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Evaluation of Maize Hybrids under Rainfed Condition in New Alluvial Zone of West Bengal

S. Biswas[1*] and A. Saha[2]

[1]*Dept. of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal (741 252), India*
[2]*Dept. of Agronomy, College of Agriculture, Tripura, Lembucherra, West Tripura (799 210), India*

Corresponding Author
S. Biswas
✉: sonali.saha80@gmail.com

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Abstract

At Bidhan Chandra Krishi Viswavidyalaya's District Seed Farm (AB-Block), Kalyani during the 2020 *kharif* season, a experiment in the field was taken to study the performance of maize hybrids and to study crop yield and adaptability of maize hybrids. Four replications of the experiment were conducted using a Randomized Block Design and six maize hybrids (DKC 9144, DKC 7204, DKC 8181, P3396, Kaveri 50 and Yuvraj). The experiment's findings showed that the maize hybrid DKC 9144 recorded the highest growth attribute like plant height (252.67 cm) and characters related to yield attributing include 100 seed weight (41.67 g), grains row^{-1} (43.00) and grain rows cob^{-1} (13.97). Highest grain yield (9.06 t ha^{-1}), stover yield (10.99 t ha^{-1}) and harvest index (47.80) were obtained by maize hybrid DKC 9144 than other maize hybrids. Lowest growth character (plant height), yield attributing characters (Grain rows cob^{-1}, Grains row^{-1} and 100 seed weight), yields (Grain yield and Stover yield) and harvest index of maize were recorded by Kaveri 50 hybrid. According to the experimental findings, cultivating the hybrid maize variety DKC 9144 under rainfed conditions in new alluvial zone of West Bengal is advised in order to maximise the output of farmers.

Keywords: Hybrids, Maize, Rainfed condition, West Bengal, Yield

Introduction

Maize (*Zea mays* L.) was first domesticated in mexico from its wild relative teosinte around 10,000 years ago. 9.09 M ha of maize are grown in India, ,yielding 2.56 t ha^{-1} on average and producing 24.26 Mt annually (Yadav *et al.*, 2016). In the globe, maize is the third-most important cereal crop after rice and maize. In terms of productivity, maize outperforms the other cereals with an average yield of 5.11 t ha^{-1}. In India, there are three separate seasons for growing maize: spring in northern India and *rabi* and *kharif* in Bihar and the peninsula. Although *rabi* maize has significantly increased in importance in India's overall maize production over the past several years, maize is still primarily a *kharif* season crop.

Maize is also gaining importance in West Bengal. In West Bengal, the area under cultivation for this crop is growing annually. 2020-21 saw the cultivation of 360.08 thousand hectares of maize, yielding a yield of 2577.64 thousand tonnes of grain and a productivity of 7,144 kg ha^{-1} (Anonymous, 2022). Cultivation of maize in *rabi* season is about 70% of the total cultivated area was the foremost reason for higher productivity in West Bengal. *Kharif* maize area in West Bengal is less because most of the area in this season is occupied by *kharif* rice. Variability in rainfall both within and between seasons has a significant impact on maize productivity, which in turn affects the planting date (Tesfay *et al.*, 2024). Variability in rainfall encompasses variations in its beginning and ending, quantity, frequency and length (Lana *et al.*, 2018). Hence, the challenge to increase maize productivity under rainfed condition during *kharif* is one of the major concerns in West Bengal. For increasing area of maize cultivation in West Bengal during *kharif* is possible by adaption of location specific production technology with adoption of suitable varieties. Physiological maturity groups, hybrid performance across production levels and field trials yield quantification help determine which cultivar is optimal

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for a certain climate and management scenario (Pradeep and Patil, 2018). Using high yielding variety seed increased the rate of production, growth and yield of maize.

Because the newer, higher-yielding hybrids of maize are three times more productive than the traditional cultivars, farmers have begun and are continuing, to replace their older cultivars. But maize hybrids' development and productivity are affected by shifting environmental factors; therefore it's critical to test them under particular agro-climatic circumstances (Manoj *et al.*, 2023). The aim or objectives of this research are to assess the performance of maize hybrids and investigate their crop production and adaptability to rainfed environment in West Bengal.

