

EVALUATION OF PLANTAIN GENOTYPES FOR YIELD AND OTHER CHARACTERS

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Abstract

An experiment was carried out at the Regional Agricultural Research Station, BARI, Ishurdi, Pabna during 2013-15, with eleven genotypes of plantain to evaluate their performances for yield attributes, yield and quality characters. The genotypes included in this investigation were MP001, MP002, MP003, MP006, MP007, MP015, MP018, MP024, MP025, ISD002 and BARI Kola-2 as check. The experiment was laid out in randomized complete block design with three replications. The genotype MP002 produced the maximum number of fingers/bunch (105.67) closely followed by BARI Kola-2 (103.00) and MP015 (101.00). Both the genotypes MP024 and MP025 showed the highest fruit length (21.70 cm), but ISD002 gave the maximum fruit girth (16.78 cm), which was statistically similar with that of MP003 (16.30 cm) and MP024 (16.33 cm). The highest yield and the maximum number of hands were produced by the genotype MP024 (47.81 t/ha and (8.33/bunch) followed by MP015 (36.70 t/ha and 6.33/bunch). Fingers of the genotypes required boiling time in the range of 20.00 min (MP001) to 15.00 min (BARI Kola-2). Flesh of all genotypes possesses pleasant aroma except MP002, MP003 and ISD002. Among the eleven genotypes MP001, MP006, MP007, MP008, MP015 and MP024 were found better when cooked as smashed. The genotype ISD002 took the maximum time (467.33 days) to reach the edible maturity stage of fruits whereas MP024 required the minimum (339.00 days). The genotypes MP015 and MP024 performed better than BARI Kola-2 in respect of bunch weight, fruit size, productivity index, yield, sucker production and qualitative characters.

Keywords: Plantain genotypes, *Musa paradisiaca*, yield attributes and cooking quality.

Introduction

Plantain (*Musa paradisiaca* L) locally known as 'kacha kola' is one of the most popular vegetables in Bangladesh. Local popular cultivars of plantain are cultivated mainly in homesteads of different regions of Bangladesh. It plays a vital role in mitigating vegetable demand during the summer and rainy season, when there is acute shortage of nutritious vegetables. It has also a great demand in the urban areas during the lean period of vegetables from May to October. In Bangladesh, plantain is used as 'bharta' (smashed) and curry, and all classes of people like it. Plantain is high-calorie fruits which contain 556 KJ of energy per 100g edible portion (Robinson, 1994). Plantain is very rich in nutrients including

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carbohydrates, phosphorus, calcium, iron, vitamin B complex and vitamin C (Chattopadhyay *et al.*, 2001). This group of banana is used as staple food in Uganda, Tanzania, Ivorycoast and South Cameron. It is very cheap and energetic food also. Total production of plantain in Bangladesh during 2014-15 was 147136 MT from an area of 10331 hectares with an average yield of 10.24 t/ha (Anon., 2015). Morphological studies and yield potential of some local plantain germplasm were studied by different investigators (Biswas *et al.*, 1992; Saha *et al.*, 1988 ; Golder *et al.*, 1992) whose findings indicated that both yield contributing characters and yield of the plantain genotypes differ significantly when grown under different agro ecological conditions. BARI released one plantain variety named BARI Kola-2. The variety is very shy in sucker production, which is hindering the extension of the variety. Therefore, the present study was conducted to evaluate the performance of eleven plantain genotypes with a view to develop high yielding and good quality plantain varieties.

