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## Evaluation of growth and yield characteristics of twenty two potato germplasm at Sher-e-Bangla Agricultural University

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### ABSTRACT

A field research was accomplished at Horticultural farm, Sher-e-Bangla Agricultural University, during the period from October 2014 to April 2015 to evaluate the growth and yield characteristics of twenty two potato germplasm ( $G_1$ - $G_{22}$ ). The experiment was laid out in randomized completely block design (RCBD) with three replications. Tallest plant was found from  $G_1$  (107.0 cm) and maximum stems  $hill^{-1}$  was found from  $G_{19}$  (5.00). The highest yield  $t ha^{-1}$  was found from  $G_{13}$  (29.9  $t ha^{-1}$ ). The findings of the experiment can be considered as a basis for further research on identifying potential potato germplasm.

**Key Words:** Potato germplasm, Plant height, Chlorophyll content and Yield

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### I. Introduction

Potato (*Solanum tuberosum*) is one of the leading vegetable and next to cereals in Bangladesh. Potato is indigenous in Andean area of South America. It is an important food crop and belongs to annual dicotyledonous herbaceous tetraploid ( $2n=28$ ) belongs to Solanaceae family. Globally, the crop ranks fourth in importance, following wheat, maize and rice (Pandey, 2008). Potato is now the third most important food item of Bangladesh by tonnage production Ahmed et al. (2013). It is a vegetable crop with a relatively high growth rate. This results in it having a relatively short growing period. In Bangladesh potato has been introduced in two grouped – a) Deshi or local varieties and b) Modern varieties or HYVs. Local varieties are low yielding, poor quality for industrial use and pithy storage capacity while modern introduced varieties are comparatively have good keeping quality. Potato growers become accustomed with heterogeneous drawbacks like bulkiness in tuber, high seed tuber price, poor tuber quality, lack of knowledge in advance technology and most significant problem is the poor storage facility in cold storage. Our research increases to sort out desired varieties and grade them in suitable classes. To be useful for plant breeder genetic resources must be characterized by

morphological and agronomic traits. For this reason, there is need to collect, characterize and evaluate remnant local germplasm before they get disappeared. It will assist to identify the proper group for desirable purposes like industrial raw material, table potato demand, further research on disease and pest resistant varieties. Huge amount of tuber production creates challenge for potato growers. As potato requires cultivating at one season only vast target of production is assured by the government. These vast quantities of tuber are sold at local market at low cost. Farmers hardly got benefit of their hard work. Thus it is high time to evaluate the agronomic performances of our potato germplasm to develop a category of early varieties, summer type varieties and industrial potato varieties to overcome this challenge. Performance evaluation obtained in this study could provide a basis for future research that could be selected separately for each in terms of investigation of potato breeding.

## II. Materials and Methods

The study was conducted in the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to study the characterization of twenty two potato germplasm. Twenty two potato germplasm have been collected from different sources within Bangladesh and from Burma, Japan and USA. Germplasm used in this experiment were – G<sub>1</sub>:Lal Pakri 1; G<sub>2</sub>:Lal Pakri 2; G<sub>3</sub>:Dohajari; G<sub>4</sub>:Shilbilati; G<sub>5</sub>:Jam Alu; G<sub>6</sub>:Fauta Pakri; G<sub>7</sub>:Bogra Gutti; G<sub>8</sub>:Ausha; G<sub>9</sub>:Blue white; G<sub>10</sub>:Blue Yellow; G<sub>11</sub>:Burma 1; G<sub>12</sub>:Burma 2; G<sub>13</sub>:Diamont; G<sub>14</sub>:Cardinal; G<sub>15</sub>:Granula; G<sub>16</sub>:Asterix; G<sub>17</sub>:Courage; G<sub>18</sub>:Lady Rosetta; G<sub>19</sub>:Segita; G<sub>20</sub>:Sharpo Mira; G<sub>21</sub>:BARI ALOO 46; G<sub>22</sub>:BARI ALOO 53 (Plate 01). The experiment was laid out in randomized completely block design (RCBD) with three replications.

**Intercultural operation:** When the seedlings started to emerge in the beds it was always kept under careful observation. After emergence of seedlings, various intercultural operations, like weeding, top dressing, irrigation was accomplished for growth and development of potato. Furadan 3G @ 20 kg/ha was applied at final land preparation to prevent soil insects Plant protection measures. Ripcord and Diathane M-45 mixture were applied at 30 DAP. Acrobat MZ (0.2%) was sprayed at 45 DAP to protect crop from the attack of late blight. Harvesting was started from 80 DAP which was continued up to 100 DAP with 10 days interval.

