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SCREENING OF THE HYBRID MAIZE VARIETIES ON THE BASIS OF REPRODUCTIVE CHARACTERISTICS

MD Hossain[*1], F Mahmud[2], SR Bhuiyan[2], N Zeba[2] and MR Islam[3]

[1]*Department of Genetics and Plant Breeding, EXIM Bank Agricultural University Bangladesh*
[2]*Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh*
[3]*Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh*

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Abstract

The experiment was conducted to screen some maize varieties available in Bangladesh on the basis of their reproductive characteristics. Mean data were used to statistical analyze like analysis of variance, mean, range were calculated by using MSTATC software program. Significant variations among 50 maize genotypes in terms of all the yield contributing characters were found in this study. The lowest (24) days to 50% tasselling was found from the genotype 25KSS and VA-786, while the minimum (54) days to 50% silking was observed in the genotype PAC-984. The longest (21cm) cob was observed in the genotype VA-786, and the highest (17.07cm) cob diameter was recorded in the genotype GP-838.The highest (16.61) row per cob was recorded in the genotype NZ-001, and the highest (40.40) number of grains per row was recorded in the genotype PAC-399. The highest100grain weight (383.33g), was recorded in the genotype 25KSS, while the lowest (153.3g) was observed in the genotype of Uttaran-2. Statistically, significant variation was recorded for days to maturity in different maize genotypes. The highest (116) days to maturity were found in the genotype Elite, while the lowest days to maturity (107.3) were found in the genotype BHM-3. Grain yield (t ha^{-1}) varied significantly in maize genotypes under the study. The average grain yield was recorded at around 6.14(t ha^{-1}), and it ranged from 2.30 to 8.17. The highest grain yield (8.17 t ha^{-1}) was recorded in genotype BHM-9, which was followed by PAC-984 (7.90t ha^{-1}) and Pacific-98 (7.90t ha^{-1}). Therefore, this experiment suggests that these three hybrids–namely, BHM-9, PAC-984, and Pacific-98 have a high potential to produce more yield and are suitable for commercial cultivation in Bangladesh.

Keywords: Maize, Varieties, Screening, Variation.

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops broadly adapted worldwide. It is a dual-purpose crop; it is known for food and feed across the world. Maize is commonly cultivated in the tropics and warm sub-tropics for food, livestock, and industrial uses (Oyekola and Fayeun, 2019). It has multifaceted use such as bread making, corn flakes, corn syrup, paper making, and food industries (Khan *et al.*, 2013). It is grown at an altitude from sea level to 3,300 meters above sea level from 500N to 400S latitude as a multipurpose crop in temperate, subtropical, and tropical regions of the world (Abdelmula and Sabiel, 2007). The annual yield of maize is 2.59 tha^{-1} which is significantly lower in comparison to developed countries, such as the USA (11.86 tha^{-1}), and China (6.10 tha^{-1}) (FAOSTAT, 2018).There are many factors that affect the grain yield of maize like inappropriate fertilizer application, weeds management, poor supply of water, and attack of different types of pests and diseases. Furthermore, the most important factor for lower yield is selecting inappropriate varieties in a given environment (Tahir *et al.*, 2008).

There are a lot of seed companies available in Bangladesh, but the qualities of all seeds are not equal. A field experiment was conducted to evaluate the maize genotype by studying their genetic components and the traits of yield, and their correlation. Fourteen genotypes were evaluated in a randomized complete block design with three replications. Significant differences were found for days to 50% tasselling, days to 50% silking, tassel branch, plant and grain yield among the variety studied (Raut *et al*., 2017). The farmers of Bangladesh are poor and unskilled. They have

***Corresponding author: MD Hossain**, *Department of Genetics and Plant Breeding, EXIM Bank Agricultural University Bangladesh. Email: deluaradust@yahoo.com*

neither capital to buy the costly seed nor the knowledge to identify the quality seed. Some farmers use their farm saved maize seed. The use of farm-saved maize seed, also known as seed recycling (Macharia *et al.*, 2010). However, significant yield loss is evident when the seed is derived from hybrids and segregating generations of certified hybrid varieties. The yield loss is attributed to genetic breakdown and the low quality of such seeds. By using hybrid maize varieties instead of segregating generations this yield loss can be reduced. Therefore, it is important to screen various maize varieties in different agro-ecological zones for their adaptation, yield potential and to release the most suitable varieties for cultivation (Hussain, 2011). In these circumstances, this experiment is undertaken to find out the superior maize varieties marketed by different seed companies available in Bangladesh.

