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## Performance of Some Exotic Potato Varieties under Bangladesh Conditions

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**Abstract:** Characterization was done with fourteen exotic varieties of potato (*Solanum tuberosum*) namely Mondial, Granola, Cardinal, Ailsa, Petronese, Morene, Diamant, Cleopetra, Binella, Dheera, Multa, Kufri Sindhuri, Heera, Chamak and a local check (Lal Pakri) under Bangladesh condition. The tuber skin color of Mondial, Granola, Ailsa, Petronese, Morene, Diamant, Binella, Dheera, Multa, Heera and Chamak were white to light yellow, while Cardinal, Kufri Sindhuri, Cleopetra were red. The tuber shape were round in Granola, Morene and Kufri Sindhuri; elongate in Mondial, Ailsa and Diamant and oval in rest of the exotic potato varieties. The plant traits were spready and green in color with no flowering habit except variety Chamak. The yield ranged of exotic varieties were 19.44 to 46.67 ton per hectare. Variety Ailsa produced the maximum yield (46.67 t ha<sup>-1</sup>) which was followed by Cardinal and Mondial.

**Key words:** Potato, variety, characters, performance, *Solanum tuberosum*

### Introduction

Potato (*Solanum tuberosum*) is an important supplementary food crop in Bangladesh. It has the capacity of producing more calories and protein per unit land area with minimum time and water than most other major food crops (Upadhy, 1995). As the 3rd most important crop in Bangladesh next only to rice and wheat it occupies only 0.86 percent of the net cropped area of the country (Elias, 1995), contributing alone as much as 50% of the total annual vegetable production (Anonymous, 1998). Although it is contributing such a major portion, its yield is very low (11.2 t ha<sup>-1</sup>) as compared with other leading potato growing countries like Netherlands (43.6 t ha<sup>-1</sup>), U.K. (43.2 t ha<sup>-1</sup>) and India (16.8 t ha<sup>-1</sup>) (Anonymous, 1997). To increase the yield, the easiest method is to select the high yielding varieties. With this view in mind, 173 high yielding varieties were introduced in Bangladesh by Tuber Crops Research Center (TCRC) during the last decade and recommended 20 varieties after screening for cultivation under Bangladesh conditions (Hussain, 1993). These existing varieties occupy in about 68% of the total potato growing areas of this country (Anonymous, 1998). So, the importance of exotic potato varieties in Bangladesh is knows no bound. But information on the systematic characterizations of all the introduced exotic varieties was inadequate. That is why, the study was undertaken to characterize the exotic potato varieties under Bangladesh conditions.

### Materials and Methods

The experiment was conducted at the Horticultural Field

of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh during 1997-99. Fourteen exotic potato varieties namely Mondial, Granola, Cardinal, Ailsa, Petronese, Morene, Diamant, Cleopetra, Binella, Dheera, Multa, Kufri Sindhuri, Heera, and Chamak were used in the study. One standard local variety Lal Pakri was used as check.

A unit plot size of the land was 2.5 x 1.5m<sup>2</sup>, which represented each variety. The experiment was conducted at randomized complete block design (RCBD) with three replications. The plot was fertilized @ of 150 Kg N, 100 Kg P, 150 Kg K, 120 Kg S and 6 Kg B per hectare in the form of urea, TSP, MP, gypsum and boric acid in addition to 10 tons cowdung per hectare. Entire amount of TSP, MP, gypsum, boric acid and half of urea were applied as basal dose before final land preparation. The remaining half of urea was applied as side dressing at 30 days after planting (DAP). The manures and fertilizers were applied in the plot after layout.

First generation seed of each variety were received from the Crop Diversification Program (CDP), Khamarbari, Dhaka, and were kept under diffuse light to have healthy and good sprouts.

Well sprouted tubers were planted at 5-7 cm depth in 60cm apart in furrows on the first week of December in both year (1997 and 1998). Seeds were covered with soil immediately after planting. Plant to plant distance was 15 cm. Weeding, earthing up, plant protection and irrigation were performed as per TCRC recommendation when needed. The crop was harvested after 95 DAP in both year. Data on yield and yield contributing characters were recorded from 10 randomly selected plants in each plot.