Materials and Methods

The field experiment was conducted in the District Seed Farm (AB-Block) of the Bidhan Chandra Krishi Viswavidyalaya in Kalyani, Nadia, West Bengal, during the 2020 *kharif* season. The experimental farm was located at 22°57′ N latitude and 88°20′ E longitude with an average altitude of 9.75 m above the mean sea level in the New Alluvial Zone of West Bengal. The soil had a sandy loam texture, pH of 7.20, medium levels of organic carbon (0.52%) and 262.24 kg of accessible K, P and N ha^{-1}. With four replications and six maize hybrids (DKC 9144, DKC 7204, DKC 8181, P3396, Kaveri 50 and Yuvraj), the experiment was configured with a randomized block design. Different types of maize were manually seeded with a 20 kg seed rate ha^{-1} at a 60 cm × 20 cm spacing. Applying urea, single super phosphate (SSP), and muriate of potash (MOP) as the sources of nitrogen, phosphorus and potassium at a rate of 150:75:75 kg ha^{-1} was the strategy. A third of the nitrogen was applied at the knee-height stage, the remaining third was applied at tasselling, and the full dose of P and K was applied as the basal treatment. The growth traits like plant stand, plant height, yield attributes like cob length, cob girth, number of rows cob^{-1}, number of grains row^{-1} and 100 seed weight and yield (grain and stover) of maize were recorded treatment wise. The data relating to growth and yield parameters, as well as other recordings during the period of experimentation were statistically following analysis of variance method. Statistically analysis and interpretation were done by of calculation values SEm (±) (standard error of mean) and critical difference (CD) at 5% level of significance as described by Panse and Sukhatme (1985). Harvest index of maize was calculated by using the following formula, as described by Shafi *et al.* (2012).

$$\text{Harvest index(\%)} = \frac{\text{Grain yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

Results and Discussion

Growth Traits

From the experimental data on growth parameters of maize hybrids (Table 1) showed that plant population $plot^{-1}$ and plant height (cm) were significantly differ in different maize hybrids. Maximum number of plant $plot^{-1}$ (89.00) was recorded in DKC 9144 maize hybrid which was statistically at par with DKC 7204, DKC 8181 and P3396 hybrids. Lowest plant $plot^{-1}$ was observed in Kaveri 50 hybrid. Highest plant height (252.67 cm) was obtained in DKC 9144 maize hybrid which was statistically at with hybrids DKC 8181 and P3396. Lowest plant height was observed in Kaveri 50 maize hybrid. Variances in the genetic traits of the particular varieties, including their height, may be the cause of the observed variances in plant height between the varieties (Biswas *et al*., 2022). Days to 50% tasselling of different hybrids varied between 55-56 days subsequent to seeding and silking at 59 days subsequent to seeding which were statistically non-significant. The variations in plant dry weight, plant height and number of leaves $plant^{-1}$. These characteristics displayed by M-410 can be linked to the varied ancestry of the parental lines that produced the hybrids. Comparable results were noted by Muchie and Fentie (2016) and Bisht *et al*. (2012). Days to 50% tasselling of different hybrids varied between 55-56 days after sowing and silking at 59 days after sowing which were statistically non-significant.

Table 1: Growth traits of different maize hybrids under rainfed situation

Treatments	Plant Population $plot^{-1}$	Plant Height (cm)	Days to 50% Tasselling	Days to 50% Silking
DKC 9144	89.00	252.67	56.00	59.00
DKC 7204	87.33	240.00	56.00	59.00
DKC 8181	87.00	249.00	56.00	59.33
P3396	87.67	244.33	56.33	59.33
Kaveri 50	85.33	230.00	56.00	59.33
Yuvraj	86.67	240.00	55.67	59.00
SEm(±)	1.02	3.47	1.01	0.99
CD at 5%	3.22	10.93	NS	NS

Yield Attributes

Yield attributing parameters of maize were greatly impacted by several hybrids under rainfed situation except cob length and cob diameter (Table 2) which were statistically non-significant. Highest number of grain rows cob^{-1} (13.97) and grains row^{-1} (43.00) were recorded in hybrids DKC 9144 which was followed by DKC 8181 hybrids. Lowest number of grain rows cob^{-1} (11.23) and grains row^{-1} (38.33) were recorded in Kaveri 50 hybrid. 100 seed weight that is seed index (41.67) was maximum in DKC 9144 hybrid and lowest 100 seed weight (35.33) was observed in Kaveri 50 hybrid. Genetic variation in the hybrids may be the cause of the variation in yield properties between the hybrids (Singh *et al*., 2016; Khedwal *et al*., 2018; Coelho *et al*., 2020). The different backgrounds from which the hybrids were generated contributed to the notable differences in grain production and other agronomic features across the different hybrids. The larger cob length, number of cobs $plant^{-1}$, number of grains row^{-1}, number of grains cob^{-1} and seed index may all be associated to the higher grain output of the aforementioned genotypes. Analogous results have also been noted by Manjunatha *et al.* (2011) and Kandel and Shrestha (2020).