Materials and Methods

The experiment was carried out at the central experimental field of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka. The crops were harvested after maturation. Data on yield and yield components were taken properly. Data were collected from the selected plants at random from each unit plot in respect of the following parameters.

Days to 50% tasselling

Days to tasselling were documented as the number of days from planting to the time 50% of the plant had fully emerged tassels.

Days to 50% silking

Days to silking were recorded as the number of days from planting to when 50% of plants had completely extruded silks.

Grain per cob

The number of grains was counted from each cob.

Cob length (cm)

The lengths of cobs were measured from the cob base to the apex in centimeters by using a measuring scale.

Cob diameter

The diameter of cobs at the top, basal and central part was measured in centimeters using a measuring tape, and the average was recorded.

Rows per cob

The total number of rows each cob was counted and the average was recorded.

Grain per row

The total number of grains from each row of cob was counted, and the average was recorded.

1000 grain weight (g)

A sample of 1,000 grain was taken at random and weighed to the nearest 1/10 gram.

Grain yield (tha^{-1})

All ears were shelled, and yield was measured as a bulk weight per plot to the nearest gram. The total plot weight was then converted to ton per hectare (tha^{-1}).

Statistical analysis

Mean data of the characters were used for statistical analysis like analysis of variance, mean, and range were calculated by using MSTATC software program.

Results & Discussion

This experiment was conducted to select the suitable maize varieties based on yield and yield contributing characteristics of maize. Fifty maize varieties were used in this study (Table-1 and Plate-1). Highly significant variations among 50 maize genotypes in terms of all the yield contributing characters and yield of maize were presented in (Table-2).

Table 1. List of different varieties of maize used in the experiment

Sl.	Varieties	Sources	Sl.	Varieties	Sources
01	BHM-3	BARI	26	AS-999	ACI
02	BHM-5	BARI	27	Kaberi-369	ACI
03	BHM-6	BARI	28	NZ-001	ACI
04	BHM-7	BARI	29	NZ-003	ACI
05	BHM-9	BARI	30	NZ-510	ACI
06	Shuvra	BARI	31	25KSS	ACI
07	BM-5	BARI	32	Pioneer-3056	Petrocem Co.
08	BM-6	BARI	33	AgroG-8255	Energypac Ltd.
09	Khaibhutta	BARI	34	GP-50	Getco
10	BHM-8	BARI	35	Auto-987	Auto Crop Care Ltd.
11	NK-40	Syngenta	36	GP-901	Getco
12	Pacific-11	BRAC	37	Krishibid -550	Krisibid Group
13	PAC-399	BRAC	38	PAC-984	BRAC
14	BARI Mistri-1	BARI	39	PAC-555	BRAC
15	PAC-984	BRAC	40	Elite	
16	Dekalb S. Gold	Monsanto	41	Krishibid -102	Krisibid Group
17	Dekalb-962	Monsanto	42	GP-838	Getco
18	Khaibhutta	BRAC	43	Pioneer-07	Petrocem Co.
19	Barnali	BRAC	44	ACI-3110	ACI
20	VB-100		45	Krishibid -222	Krisibid Group
21	Pacific-98	BRAC	46	Progreen-1000	AR Malik
22	PAC-740	BRAC	47	GP-100	Getco
23	Dekalb-9120	Monsanto	48	PAC-999	BRAC
24	VA-786		49	Bioseed-707	Getco
25	Profit	ACI	50	Badsha	Getco

Table-2: Mean performance of yield attributes and yield of different maize varieties