The data were analysed as per procedures of Gomez and Gomez (1993).

### Results and Discussion

**Rate of emergence:** There was a significant variation in emergence percent among the varieties (Table 1a). The highest emergence (91%) was observed from Cardinal which was statistically identical with most of the varieties except the variety Granola (63%) and Cleopetra (70%). A previous report (Anonymous, 1987) indicated that the rate of emergence among the six Dutch varieties varied from 82 to 93% which was closely related to these findings.

**Plant survivability (%):** The plant survivability of the varieties varied markedly (Table 1a). The maximum plant survivability (97%) were obtained from Cardinal and the lowest plant survivability (82%) were appeared in Granola and Cleopetra. The final plant stand varied from 82 to 97% which is nearer to the findings of Anonymous (1997), who found that the final plant stand (percent of emerged plants) varied from 76 to 100%.

**Plant height:** Wide variation was observed among the varieties in respect of plant height (Table 1a). The tallest (44.91 cm) plant was observed in the variety Binella and the shortest (31.42 cm) in the variety Chamak. The control variety Lalpakri attained a plant height of 34.00 cm whereas Islam *et al.* (1996), reported a much higher height of Lal Pakri variety (53.9 cm). The variation in plant height of the same variety in different studies was probably due to variation in growing environment and quality of planting materials.

**Canopy:** The canopy of the varieties differed significantly. The maximum canopy (1125.22 cm<sup>2</sup>) was found in the plants of Ailsa which was at par with Cardinal (1072.00 cm<sup>2</sup>) and Heera (1027.84 cm<sup>2</sup>) and the lowest canopy (415.46 cm<sup>2</sup>) was recorded from the plants of Chamak (Table 1a).

**Number of stems per hill:** The number of stems per hill of the varieties exhibited wide variation (Table 1a). The highest number of stem per hill was recorded in Ailsa (4.59) followed by Cardinal (4.50) and Mondial (4.00). The minimum number of stems per hill was obtained in Lal pakri (2.19). The results of this experiment support the findings of Anonymous (1987), who found that the number of stems in these varieties varied from 1.5 (Charlotte) to 4.50 (Cardinal).

**Number of leaves per hill:** There existed varietal difference in respect of number of leaves per hill.

Significantly maximum number of leaves per hill was produced from the plants of the variety Ailsa (53.80), which was followed by Cardinal (49.75), Lalpakri (46.60) and Chamak (45.80) whereas the least number of leaves per hill was produced by Heera (22.25) (Table 1a).

**Growth habit:** There was no variation in growth habit of exotic potato varieties under study (Table 1b). All of the exotic varieties were observed to spready type but only the control Lal pakri looked erect which is similar to the result of Islam *et al.* (1996).

**Flowering behaviour:** Flowering was not observed in most of the varieties including the local variety (All pakri), which was similar to the observation of Hussain (1993), who said that in respect of climatic condition of Bangladesh, flowering in potato is uncommon but in this experiment, the variety Chamak gave the off white flower.

**Tuber shape and color:** The tubers of different varieties of potato under study showed a great variation in their shape, flesh and skin color (Table 1b). The tubers of Lal Pakri, Granola, Morene and Kufri Sindhuri were round while they were elongated in Mondial, Ailsa and Diamant. The rest of the exotic varieties (Cardinal, Petronese, Cleopetra, Binella, Dheera, Multa, Heera and Chamak) produced oval shaped tuber.

The flesh color was observed yellow in most of the exotic variety. Creamy color were also observed in few varieties (Petronese, Multa, Heera and Chamak) and whitish flesh color were found in Ailsa and Dheera.

The skin color of the tuber of most of the varieties was found in yellow with different extent and red color was also observed in some varieties (Cardinal, Cleopetra and Kufri Sindhuri). Similar findings were also observed by Akhter *et al.* (1994).