Materials and Methods

The experiment was conducted at the Regional Agricultural Research Station, BARI, Ishurdi, Pabna during 2013-15. The plantain genotypes included in this investigation were MP001, MP002, MP003, ISD002, MP006, MP007, MP015, MP018, MP024, MP025 and BARI Kola- 2 (check). The genotypes MP001, MP002, MP006 and MP025 were collected from Gazipur, ISD002 from Ishurdi, MP024 from Jessore, MP003 and MP015 from Rajshahi, MP007 and MP018 from Chittagong and BARI Kola-2 (FHIA 03) from Belgium through the International Network for the Improvement of Banana and Plantain (INIBAP). The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 5.7 m × 1.9 m. Sword suckers (weight 2.5 kg ± 50 g, age 70 ± 15 days) were planted in the field on 20 October 2013 maintaining a plant spacing of 1.9 m × 1.9 m. The land was fertilized with cowdung @ 30 t/ha, and urea, TSP, MoP and gypsum @ 1550, 1250, 1550 and 620 kg per hectare, respectively as per recommendation of BARI (Anon., 2005). Half of cowdung, TSP and Gypsum were applied in the field during final land preparation and the remaining half were applied in the pit 10 days before planting. Urea and MoP were applied as side dressing in five equal installments at one month interval starting from one month after planting. Weeding, mulching, desuckering, propping and irrigation were done as and when necessary. The fungicide 'Knowin' was sprayed five times at 15 days interval @ 1.5% to control sigatoka disease. Harvesting was started from 21 September 2014 and continued up to 30 January 2015. Data were recorded on growth (pseudostem height at shooting, base girth at shooting, top girth at shooting, number of green and yellow leaves/plant at shooting, number of suckers/plant at shooting) yield attributes [pseudostem weight at harvest, number of hands and fingers/bunch, bunch weight (yield/plant), fruit size (length and width), fruit girth, cooking quality (time of boiling, flesh texture after boiling, aroma and taste as smashed)

and qualitative characters (shape, peel colour, pulp colour and blossom end of the fruit). Yield/plant (bunch weight in kg) was converted to per hectare yield in tons. The procedure of Islam *et al.* (2002) was followed during data collection on shape, peel colour, pulp colour and blossom end of the fruit, flesh texture after boiling and aroma. Cooking quality and qualitative characters were tested by a panel consisting of seven persons of different levels. After boiling and peeling the fruits were smashed with salt, green chilli, onions and mustard oil, and then the smashed bananas (bharta) were tasted by the members of that panel. The recorded data were analyzed with the help of MSTAT C software and means were compared by DMRT at 5% level of probability.

Results and Discussion

Morphological characters

Pseudostem height at shooting (m): Pseudostem height of eleven plantain genotypes ranged from 2.56 m to 3.11 m (Table 1). The highest pseudo stem height at shooting (3.11 m) was found in MP003 closely followed by MP024 (3.09 m), MP025 (3.08 m), MP015 (3.06 m), MP006 (2.96 m), MP007 (2.88 m) and MP018 (2.81 m). The ISD002 had the shortest pseudostem height (2.56 m). The results are in agreement with the findings of Rahman *et al.* (2005) who obtained pseudostem height in the range of 2.61 m to 3.10 m in plantain lines.

Base girth and top girth at shooting (cm): Base girth and top girth were found the highest (83.30 cm and 69.00 cm, respectively) in BARI Kola-2 which was followed by MP025 (71.00 cm and 51.00 cm) and MP006 (67.67 cm and 45.00 cm), respectively. The lowest base girth and top girth (53.33 cm and 36.67 cm) were obtained from ISD002. Similar results were also observed by Hoque *et al.* (2003) who obtained base girth ranging from 69.67 cm to 82.33 cm in some plantain genotypes; they observed 82.33 cm base girth for BARI Kola-2 (FHIA 03).

Number of green leaves/plant at shooting: Significant differences were found among the genotypes in respect of number of leaves/plant at shooting (Table 1). The highest number of green leaves was found in MP003 (11.33) closely followed by MP018 (11.00), BARI Kola-2 (11.00) MP007 (10.67), MP006 (9.67) and MP015 (9.67). The lowest number of leaves /plant was recorded in MP002 (2.00). Similar results were also reported by Saifullah *et al.* (2000) who obtained green leaves/plant at shooting in the range of 10.11 to 11.17 when evaluated nine plantain genotypes.

Number of yellow leaves/plant at shooting: The genotypes differed significantly in respect of number of yellow leaves/plant at shooting (Table 1). The maximum number of yellow leaves was obtained from MP018 (3.33) which was closely followed by MP003 (3.30), MP007 (3.00), MP015 (2.67) and MP006 (2.33) while the lowest number was obtained from MP024 (1.65).