Sl.	Name of the Varieties	Days to 50% teaseling	Days to 50% silking	Cob length (cm)	Cob diameter (cm)	Row per cob	Seed per row	Thousand seed weight (g)	Days to maturity	Grain yield (t ha^{-1})
01	Barnali	57.00a	59.67b	19.00a-g	13.40g-k	12.59h-k	21.40gh	316.7c-j	113.3b-d	4.30s
02	Shuvra	55.33cde	58.33cd	17.20f-j	13.83e-k	14.05b-i	25.33e-h	306.7e-j	114.0a-c	4.46s
03	Khaibhutta	57.00a	60.33a	16.67g-j	10.63l	13.03f-k	30.81b-e	186.7k	115.0ab	3.26t
04	BARI S.Corn-1	55.67cd	58.67cd	15.70j	12.40k	11.67kl	21.33h	166.7k	114.7a-c	2.30u
05	BM-5	57.00a	60.00ab	17.77f-j	13.17i-k	13.96b-i	25.24e-h	290.0h-j	114.0a-c	4.56s
06	BM-6	56.00bc	58.67cd	16.20h-j	13.70f-k	13.30e-j	28.14c-h	293.3g-j	115.0ab	5.30p-r
07	BHM -3	52.33l	55.33hi	17.17f-j	13.07jk	12.60h-k	30.33b-e	316.6c-j	107.3k	7.30bc
08	BHM-5	53.00j-l	56.00f-h	17.37f-j	14.10c-j	13.97b-i	25.50e-h	283.3ij	109.3g-k	6.90de
09	BHM-6	53.00j-l	55.33hi	17.93e-j	14.93b-h	13.94b-i	29.34c-h	273.3j	111.6d-f	7.57b
10	BHM-7	54.33f-h	56.00f-h	17.47f-j	15.00b-f	14.57b-g	29.43b-g	286.6ij	108.0i-k	7.30bc
11	BHM-8	53.00j-l	56.00f-h	17.00f-j	14.73b-i	14.18b-i	28.50c-h	310.0d-j	109.3g-k	7.07cd
12	BHM-9	55.33c-e	57.00e	18.77a-i	14.30c-j	14.67b-f	31.00b-e	290.0h-j	109.3g-k	8.17a
13	NK-40	56.67ab	60.33a	19.43a-f	15.33b-e	13.39d-j	25.50e-h	340.0a-h	109.3g-k	6.77d-f
14	Pacific-11	54.00g-i	56.00f-h	16.80f-j	14.57b-j	14.27b-g	29.59b-f	320.0c-j	108.3h-k	7.30bc
15	PAC-399	56.00bc	59.00c	19.27a-g	15.27b-f	15.33a-c	40.40a	303.3e-j	108.3h-k	7.57b
16	PAC-984	51.00m	54.00j	18.07d-j	14.30c-j	14.87b-e	37.33ab	293.3g-j	107.6jk	7.90a
17	Dekalb S. Gold	54.00g-i	56.33e-g	18.07d-j	14.07d-j	14.86b-e	30.44b-e	296.7f-j	111.0e-g	5.46o-q
18	Dekalb-962	53.00j-l	55.00i	17.10f-j	14.50b-j	14.48b-g	29.90b-e	323.3b-j	114.0a-c	5.00r
19	Uttaran-2	53.67h-j	56.67ef	17.00f-j	10.00l	11.04l	21.77f-h	153.3k	115.0ab	6.56e-h
20	VB-100	25.00n	56.67ef	18.93a-h	14.90b-h	12.53i-k	24.40e-h	360.0a-d	114.0a-c	4.56s
21	Paciffic-98	55.33c-e	58.33cd	18.97a-g	14.80b-h	14.37b-g	30.74b-e	350.0a-e	109.3g-k	7.90a
22	PAC-740	54.00ghi	56.67ef	19.00a-g	15.40b-e	15.60ab	32.43b-e	313.3d-j	109.3g-k	6.67e-h
23	Dekalb -9120	25.33n	56.67ef	20.80a-c	15.70bc	15.07b-d	28.70c-h	276.7j	115.0ab	5.30p-r
24	VA-786	24.00o	57.00e	21.00a	15.40b-e	14.53b-g	28.54c-h	340.0a-h	116.0a	5.20qr
25	Profit	53.00j-l	55.00i	19.43a-f	15.50b-d	14.79b-e	29.37b-h	340.0a-h	110.0f-i	6.67e-h
26	AS-999	54.00g-i	56.00f-h	19.37a-g	15.50b-d	14.23b-h	31.78b-e	350.0a-e	110.0f-i	6.70e-g
27	Kaberi-369	53.00j-l	55.33hi	18.57a-i	14.67b-i	13.90c-i	31.87b-e	313.3d-j	112.7c-e	5.90k-n