**Days to maturity:** The varieties showed significant differences in the required days to maturity. The variety Heera required the least period (75 days) to maturity, whereas maximum days to maturity were recorded from the variety Kufri Sindhuri (94 days), which was followed by Chamak (91 days) and Lal pakri (90 days). In this study Heera was found as the earliest bulking variety and most of the varieties were matured within 85 to 90 days (Table 1b). Anonymous (1987) also reported the similar results in Dutch varieties.

**Weight of fresh plant:** There was a significant variation in weight of fresh plant among the varieties (Table 1b). The highest weight (2.90 kg) of fresh plant was observed in Petronese which was followed by Ailsa (2.80 kg), Lal Pakri

Table 1a: Characteristics of some exotic potato varieties during 1997-99 at BSMRAU

Potato varieties	Emergence (%)	Plant survivability (%)	Plant height (cm)	Canopy (cm <sup>2</sup> )	No. of stem/hill	No. of leaves/hill
Lal pakri	86a	93ab	34.00cde	544.79fg	2.19e	46.60abc
Mondial	88a	92ab	36.65bcde	657.89ef	4.00abc	42.83bc
Granola	63c	82b	35.68bcde	631.28ef	2.92ade	41.60bc
Cardinal	91a	97a	43.03ab	1072.00a	4.50ab	49.75ab
Ailsa	87a	93ab	37.37abcde	1125.22a	4.59a	53.80a
Petronese	87a	92ab	36.63bcde	714.29de	3.83abc	41.80bc
Morene	86a	93ab	37.11abcde	738.94de	3.18bcde	28.80ef
Diamant	89a	96a	43.75ab	932.40bc	3.52abcde	28.40ef
Cleopetra	70bc	82b	33.00de	621.83ef	2.40de	25.00ef
Binella	87a	89ab	44.91a	907.50bc	3.55abcde	32.00de
Dheera	82ab	88ab	33.09de	835.78cd	3.38abcde	39.80cd
Multa	80ab	85ab	32.00e	445.12gh	2.23e	38.93cd
Kufri Sindhuri	87a	95ab	41.58abc	667.20ef	3.44abcde	43.60bc
Heera	90a	95ab	40.60abcd	1027.84ab	3.65abcd	22.25f
Chamak	83a	90ab	31.42e	415.46h	3.10cde	45.80abc
CV%	8.53	7.34	11.29	9.49	21.20	13.24

Means separation in columns followed by the same letter(s) are not significantly different at  $P \leq 0.05$

Table 1b: Characteristics of some exotic potato varieties during 1997-99 at BSMRAU

Potato varieties	Growth habit	Flower and its color (if any)	Tuber			Days to maturity	Wt. of fresh plant (kg)	Dry matter (%) of	
			Shape	Flesh color	Skin color			Shoot	Tuber
Lal pakri	Erect	Nil	Round	Yellow	Red	90a	2.50abc	21.20cd	23.00ab
Mondial	Spready	Nil	Elongate	Yellow	Light yellow	86ab	1.70e	16.80fgh	21.70bc
Granola	"	Nil	Round	Yellow	Dark yellow	87ab	0.50fg	29.10a	16.40f
Cardinal	"	Nil	Oval	Yellowish	Light red	87ab	2.50abc	17.70efgh	19.00de
Ailsa	"	Nil	Elongate	Whitish	Creamy	89a	2.80ab	19.40def	18.90de
Petronese	"	Nil	Oval	Creamy	Creamy	88a	2.90a	18.90defg	20.30cd
Morene	"	Nil	Round	Yellowish	Yellowish white	85ab	1.90de	23.00bc	18.40df
Diamant	"	Nil	Elongate	Yellowish	Whitish brown	85ab	1.00f	15.60ghi	18.40def
Cleopetra	"	Nil	Oval	Light yellow	Red	87ab	0.60fg	15.90ghi	17.80ef
Binella	"	Nil	Oval	Yellow	Creamy	89a	0.80fg	17.40efgh	14.10g
Dheera	"	Nil	Oval	Whitish	Light yellow	89a	2.20cde	14.60hi	23.00ab
Multa	"	Nil	Oval	Creamy	Creamy	85ab	0.30g	25.00b	22.20abc
Kufri Sindhuri	"	Nil	round	Yellowish	Red	94s	2.30bcd	20.60cde	34.10a
Heera	"	Nil	Oval	Creamy whitish	Light yellow	75b	0.80fg	14.70hi	17.20ef
Chamak	"	Presence (Off white)	Oval	Creamy	Light yellow	91a	2.50abc	13.40i	17.10ef
CV(%)	"	"	"	"	"	7.19	18.06	9.67	6.58