Table 1. Morphological characters of eleven plantain genotypes

Genotype	Pseudostem height at shooting (m)	Base girth at shooting (cm)	Top girth at shooting (cm)	Green leaves/plant at shooting (no.)	Yellow leaves/plant at shooting (no.)	Suckers/plant at harvest (no.)	Days to fruit maturity
MP001	2.67c	59.67ef	42.0cde	7.66bc	1.67c	14.30b-e	351.67c
MP002	2.82abc	65.67cd	43.33cd	2.00d	2.00bc	18.67a	350.33cd
MP003	3.11a	62.33de	42.00cde	11.33a	3.30a	11.30e	372.33b
ISD002	2.56c	53.33g	36.67f	7.67bc	2.00bc	12.67de	467.33a
MP006	2.96ab	67.67bc	45.00c	9.67ab	2.33abc	16.33abc	338.00d
MP007	2.88abc	56.00fg	42.00cde	10.67a	3.00ab	13.33cde	352.67c
MP015	3.06a	59.33ef	43.66cd	9.67ab	2.67abc	15.00bcd	374.00b
MP018	2.81abc	62.33de	42.67cde	11.00a	3.33a	15.33bcd	354.33c
MP024	3.09a	59.33ef	38.33ef	7.00c	1.65c	17.33ab	339.00d
MP025	3.08a	71.00b	51.00b	8.00bc	2.00bc	14.00cde	342.66cd
BARI Kola-2	2.58c	83.30a	69.00a	11.00a	2.00bc	11.33e	377.00b
CV (%)	6.98	4.92	5.85	13.98	12.64	13.15	9.14

Means within a column followed by common letter(s) are not significantly different from each other by DMRT at 5% level of probability.

Table 2. Yield and yield attributes of eleven plantain genotypes

Genotypes	Pseudostem weight at harvest (kg)	Hands/bunch (no.)	Fingers/bunch (no)	Bunch weight (kg)	Fruit length (cm)	Fruit girth (cm)	Yield (t/ha)	Productivity index*
MP001	12.51cd	6.00bc	67.33de	11.35e	19.20ab	13.85cd	31.43e	3.33cd
MP002	11.55cdef	6.67b	105.67a	9.75h	13.20d	13.50d	27.00h	2.78e
MP003	10.91f	6.33bc	85.00c	9.17i	16.10bc	16.30ab	25.40i	2.46f
ISD002	10.57f	5.00d	57.67f	9.18i	19.18ab	16.78a	24.42i	1.96g
MP-006	11.00ef	6.33bc	82.00c	10.31g	20.16a	14.50bc	28.55g	3.05de
MP007	12.40cde	5.67cd	72.00d	12.03d	19.10ab	14.00c	33.32d	3.41c
MP015	13.50c	6.33bc	101.00a	13.25b	14.80cd	15.50b	36.70b	3.54b
MP018	10.90f	6.00bc	63.67e	7.53j	19.30ab	14.30bc	20.85j	2.13g
MP024	10.25f	8.33a	93.00b	17.26a	21.70a	16.33ab	47.81a	5.09a
MP025	19.91a	6.00bc	68.65d	10.83f	21.70a	14.20bc	29.99f	3.16cd
BARI Kola -2	17.33b	6.33bc	103.00a	12.55c	15.70c	13.85cd	34.76c	3.25cd
CV (%)	6.82	7.08	9.55	7.60	5.69	4.97	8.63	9.05

Means within a column followed by common letter(s) are not significantly different from each other by DMRT at 5% level of probability.

*Productivity index = 100 x bunch weight/days to maturity (cycling time) (Ayala-Silva *et al.*, 2009)

Number of suckers at harvest: Number of suckers/plant at harvest was found the highest in MP002 (18.67) closely followed by MP024 (17.33) and MP006 (16.33) (Table 1). The lowest number of suckers was obtained from the genotype MP003 (11.30).

Days to fruit maturity: The genotypes differed significantly in respect of days to maturity i.e. planting to edible maturity of fruits (Table 1). The genotype ISD002 took the maximum time (467.33 days) to reach the harvesting stage, preceded by BARI Kola-2 (377.00 days), MP015 (374.00 days) and MP003 (372.33) and the genotype MP006 required minimum time for harvesting (338.00 days). Similar observations were also reported by Saifullah *et al.* (2000) who mentioned the range of 316.33 to 379.33 days for fruit maturity of nine plantain genotypes.