Table-2: Mean performance of yield attributes and yield of different maize varieties

Sl.	Name of the Varieties	Days to 50% teaseling	Days to 50% silking	Cob length (cm)	Cob diameter (cm)	Row per cob	Seed per row	Thousand seed weight (g)	Days to maturity	Grain yield (t ha^{-1})
28	NZ-001	56.00bc	58.33cd	18.43a-i	15.57b-d	16.61a	29.13c-h	280.0j	115.0ab	6.367g-j
29	NZ-003	56.67ab	58.67cd	20.87ab	15.27b-f	14.87b-e	27.67c-h	366.6a-c	109.6f-j	6.900de
30	NZ-510	53.33i-k	56.00f-h	20.53a-e	15.27b-f	15.30a-c	27.00c-h	343.3a-g	114.3a-c	5.80l-n
31	25KSS	24.00o	56.00f-h	18.90a-i	15.23b-f	13.57d-j	26.13d-h	383.3a	114.7a-c	5.70m-o
32	Pioneer-3056	55.67cd	58.67cd	18.50a-i	13.37h-k	12.05j-l	28.37c-h	333.3a-i	110.3f-h	6.87de
33	AgroG-8255	55.33c-e	56.67ef	18.13c-j	14.27c-j	13.80c-i	32.13b-e	333.3a-i	115.0ab	6.56e-h
34	GP-50	56.00bc	58.33cd	19.40a-g	15.13b-f	14.37b-g	32.43b-e	310.0d-j	110.0f-i	6.70e-g
35	Auto-987	53.00j-l	56.00f-h	17.63f-j	14.23c-j	13.76c-i	27.29c-h	350.0a-e	113.0b-e	5.60n-p
36	GP-901	54.00g-i	56.00f-h	18.80a-i	14.53b-j	14.85b-e	30.88b-e	316.7c-j	114.0a-c	6.16i-k
37	Kbd-550	56.00bc	58.33cd	19.10a-g	15.23b-f	14.29b-g	28.95c-h	346.7a-f	114.7a-c	6.36g-j
38	NK-6607	55.00d-f	57.00e	18.27b-j	14.00d-j	12.98g-k	33.97a-d	313.3d-j	116.0a	6.36h-j
39	PAC-555	53.67h-j	55.67g-i	17.50f-j	14.53b-j	14.00b-i	32.10b-e	323.3b-j	114.7a-c	6.46f-i
40	Elite	54.67e-g	58.33cd	20.67a-d	15.97ab	14.45b-g	25.70e-h	320.0c-j	116.0a	5.80l-n
41	Kbd-102	55.67cd	58.00d	18.43a-i	15.27b-f	14.05b-i	26.09d-h	313.3d-j	109.3g-k	6.57e-h
42	GP-838	55.00d-f	56.67ef	18.30a-j	17.07a	16.58a	29.12c-h	340.0a-h	114.7a-c	6.56e-h
43	Pioneer-07	53.00j-l	56.00f-h	17.30f-j	15.07b-f	15.07b-d	34.53a-c	343.3a-g	109.3g-k	6.90de
44	ACI-3110	53.67h-j	56.67ef	17.67f-j	14.63b-j	13.50d-j	29.00c-h	320.0c-j	113.7 b-d	5.20qr
45	Kbd -222	53.00j-l	55.67g-i	18.83a-i	15.43b-e	13.53d-j	24.93e-h	373.3ab	114.7a-c	5.46o-q
46	ProGreen-1000	53.67h-j	56.67ef	19.43a-f	14.47b-j	13.31e-j	27.84c-h	360.0a-d	116.0a	5.90k-n
47	GP-100	53.00j-l	55.67g-i	18.27b-j	14.10c-j	13.06f-k	31.07b-e	313.3d-j	113.0b-e	6.06j-l
48	PAC-999	52.33l	55.33hi	18.97a-g	14.97b-g	14.20b-h	32.00b-e	303.3e-j	110.0f-i	6.77d-f
49	Bioseed-707	52.67kl	55.67g-i	16.17ij	14.23c-j	13.43d-j	25.81e-h	290.0h-j	113.7b-d	6.06j-l
50	Badsha	54.00g-i	57.00e	17.13f-j	14.37b-j	14.30b-g	27.77c-h	300.0e-j	114.7a-c	6.00k-m
	Min	24.00	54.00	15.70	10.00	11.04	21.33	153.33	107.33	2.30
	Max	57.00	60.33	21.00	17.07	16.61	40.40	383.33	116.00	8.17
	Mean	52.01	56.95	18.34	14.51	14.03	28.98	311.40	112.35	6.14