Means separation in columns followed by the same letter(s) are not significantly different by at  $P \leq 0.05$

Table 2: Tuber grade and yield potential of some exotic potato varieties during 1997-99 at BSMRAU

Potato varieties	Tuber grades										Yield/hill (kg)
	<28 mm		28-35 mm		35-45 mm		45-55 mm		>55 mm		
	No. (%)	Wt. (%)	No. (%)	Wt. (%)	No. (%)	Wt. (%)	No. (%)	Wt. (%)	No. (%)	Wt. (%)	
Lal pakri	64.58	43.01	23.76	20.53	16.46	6.66	5.00	20.00	-	-	0.16e
Mondial	44.73	8.78	24.25	19.65	21.85	13.92	13.71	32.18	3.39	17.54	0.37ab
Granola	59.43	21.95	23.29	29.27	31.71	13.25	4.03	17.07	-	-	0.21dc
Cardinal	31.92	5.68	31.27	27.27	38.09	26.13	10.68	28.96	-	-	0.38ab
Ailsa	51.19	12.76	25.60	25.53	25.54	14.88	8.33	36.17	-	-	0.42a
Petronese	63.74	24.22	21.76	29.48	18.52	7.63	6.87	27.78	-	-	0.35b
Morene	40.57	11.12	19.34	15.87	28.57	20.28	19.81	44.44	-	-	0.24cd
Diamant	53.60	15.63	24.0	31.25	23.87	14.4	8.0	29.25	-	-	0.29c
Cleopetra	53.01	13.33	43.37	66.67	20.00	3.62	-	-	-	-	0.18e
Binella	58.20	14.71	17.99	20.59	44.11	19.05	4.76	20.59	-	-	0.28c
Dheera	78.54	45.28	10.63	17.28	19.44	6.83	4.00	18.00	-	-	0.20dc
Multa	35.0	7.04	55.0	66.34	26.62	10.0	-	-	-	-	0.175e
K. Sindhuri	62.34	31.76	21.82	28.58	31.75	12.99	2.85	11.11	-	-	0.27c
Heera	36.74	870	32.07	21.74	26.08	16.98	12.60	30.43	1.61	13.05	0.26c
Chamak	74.01	47.62	20.34	33.33	14.29	4.52	1.13	4.76	-	-	0.205dc
Mean	53.84	20.64	26.29	30.23	25.79	12.74	6.78	21.38	0.33	2.04	0.26
SD	14.00	14.47	13.71	16.53	8.16	6.32	4.93	13.00	0.89	5.08	0.081
CV (%)	26.00	70.00	52.00	54.68	31.64	49.60	72.71	60.8	-	-	9.20

Means separation in columns followed by the same letter(s) are not significantly different  $P \leq 0.05$

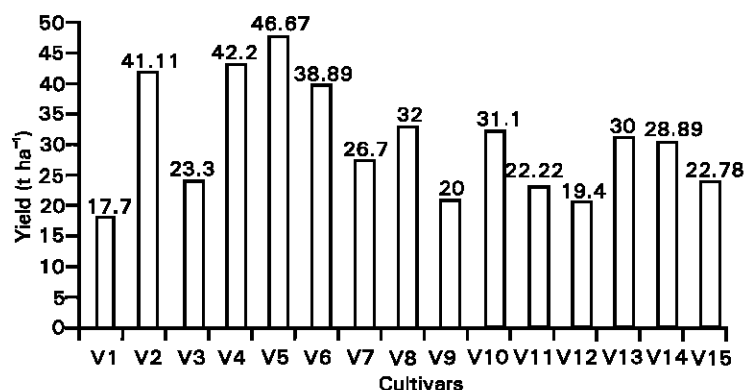


Fig. 1: Yield (t ha<sup>-1</sup>) of different potato varieties

V1=Lalpakri, V2=Mondiel, V3=Granola, V4=Cardinal, V5=Ailsa, V6=Petronese, V7=Morene, V8=Diamant, V9=Cleopetra, V10=Binella, V11=Dheera, V12=Multa, V13=Kufri Sindhuri, V14=Heera, V15=Chamak