Yield and yield contributing characters

Pseudostem weight at harvest: Pseudostem weight in different genotypes ranged from 10.25 kg to 19.91 kg (Table 2). The maximum pseudostem weight was obtained from MP025 (19.91 kg) followed by BARI Kola-2 (17.33 kg) and MP015 (13.50 kg). The minimum weight was recorded in MP024 (10.25 kg).

Number of hands/bunch: The genotype MP024 produced the highest number of hands/bunch (8.33) which was statistically different from the others (Table 2). The genotypes MP002, MP003, MP006, MP015 and BARI Kola-2 also gave better number of hands/bunch because these genotypes produced number of hands/bunch more than 6.00. On the other hand, ISD002 produced the lowest number of hands (5.0). The results are in partial agreement with the findings of Hoque *et al.* (2003) who reported the range of 5.83 to 8.33 for hands/bunch.

Number of fingers/bunch: The maximum number of fingers per bunch was recorded in MP002 (105.67) which was closely followed by BARI Kola-2 (103.00) and MP015 (101.00) (Table 2). The lowest was recorded in ISD002 (57.67).

Bunch weight (yield/plant): The genotype MP024 produced the heaviest bunch (17.26 kg) followed by MP015 (13.25 kg) (Table 2). The genotype MP018 produced the lowest bunch weight (7.53 kg). The result was almost similar to Hoque *et al.* (2003) who reported bunch weight in the range of 9.45 kg to 18.23 kg.

Fruit size: Fruit size ranged from 13.20 cm to 21.70cm in length and 13.50 cm to 16.78 cm in girth (Table 2). The genotypes MP024 and MP025 produced the highest fruit length (21.70 cm) which was similar with MP006 (20.16 cm), MP018 (19.30 cm), MP001 (19.20 cm), MP007 (19.10 cm) and ISD002 (19.18 cm). The lowest fruit length was produced by the genotype MP002 (13.20 cm). The highest girth (16.78 cm) was obtained from ISD002 closely followed by MP024 (16.33 cm) and the lowest from MP002 (13.50 cm). The findings are in

conformity with those of Saifullah *et al.* (2000) who reported the range of fruit (finger) length from 9.88 to 20.89 cm and Islam *et al.* (2002) mentioned fruit girth ranged from 11.83 to 16.87 cm.

Yield: The highest yield was obtained from MP024 (47.81 t/ha) followed by MP015 (36.70 t/ha) and BARI Kola-2 (34.76 t/ha). The maximum yield in MP024 was due to the highest number of hands/bunch and the highest bunch weight. The lowest yield was recorded in MP018 (20.85 t/ha). The findings are similar to Islam *et al.* (2002) who reported that the per hectare yield of 10 local plantain varieties ranged from 29.43 to 52.94 tons. These results are also supported by Biswas *et al.* (1992) and Golder *et al.* (1992). Sarker *et al.* (2002) obtained yield in the range of 18.20 to 30.60 tons per hectare; Biswas *et al.* (1992) 29.45 to 48.12 tons per hectare and Golder *et al.* (1992) 28.20 to 41.5 tons per hectare in different plantain lines.

Productivity index: The plantain genotypes showed variation regarding to productivity index which ranged from 1.96 to 5.09 (Table 2). The genotype MP024 gave the maximum productivity index (5.09) followed by MP015 (3.54), MP007 (3.41), MP001 (3.33) and BARI Kola-2 (3.25). Ayala-Silva *et al.* (2009) obtained productivity index for 5 cooking bananas in the range of 0.86 to 1.43 and opined that the variety with the higher productivity index was better in terms of production.

Qualitative Characters

Shape of fruit: The genotypes MP001, MP002, MP006, MP015, MP024 and BARI Kola-2 produced fruits which are straight in shape, while MP003 and MP018 produced fruits which are swollen in middle (Table 3). The genotypes ISD002 and MP007 had the curve shaped fruits and the genotype MP025 produced constricted shaped fruits.