Days to 50% tasseling

Days to 50% tasselling showed statistically significant variation in different maize genotypes under study. Data revealed that the average days to 50% tasselling was recorded at 52.01, and it ranged from 24 to 57 (Table-2). The highest (57) days to 50% tasseling was found in the genotypes BM-5, Barnali, and Khaibhutta whereas the lowest (24) days was found from the genotype 25KSS and VA-786. Data revealed that different varieties required different days to 50% tasselling (male flowering), and it might be due to genetic factor of the genotype. In an experiment Raut *et al.*, (2017) observed that the mean value of day to 50% tasselling of 14 genotypes was 56.26 days. ANOVA revealed a highly significant difference (2.00) for this trait.

Days to 50% silking

Statistically, significant variation was observed for days to 50% silking (female flowering) among the genotypes. The average days to 50% silking was recorded at 56.95 days, and it ranged from 54 to 60.33 (Table-2). The minimum (54) days to 50% silking was observed in the genotype PAC-984, which was followed by the varieties Dekalb-962 (55), Profit (55), Kaberi-369 (55.33), and PAC-999 (55.33). The highest (60.33) days to 50% silking was found in the genotypes NK-40 and Khaibhutta, which was followed by genotypes Barnali (59.67) and PAC-399 (59), respectively. The differences in days to 50% flowering might be due to the genetic factor of the genotype concerned. In an experiment, Raut *et al.,* (2017) observed that the mean value of days to50% silking among 14 genotypes was 61.07 Days. There were highly significant differences (2.60) among 14 genotypes for this trait.

Cob length (cm)

Significant variation was exhibited in respect of cob length among different varieties. The average cob length was recorded as 18.34 and it ranged from 15.70 to 21.00 (Table-2). The longest (21cm) cob was observed in the genotype VA-786, which was followed by NZ-003 (20.87 cm), Elite (20.67 cm), and Dekalb-9120 (20.80 cm), whereas the shortest (15.70 cm) cob length was observed in the genotype BARI Sweet Corn-1 which was followed by Uttaran-2 (17.00), BHM-8 (17.00) and Dekalb-962 (17.10) respectively.

Cob diameter (cm)

Cob diameter varied significantly in different maize genotypes. Borrás and Vitantonio-Mazzini(2018) reported that cob/ear biomass depends on the rate of plant biomass accumulation and the proportion of this biomass that is allocated to the cob/ear. The average cob diameter was recorded at 14.51, and it ranged from 10.00 to 17.07 (Table-2). The highest (17.07cm) cob diameter was recorded in the genotype GP-838, which was followed by Elite (15.97), Dekalb-9120 (15.70), NZ-001 (15.57), Profit (15.50), AS-999 (15.50) and NK-40 (15.33). On the other hand, the lowest (10.00) cob diameter was observed in the genotype Uttaran-2, which was followed by Khaibhutta (10.63) and BHM-3 (13.07), respectively. Raut *et al.,* (2017) observed a highly significant difference among 14 genotypes for cob diameter.