Table 2: Yield attributing characters of different hybrids under rainfed situation

Treatments	Cob Length (cm)	Cob Diameter (cm)	Grain rows cob^{-1}	Grains row^{-1}	100 Seed Weight (g)
DKC 9144	20.20	12.84	13.97	43.00	41.67
DKC 7204	19.37	11.70	12.50	40.67	37.67
DKC 8181	19.50	11.67	12.97	41.00	38.00
P3396	19.17	11.37	12.27	40.33	37.67
Kaveri 50	18.33	11.00	11.23	38.33	35.33
Yuvraj	18.47	11.40	12.43	40.00	37.33
SEm(±)	0.41	0.40	0.28	0.61	1.00
CD at 5%	NS	NS	0.89	1.93	3.15

Yield and Harvest Index

Yields of maize were greatly impacted by different hybrids (Table 3 and Figure 1). Highest grain yield (9.06 t ha^{-1}) and stover yield (10.99 t ha^{-1}) were obtained in hybrid DKC 9144 which were followed by hybrid DKC 8181. Lowest grain and stover yield were recorded in Kaveri 50 hybrid. Harvest index (%) was also followed the same trend that is DKC 9144 obtained maximum harvest index (47.80%) and Kaveri 50 recorded the lowest harvest index (42.30%). Graphical presentation of average yields of maize hybrids showed that DKC 9144 was always best performing hybrids during experimental trial at Kalyani, Nadia, West Bengal. This could be because, compared to other genotypes, this one has a higher potential for producing more green fodder and cob yield, which would offer a larger return (Biswas *et al.*, 2020). The outcomes are in line with the study carried out by Singh *et al.* (2013), who likewise observed a noteworthy variance in grain yield among hybrids. The findings of this study is also supported by findings of Opsi *et al.* (2012), Row *et al*. (2015), Khedwal *et al*. (2018), Coelho *et al*. (2020) and Pradeep and Patil (2018).

Table 3: Yields and harvest index of different hybrids under rainfed situation

Treatments	Grain Yield (t ha^{-1})	Stover Yield (t ha^{-1})	Harvest Index (%)
DKC 9144	9.06	10.99	47.80
DKC 7204	8.21	9.98	44.10
DKC 8181	8.30	10.16	45.00
P3396	8.17	10.03	43.90
Kaveri 50	7.63	9.60	42.30
Yuvraj	7.65	9.62	42.80
SEm(±)	0.23	0.25	0.90
CD at 5%	0.72	0.79	2.70

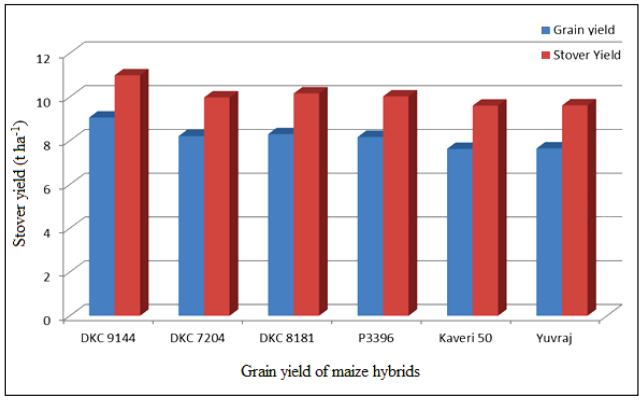

Figure 1: Grain Yield and Stover Yield (t ha^{-1}) of different maize hybrids

Conclusion

This field experiment's findings led to the conclusion that, out of the six evaluated maize hybrids, DKC 9144 was the most suitable and should be recommended because it had the best yield attributing parameters, growth parameters and yield. It was discovered to be more productive than others in the newly alluvial zone under rainfed situation in West Bengal. Since it is advised that further research be done before advising farmers to use the DKC 9144 hybrid and should be tested in other zones of West Bengal.

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