of 3 m × 3.2 m on 9th of July 2021.

The observations on growth parameters and yield attributes of maize hybrids was recorded during the experiment, and was subjected to statistical analysis by adopting the tactics of study of variance (ANOVA) as described by Gomez and Gomes (1984). The significance of comparison was tested. The significant difference (SD) values were calculated for a 5% probability of error. Critical difference (CD) values were calculated for comparisons between treatment means whenever the variance ratio (F value) was found to be significant.

Table No. 1 Chemical analysis of soil at pre-experimental stage

Parameter	Value (unit)	Method	Reference
Organic carbon (%)	0.35%	Walkley and Black Method	Jackson, 1973
Available Nitrogen	243 kg/ha	Alkaline Permanganate Method	Subbaiah and Asija, 1956
Available Phosphorus	20.10 kg/ha	Olsen's Colorimetric Method	Olsen *et al*., 1954
Available Potassium	105.00 kg/ha	Flame Photometer method	Jackson, 1973
Soil pH	7.8	Glass electrode pH meter	Jackson, 1973

Result and discussion

Growth Parameters

The recorded and analysed data pertaining to growth parameters indicates that significantly higher plant height (217.05 cm), number of leaves per plant (12.80) and plant dry weight (151.25 g) was recorded in maize hybrid UM-12.

The difference in the plant height, number of leaves per plant, plant dry weight was probably due to the diverse background of parental lines, from where the hybrids were developed. Similar findings were reported by Muchie and Fentie (2016), Pal and Bhatnagar (2012).

Yield and yield attributes

Yield attributes such as Cobs per plant (No.), Cob length (cm), Grain row per cob (No.), Number of grains per row (No.), Seed index (g) varied among different maize hybrids. The Hybrid UM-12 was recorded with higher yield attributes *viz*. Cobs per plant (No.) (1.80), Cob length (16.62 cm), Grain row per cob (No.) (14.80), Number of grains per row (No.) (31.73), Seed index (32.33 g). The maize hybrid UM-12 was also recorded significantly higher Seed yield (8.27 t/ha), Stover yield (20.50 t/ha) and Biological yield (28.76 t/ha).

The significant difference in grain yield and other agronomic traits among various hybrids was 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 Cobs per plant, Cob length, Grain row per cob, Number of grains per row and Seed index. Similar results have also been reported by Kumar and Kandel (2020) and Manjunatha *et al.* (2018).

Table No. 2 Evaluation of growth parameters of maize hybrids under agro-climatic conditions of Prayagraj, Uttar Pradesh.

Hybrids	At harvest		
	Plant height (cm)	Number of leaves (No.)	Plant dry weight(g)
UM-11	187.68	12.20	142.71
UM-12	217.05	12.80	151.25
UM-13	199.49	12.53	127.93
UM-14	202.12	11.60	136.57
UM-15	199.89	12.33	140.20
UM-16	208.85	11.80	132.24
UM-17	196.48	11.40	142.65
UM-18	203.07	11.67	138.42
UM-19	204.13	11.87	145.86
UM-20	182.19	11.93	142.11
SEm(±)	**3.89**	**0.26**	**1.08**
CD (p=0.05)	**11.25**	**0.76**	**3.20**

Table No. 3 Evaluation of yield attributes and yield of maize hybrids under agroclimatic conditions of Prayagraj, Uttar Pradesh.

Hybrids	Number of cobs per plant (No.)	Number of grain rows/cob (No.)	Number of grains /row (No.)	Cob length (cm)	Seed index (g)	Seed yield (t/ha)	Stover yield (t/ha)	Biological yield (t/ha)
UM-11	1.47	13.47	27.73	15.47	26.33	5.55	18.44	23.99
UM-12	1.80	14.80	31.73	16.62	32.33	8.27	20.50	28.76
UM-13	1.47	14.20	28.40	15.46	28.67	7.61	19.02	26.37
UM-14	1.67	13.37	30.00	14.57	27.67	5.97	18.67	24.64
UM-15	1.67	13.42	24.80	13.81	27.67	6.80	15.67	22.47
UM-16	1.47	13.00	28.27	15.29	29.67	6.67	13.47	20.14
UM-17	1.27	12.20	30.33	16.51	26.00	5.49	12.78	18.27
UM-18	1.47	14.47	28.00	15.32	25.67	5.54	15.68	21.22
UM-19	1.53	12.87	28.27	15.37	30.33	7.71	19.05	26.76
UM-20	1.60	13.30	28.33	16.43	27.67	5.77	18.40	24.18
SEm(±)	**0.16**	**0.41**	**0.99**	**0.38**	**1.44**	**0.42**	**0.60**	**0.83**
CD (p=0.05)	**-**	**1.17**	**2.88**	**1.09**	**-**	**1.20**	**1.75**	**1.17**

Conclusion

Based on the findings of this field experiment it is concluded that among 10 tested maize hybrids, UM-12 was found the most suitable maize hybrid to be recommended as it recorded highest growth parameters, yield attributes and yield. It was found more productive, when compared to others under agroclimatic conditions of Prayagraj, Uttar Pradesh. Since the results are based on a single season of research, they can be repeated for conformation.

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