**Data collection and analysis:** Data were collected on plant height, number of stem hill<sup>-1</sup>, chlorophyll percentage, number of leaves plant<sup>-1</sup>, days to maturity, percentage of tuber hill<sup>-1</sup> (%), yield hill<sup>-1</sup> (kg hill<sup>-1</sup>) and calculated yield ha<sup>-1</sup> (t ha<sup>-1</sup>). Collected data were statistically analyzed using MSTAT-C computer package program and mean was calculated. Differences between treatments were evaluated by Least Significance Difference (LSD) test at 5% level of significance. To determine genetic diversity among studied germplasm.

## III. Results and Discussion

### Plant height

Potato germplasm further showed significant variation in case of plant height. Tallest plant was found from G<sub>1</sub> (107.0 cm) followed by G<sub>15</sub> (101.9 cm) whereas smallest plant was found from G<sub>11</sub> (49.8 cm) which was statistically identical with G<sub>12</sub> and G<sub>19</sub> (Table 01). Qasim *et al.* (2013) found tallest plants (53.4 cm) in potato varieties when potatoes were sown on the ridges.

### Number of stem hill<sup>-1</sup>

Number of stem hill<sup>-1</sup> showed significant variation among potato germplasm within 60 DAP. Maximum stems hill<sup>-1</sup> was found from G<sub>19</sub> (5.00) followed by G<sub>13</sub>, G<sub>14</sub> while minimum from G<sub>11</sub> (1.33) (Table 01). Ayyub *et al.* (2011) found maximum number of stem per plant was 5.13 with the application of sulphate of potash while minimum was found 4 with the application of Murate of potash and in control it was 4.06.

### Chlorophyll percentage

Chlorophyll percentages (%) were varied significantly among potato germplasm. Percentage of chlorophyll content varied between 30.3 to 53.6%. Maximum chlorophyll content was found from G<sub>17</sub> (53.5%) whereas minimum from G<sub>18</sub> (30.3%) (Table 01). The difference in chlorophyll percentage among the cultivars might be due to influence of the genetic makeup of cultivars. Chlorophyll is a pigment associated with photosynthesis process. The process photosynthesis has taken place only in

presence of this pigment. The variation in total chlorophyll content may be a good indicator of stress in plants that have been caused by environmental factors.

### Number of leaves plant<sup>-1</sup>

Variation was found significantly in number of leaves plant<sup>-1</sup> among potato germplasm. Maximum number of leaves was found from G<sub>9</sub> (58.3) and minimum from G<sub>13</sub> (29.9) (Table 01). Haque et al. (2015) found maximum number of leaves in Jam alu (167.3) and minimum number of leaves found in courage (26.67) where as in current experiment number of leaves per plant was recorded in jam alu 45.3 and in courage it was found 40.7 which showed dissimilar result. Khan et al. (2012) found number of leaves per hill variation in potato germplasm and found it varied from 75 to 126 within different germplasm.

### Days to maturity

Days to maturity were varied significantly among potato germplasm. Maximum day to maturity was found from both G<sub>10</sub> and G<sub>22</sub> (96.0) and minimum from G<sub>1</sub> (89.0) (Table 01). Among twenty two germplasm G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub>, G<sub>4</sub>, G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub>, G<sub>8</sub>, G<sub>11</sub>, G<sub>12</sub>, G<sub>13</sub>, G<sub>14</sub>, G<sub>15</sub>, G<sub>16</sub>, G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub>, G<sub>20</sub> can be characterized as medium days to maturity and G<sub>9</sub>, G<sub>10</sub>, G<sub>21</sub>, G<sub>22</sub> can be characterized as late days to maturity germplasm. Getachew et al. (2012) found the earliest days to 50% maturity (106.91 days) was observed at the closer intra row spacing of 10 cm but it was extended (113.33 days) at the wider intra row spacing of 40 cm.