Peel and pulp colour at edible stage: The peel colour of fruit was green in MP001, ISD002, MP006 and MP024, whereas MP003, MP018, MP025 and BARI Kola-2 were deep green, MP002 and MP015 were green with white coated and MP007 was light green (Table 3). Pulp colour of the fruits was cream, whitish and light yellow to cream. The colour of pulp was cream in MP001, ISD002, MP006, MP007 and MP025. The pulp colour of MP002, MP003, MP018, MP024 and BARI Kola-2 were whitish while the genotype MP015 was light yellow to cream. The results are in line with the finding of Biswas *et al.* (1992) who also found the variation in the pulp colour in plantain cultivars.

Blossom end of the fruit: The blossom end of fingers was slightly blunt in MP001, while those of MP002, MP024 and BARI Kola-2 were pointed blossom end (Table 3). On the other hand, MP003, MP006, MP007 and MP018 were semi pointed. The fingers of ISD002 were slightly curved. The genotype MP025 produced fingers with blunt blossom end and MP015 had slightly constricted

blossom end. The result is in agreement with of the findings of Biswas *et al.* (1992) who obtained 7 types of blossom end of fruit.

Table 3. Qualitative characters of fruits of eleven plantain genotypes

Genotype	Shape	Peel colour	Pulp colour	Blossom end
MP001	Straight	Green	Cream	Slightly blunt
MP002	Straight	Green coated with white	Whitish	Pointed
MP003	Swollen in middle	Deep green	Whitish	Semi pointed
ISD002	Curve	Green	Cream	Slightly curve
MP006	Straight	Green	Cream	Semi pointed
MP007	Curve	Light green	Cream	Semi pointed
MP015	Straight	Green coated with white	Light yellow to cream	Slightly Constricted
MP018	Swollen in middle	Deep green	Whitish	Semi pointed
MP024	Straight	Green	Whitish	Pointed
MP025	Constricted	Deep Green	Cream	Blunt
BARI Kola-2	Straight	Deep green	Whitish	Pointed

Table 4. Cooking quality of fruits of eleven plantain genotypes

Genotypes	Time of boiling (min)	Flesh texture after boiling	Aroma	Taste as smashed
MP001	20.00a	Semi soggy	Pleasant	Good
MP002	17.0bc	Firm	Unpleasant	Not good
MP003	17.0bc	Firm	Unpleasant	Not good
ISD002	16.30bc	Firm	Unpleasant	Not good
MP006	18.0ab	Firm	Pleasant	Good
MP007	16.0bc	Semi soggy	Pleasant	Good
MP015	18.50ab	Firm	Pleasant	Very good
MP018	15.50d	Firm	Pleasant	Good
MP024	19.30a	Firm	Pleasant	Very Good
MP025	16.51c	Semi soggy	Pleasant	Good
BARI Kola- 2	15.0d	Firm	Pleasant	Very Good

Cooking quality

Boiling time: The genotype MP001 took the maximum time to boil the fingers (20.00 min) which was similar with MP024 (19.30 min), MP015 (18.00 min) and MP006 (18.00 min) (Table 4). BARI Kola-2 required the minimum time to boil the fingers (15.00 min). The results are in consonance with the findings of Hoque *et al.* (2003) who reported the time required to boil the fingers ranging from 15.33 min (BARI Kola-2) to 19.33 min.

Flesh texture after boiling: After boiling, the flesh texture of MP001, MP007 and MP025 were found semi soggy, whereas the flesh of rest of the genotypes were firm in texture (Table 4).

Aroma: The flesh of boiled fingers of all genotypes had pleasant aroma except MP002, MP003 and ISD002 which had unpleasant aroma (Table 4).

Taste as smashed: Among the genotypes, MP015, MP024 and BARI Kola-2 had very good taste both as smashed. The genotypes MP001, MP006, MP007, MP018 and MP025 had good taste whereas MP002, MP003, ISD002 were not good either as smashed (Table 4).

Conclusion

Based on the above results it can be concluded that the genotypes MP015 and MP024 performed better in respect of yield and qualitative characters. These genotypes might be subjected to further evaluation to release as variety (ies).

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