Row per cob

The average row per cob was recorded at 14.03, and it ranged from 11.04 to16.61 (Table-2). The highest (16.61) row per cob was recorded in the genotype NZ-001, which was followed by the genotypes GP-838 (16.58), PAC-740 (15.60), PAC-399 (15.33), NZ-510 (15.3) and Pioneer-07 (15.07). On the other hand, the lowest (11.04) number of seed rows per cob was observed in genotype Uttaran-2. These results were in line with Ahmad *et al.,*(1978); in maize. The number of seed rows per cob is a genetically controlled factor, but the environmental and nutritional level may also influence the number of rows per cob (Tahir *et al.,* 2008). The more number of rows per cob results in more grain yield. Row per cob varied significantly due to different maize genotypes.

Seeds per row

Number of seeds per row varied significantly in different maize genotypes. The average number of grains per row was recorded around 28.98 and it ranged from 21.33 to 40.40 (Table-2). The highest (40.40) number of grains per row was recorded in the genotype PAC-399 which was followed by PAC-984 (37.33), whereas the lowest (21.33) number was observed from the genotype BARI Sweet Corn-1 which was closely followed by Barnali (21.40), Uttaran-2 (21.77) and VB-100 (24.40) respectively. Borrásand Vitantonio-Mazzini (2018) reported that maize grain yield is highly related to the number of kernels that are established during the flowering period. The kernel number depends on the accumulation of ear biomass and the efficiency of using this biomass for the kernel set.

Thousand-grain weight (g)

The average 1000 grain weight was 311.40 g, and it ranged from 153.33 g to 383.33 g (Table-2). The highest (383.3 g), 1000 grain weight was recorded in the genotype 25KSS, while the lowest (153.3 g) weight of 1000 grain was observed in the genotype of Uttaran-2. Similar results were also reported by Jing *et al.* (2003) and Ali (1994). Thousand-grain weights are an important factor directly contributing to the final grain yield of crop. There was a prominent effect of different hybrids on 1000 grain weight. This was due to a genetically controlled factor that 1000 grain weight of different hybrids was different. As for the effect of environmental factors on 1000 grain weight is concerned, it could not be neglected, but the selection of a suitable hybrid can manage the influence of the environment. Data indicated that highly significant due to 1000 grain weight among different maize genotypes.

Days to maturity

Statistically, significant variation was recorded for days to maturity of different maize genotypes. The average days to maturity were recorded as around 112.35, and it ranged from 107.33 to 116(Table-2). The highest (116) days to maturity was found in the genotypes Elite and VA-786 which was followed by the genotypes Uttaran-2 (115), NZ-001 (115), BM-6 (115), Khaibhutta (115), and Dekalb-9120 (115). The minimum (107.3) days to maturation was found in the genotype BHM-3, which was followed by the genotypes BHM-7 (108), Pacific-11 (108.3), and PAC-740 (109.3), respectively.

Grain yield (tha^{-1})

Grain yield varied significantly in different maize genotypes under (Table-2). Data revealed that the average grain yield was recorded at 6.14tha^{-1}and it ranged from 2.30 to 8.17 tha^{-1} (Table-2). The highest (8.17tha^{-1}) grain yield was recorded in the genotype BHM-9, which was followed by PAC-984 (7.90tha^{-1}) and Pacific-98 (7.90tha^{-1}), and the lowest (2.30tha^{-1}) grain yield was observed in the genotype BARI Sweet Corn-1 which was followed by the variety Khaibhutta (3.26tha^{-1}). Tahir *et al.*, 2018 observed that **t**he maximum grain yield (8.83 tha^{-1}) was obtained from the variety HG-3740. As the three hybrids – namely, BHM-9, PAC-984, and Pacific-98 have produced more yield than other hybrids, they are suitable for commercial cultivation in Bangladesh.

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