**Table 01. Performance of potato germplasm to different growth attributes**

Germplasm*	Plant height	Number of stem hill <sup>-1</sup>	Chlorophyll percentage	No. of leaves hill <sup>-1</sup>	Days to maturity
G <sub>1</sub>	107.0 a	2.3 fg	39.2 e	40.1 cde	89.0 f
G <sub>2</sub>	98.0 bcd	2.3 fg	50.0 b	40.7 cde	90.0 ef
G <sub>3</sub>	98.7 abc	3.0 efg	46.1 c	42.1 cde	89.3 f
G <sub>4</sub>	85.0 efg	4.0 bcd	40.3 de	44.7 bcd	89.0 f
G <sub>5</sub>	87.0 ef	3.7 cde	46.0 c	45.3 bcd	90.0 ef
G <sub>6</sub>	89.7 cde	2.3 fg	39.4 e	40.2 cde	92.3 d
G <sub>7</sub>	92.3 cde	3.0 efg	43.7 c	41.2 cde	91.3 de
G <sub>8</sub>	64.3 j	2.3 fg	45.9 c	34.6 ef	92.3 d
G <sub>9</sub>	93.3 bcde	3.7 cde	51.0 ab	58.3 a	95.7 ab
G <sub>10</sub>	92.7 cde	2.3 fg	52.3 ab	46.3 bc	96.0 a
G <sub>11</sub>	49.8 k	1.3 i	40.5 de	33.8 ef	94.0 c
G <sub>12</sub>	55.1 k	2.0 gh	40.5 de	37.4 cdef	95.7 ab
G <sub>13</sub>	76.0 hi	4.7 ab	44.2 c	29.9 f	92.0 d
G <sub>14</sub>	78.4 fgh	4.3 abc	43.2 cd	46.4 bc	89.7 f
G <sub>15</sub>	101.9 ab	3.0 efg	35.1 f	40.7 cde	94.3 bc
G <sub>16</sub>	88.7 de	3.0 efg	44.7 c	42.0 cde	90.0 ef
G <sub>17</sub>	71.7 hij	3.0 efg	53.5 a	40.7 cde	95.7 ab
G <sub>18</sub>	68.7 ij	2.7 efg	30.3 g	40.7 cde	91.3 de
G <sub>19</sub>	50.0 k	5.0 a	45.6 c	53.8 ab	91.7 d
G <sub>20</sub>	75.5 hi	1.7 hi	43.8 c	36.2 def	91.4 de
G <sub>21</sub>	72.4 hij	3.3 def	53.6 a	43.2 cde	95.0 abc
G <sub>22</sub>	76.3 ghi	3.0 efg	40.5 de	39.9 cde	96.0 a
CV%	6.2	18.2	4.05	12.18	0.87
LSD(0.05)	8.3	0.9	2.94	8.37	1.32

\*\*In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

\*G<sub>1</sub>:Lal Pakri 1; G<sub>2</sub>:Lal Pakri 2; G<sub>3</sub>:Dohajari; G<sub>4</sub>:Shilbilati; G<sub>5</sub>:Jam Alu; G<sub>6</sub>:Fauta Pakri; G<sub>7</sub>:Bogra Gutti; G<sub>8</sub>:Ausha; G<sub>9</sub>:Blue white; G<sub>10</sub>:Blue Yellow; G<sub>11</sub>:Burma 1; G<sub>12</sub>:Burma 2; G<sub>13</sub>:Diamont; G<sub>14</sub>:Cardinal; G<sub>15</sub>:Granula; G<sub>16</sub>:Asterix; G<sub>17</sub>:Courage; G<sub>18</sub>:Lady Rosetta; G<sub>19</sub>:Segita; G<sub>20</sub>:Sharpo Mira; G<sub>21</sub>:BARI ALOO 46; G<sub>22</sub>:BARI ALOO 53

**Percentage of tubers hill<sup>-1</sup>**

Percentage of tubers showed variation among potato germplasm. The highest amount of tubers among large, medium, small sized found in G<sub>12</sub>,G<sub>13</sub>; G<sub>10</sub> and G<sub>6</sub>,G<sub>7</sub>, respectively (Table 02).

**Yield hill<sup>-1</sup>**

Significant variation was found in germplasm of potato. Maximum yieldhill<sup>-1</sup>was found from G<sub>19</sub> (0.8 kg) followed by G<sub>2</sub>, G<sub>9</sub>, G<sub>10</sub> and G<sub>13</sub> whereas minimum from G<sub>3</sub>, G<sub>4</sub>, G<sub>7</sub>, G<sub>8</sub> (0.1 kg) which was statistically similar with rest of the germplasm (Table 02). It was observed that tuber yield per hill were gradually increased when tuber were harvested later. It varied sixty days to eighty days after planting and the variation are changed when potatoes are harvested lately.

**Yield ha<sup>-1</sup>**

The highest yield t ha<sup>-1</sup> was found from G<sub>13</sub> (29.9 t ha<sup>-1</sup>) while minimum from G<sub>8</sub> (12.3 t ha<sup>-1</sup>) (Table 02). Ahmed *et al.* (2000) observed yield in cardinal variety which shows dissimilar results. Yield was found to increase with the increase in seed tuber size and the maximum yield (39.34 t ha<sup>-1</sup>) was obtained from the large seeds (17.5g) found by Sultana *et al.* (2001).