(2.50 kg), Cardinal (2.50 kg), and Chamak (2.50 kg). The lowest weight of fresh plant was observed in Multa (0.30 kg) which was followed by Granola (0.50 kg), Cleopetra (0.60 kg), Binella (0.80 kg) and Heera (0.80 kg).

**Dry matter (%) of shoot and tuber:** Significant variations were observed among the varieties in respect of dry matter (%) of shoot and tuber (Table 1b). The highest percentage of dry matter of biomass was observed in Granola (29.1%), which was followed by Multa (25%), Morene (23%) and Lal Pakri (21.2%). Chamak gave the lowest dry matter (13.40%) of shoot. Multa, Morene and Lal pakri gave the medium performance.

In case of dry matter (%) of tuber, Kufri Sindhuri showed the better performance, which was followed by Lal pakri, Dheera and Multa. In this study, the dry matter content varied from 14.10 (Binella) to 24.10% in case of tuber dry matter (Kufri Sindhuri). This result is also nearer to that of Anonymous (1987), who found that the dry matter percentage of the maximum potato varieties ranged from 15 to 24%.

**Grade of tubers:** The varieties Lal Pakri, Granola, Petronese, Dheera, Kufri Sindhuri and Chamak had more than 20% tubers by weight and above 60 % tubers by numbers in the group less than 28 mm (Table 2). Varieties in which more than 30% tubers by weight in the group 28-35mm include Diamant, Cleopetra, Multa and Chamak. Most of the varieties had more than 20% tubers in this group (28-35mm) regarding both number and weight. It was also observed that the varieties Granola, Cardinal, Binella and Kufri Sindhuri had more than 30% tubers (by weight) in the group 35-45 mm include Mondial, Ailsa, Morene and Heera. Two varieties, Cleopetra and Multa did not produce any tuber bigger than 45 mm. On the contrary, only two varieties Mondial and Heera produced the largest (>55 mm) size tubers. The grading of tubers is

more or less similar to the findings of Anonymous (1991).

**Yield:** Different variety showed marked variation in case of yield per hill (Table 2). Ailsa produced the maximum yield (0.42 kg) per hill which was closely related to Cardinal (0.38 kg) and Mondial (0.37 kg). Minimum yields were recorded from Lal Pakri (0.16 kg), which was statistically similar to Multa (0.17 kg) and Cleopetra (0.18 kg). Similar trends were also found in case of yield per hectare (Fig. 1). The highest yield was obtained from Ailsa (46.67 t ha<sup>-1</sup>) which was followed by Cardinal (42.21 t ha<sup>-1</sup>), Mondial (41.11 t ha<sup>-1</sup>) and Petronese (38.89 t ha<sup>-1</sup>). Most of the varieties gave the yield within the range of 20-31 t ha<sup>-1</sup>. Akhter *et al.* (1994) have also opined the similar result. Iqbal and Haque (1982) observed that the yield of Cardinal, Petronese and Kufri Sindhuri were statistically similar which is in agreement with that of these findings.

The highest yield was contributed by large number of leaves and stems which helps in deposition of greater amount of photosynthates and ultimately maximize the yield. There are also reports that yield of tubers has a positive relationship with the number of stems per hill (Davies, 1969; Siddique *et al.*, 1987).

From the results of the study it appeared that Ailsa, Cardinal, Mondial, Petronese, Diamant and Binella have a bright prospect for cultivation under the climatic conditions of Gazipur, Bangladesh.

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