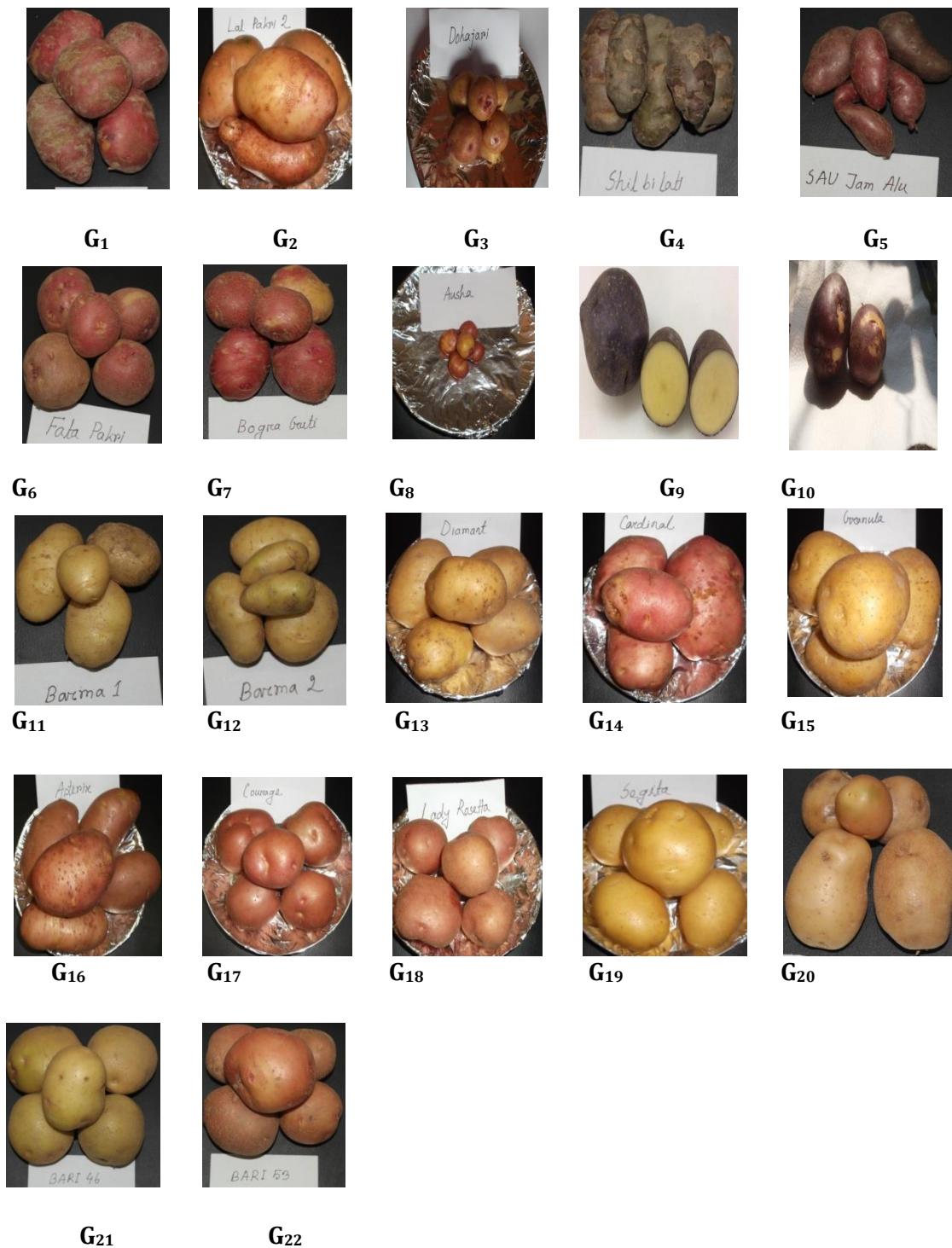
**Table 02. Performance of potato germplasm to different yield attributes\*\***

Germplasm*	Percentage of tubers hill <sup>-1</sup>			Yield hill <sup>-1</sup>	Yield ha <sup>-1</sup>
	Large	Medium	Small		
G <sub>1</sub>	13 i	32 d	55.0 d	0.3 b	28.6 b
G <sub>2</sub>	25 d	25 f	50.0 e	0.5 ab	24.9 fg
G <sub>3</sub>	21 ef	42 b	37.0 i	0.1 b	26.3 d
G <sub>4</sub>	25 d	32 d	42.0 g	0.1 b	25.1 efg
G <sub>5</sub>	40 b	27 e	33.0 j	0.3 b	27.8 bc
G <sub>6</sub>	06 k	19 i	76.0 a	0.2 b	26.1 de
G <sub>7</sub>	04 l	21 h	76.0 a	0.1 b	15.0 m
G <sub>8</sub>	04 l	23 g	74.0 b	0.1 b	12.3 n
G <sub>9</sub>	14 i	43 b	43.3 g	0.5 ab	24.4 g
G <sub>10</sub>	16 h	50 a	34.0 j	0.4 ab	24.5 fg
G <sub>11</sub>	40 b	40 c	20.0 l	0.3 b	27.5 c
G <sub>12</sub>	50 a	25 f	25.0 k	0.3 b	25.2 efg
G <sub>13</sub>	50 a	33 d	17.0 m	0.5 ab	29.9 a
G <sub>14</sub>	08 j	25 f	67.0 c	0.4 ab	26.4 d
G <sub>15</sub>	19 g	25 f	56.0 d	0.3 b	21.5 ij
G <sub>16</sub>	30 c	20 hi	50.0 e	0.3 b	22.5 hi
G <sub>17</sub>	22 e	33 d	45.0 f	0.3 b	20.8 jk
G <sub>18</sub>	14 i	43 b	43.0 g	0.3 b	19.9 k
G <sub>19</sub>	22 e	33 d	45.0 f	0.8 a	18.0 l
G <sub>20</sub>	20 fg	40 c	40.0 h	0.4 ab	25.5 def
G <sub>21</sub>	20 fg	40 c	40.0 h	0.3 b	20.7 jk
G <sub>22</sub>	20 fg	40 c	40.0 h	0.3 b	22.7 h
CV%	4.64	3.17	2.06	6.9	2.5
LSD(0.05)	1.67	1.68	1.55	0.4	1.0

\*\*In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

\*G<sub>1</sub>:Lal Pakri 1; G<sub>2</sub>:Lal Pakri 2; G<sub>3</sub>:Dohajari; G<sub>4</sub>:Shilbilati; G<sub>5</sub>:Jam Alu; G<sub>6</sub>:Fauta Pakri; G<sub>7</sub>:Bogra Gutti; G<sub>8</sub>:Ausha; G<sub>9</sub>:Blue white; G<sub>10</sub>:Blue Yellow; G<sub>11</sub>:Burma 1; G<sub>12</sub>:Burma 2; G<sub>13</sub>:Diamont; G<sub>14</sub>:Cardinal; G<sub>15</sub>:Granula; G<sub>16</sub>:Asterix; G<sub>17</sub>:Courage; G<sub>18</sub>:Lady Rosetta; G<sub>19</sub>:Segita; G<sub>20</sub>:Sharpo Mira; G<sub>21</sub>:BARI ALOO 46; G<sub>22</sub>:BARI ALOO 53





**Plate 01. Photographic presentation of twenty two potato germplasms**

G<sub>1</sub>:Lal Pakri 1; G<sub>2</sub>:Lal Pakri 2; G<sub>3</sub>:Dohajari; G<sub>4</sub>:Shilbilati; G<sub>5</sub>:Jam Alu; G<sub>6</sub>:Fata Pakri; G<sub>7</sub>:Bogra Gutti; G<sub>8</sub>:Ausha; G<sub>9</sub>:Blue white; G<sub>10</sub>:Blue Yellow; G<sub>11</sub>:Burma 1; G<sub>12</sub>:Burma 2; G<sub>13</sub>:Diamont; G<sub>14</sub>:Cardinal; G<sub>15</sub>:Granula; G<sub>16</sub>:Asterix; G<sub>17</sub>:Courage; G<sub>18</sub>:Lady Rosetta; G<sub>19</sub>:Segita; G<sub>20</sub>:Sharpo Mira; G<sub>21</sub>:BARI ALOO 46; G<sub>22</sub>:BARI ALOO 53

#### IV. Conclusion

Twenty two potato germplasm were cultivated in winter season during this experiment showed significant variation for different growth and yield attributes. Tallest plant was found from G<sub>1</sub> (107.0 cm) followed by G<sub>15</sub> (101.9 cm) whereas smallest plant was found from G<sub>11</sub> (49.8 cm) which was statistically identical with G<sub>12</sub> and G<sub>19</sub>. Maximum yield t ha<sup>-1</sup> was found from G<sub>13</sub> (29.9 t ha<sup>-1</sup>) while minimum from G<sub>8</sub> (12.3 t ha<sup>-1</sup>). This research could have been a fundamental experiment for potato breeders to find out potential potato germplasm for future use.

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