

**EVALUATION OF EXOTIC POTATO GERMPLASM ON
YIELD AND YIELD CONTRIBUTING CHARACTERS**

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HORTICULTURE**

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SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA-1207**

DECEMBER 2007



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A Thesis

By

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REGISTRATION NO: 01053

A Thesis

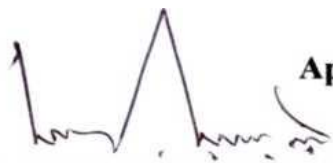
*Submitted to the Department of Horticulture and Postharvest Technology
Sher-e-Bangla Agricultural University, Dhaka,
In partial fulfillment of the requirements for the degree
of*

MASTER OF SCIENCE

IN

HORTICULTURE

SEMESTER: JULY - DECEMBER 2007



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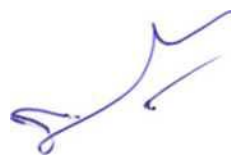
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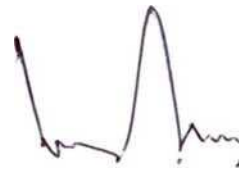
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*This is to certify that the thesis entitled, “Evaluation of Exotic Potato Germplasm on Yield and Yield Contributing Characters ”submitted to the Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in HORTICULTURE** , embodies the result of a piece of bonafide research work carried out by **Md. Eakramul Haque**, Registration No. **01053** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

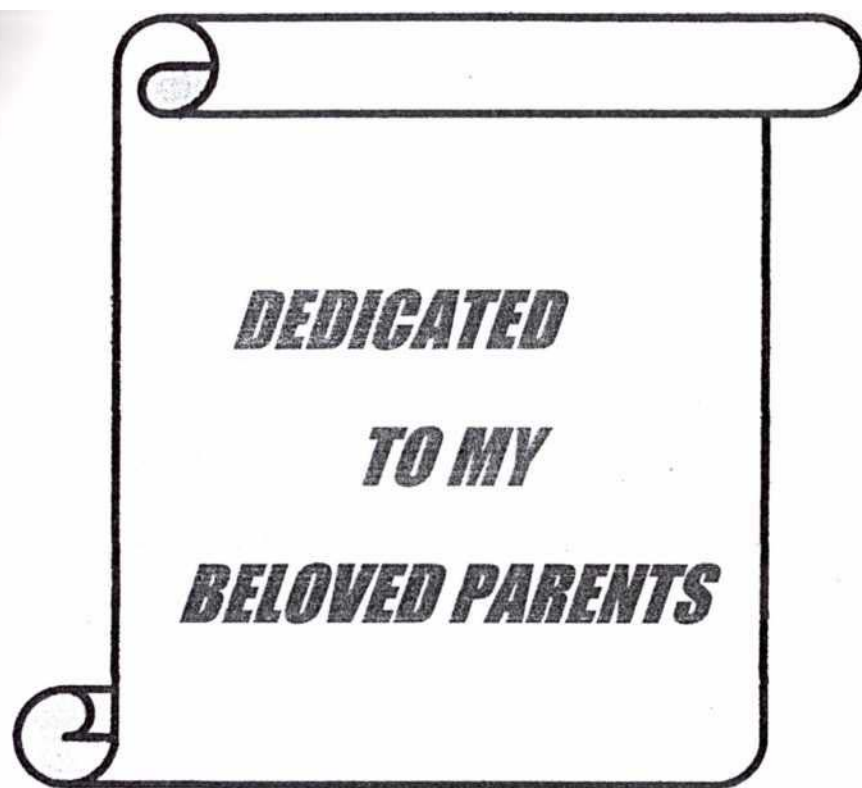
I further certify that such help or sources of information, as has been availed of during the course of this investigation has duly acknowledged.

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ACKNOWLEDGEMENT

All praises are due to the Almighty Allah, Who has created the Universe and who enabled the author to complete this piece of research work and preparation of thesis successfully.

The author expresses his thanks to his Supervisor **Prof. Md. Mahtab Uddin** Department of Horticulture and Post Harvest Technology, Bangladesh Sher-E-Bangla Agricultural University (SAU), Dhaka- 1207. For his kind guidance for the research work and completion of the thesis.

The author wishes to extend his sincere appreciation and heartfelt gratitude to his honorable Chairman of Advisory Committee, Prof. **Md. Ruhul Amin**, Department of Horticulture and Post Harvest Technology, Bangladesh Sher-E-Bangla Agricultural University (SAU), Dhaka-1207 for his overall guidance and supervision during the preparation of thesis.

Heartiest gratitude is due to the respectable member of the Advisory Committee member Mr. **Hasanuzzaman Akand**, Associate Professor, Department of Horticulture and Post Harvest Technology, Bangladesh Sher-E-Bangla Agricultural University (SAU), Dhaka-1207 for his valuable suggestions, kind cooperation and dynamic guidance throughout the study and research.

The author also wishes to express his profound gratitude to his honorable teachers of the Department of Horticulture and Postharvest Technology, Sher-E-Bangla Agricultural University (SAU), Dhaka-1207 for their valuable advice and encouragement.

The author also expresses his heartfelt gratitude and profound respect to **Dr. Tapon Kumar Dey, Principle Scientific Officer, Breeder Seed Production Center, Bangladesh Agricultural Research Institute, Debigonj, Panchagorh**, for his kind help, cooperation and valuable guidance to complete this research work and preparation of the thesis.

The author extends his grateful thanks to all the scientists and staff of Breeder Seed Production Center, Bangladesh Agricultural Research Institute, Debigonj, Panchagorh, **for** their continuous co-operation, help and friendliness throughout the research period.

The author expresses his boundless gratitude to his beloved parents, who inspired him with the best of their prayer, great sacrifice and blessing in carrying out the higher study. The author also expresses his sincere gratitude to his sisters, brothers, and friends for their co-operation and encouragement in all phases of his academic life.

The Author

EVALUATION OF EXOTIC POTATO GERMPLASM ON YIELD AND YIELD CONTRIBUTING CHARACTERS

Abstract

A field experiment was conducted with 12 exotic potato germplasm viz. Atlantic, Atlas, Aziba, Billini, Croste, Daifla, Daise, Delaware, Quincy, Sagita, Sassy, Spunta with Diamant as check at Breeder Seed Production Center, Debigonj, Panchagorh, during December 21, 2006 to March 28, 2007 to determine their suitability as a variety in Bangladesh. All the varieties gave more than 90% emergence at 20-35 DAP (Days after Planting). Tallest (87.8 cm) plant height was recorded in Quincy and the shortest (57.0 cm) was from Atlas and the minimum (2.0) was obtained from Daifla. Maximum (7.2) stem number per hill was counted in Diamant followed by Delaware. Although there was significant variation among the varieties on foliage coverage but all showed more than 90% foliage coverage at 60 DAP and 100% foliage coverage was shown by Daifla, Aziba and Sagita. Significant variation in stem (plant) diameter among the varieties were evident. Maximum (5.9 cm) plant diameter was recorded from Atlas and the minimum (2.6 cm) was from Diamant. Number of tuber per plant ranged from 6.5 to 14.1 with the minimum and the maximum by Croste and Delaware, respectively. Significantly the highest yield (44.5 t/ha) was found in Aziba and the lowest (32.29 t/ha) was obtained from Sassy. Irrespective of varieties, all produced maximum percent of seed tuber (grade) both by number and by weight. All the varieties showed late blight infection even after receiving two times fungicidal spray. All the varieties were free from PLRV (Potato Leaf Roll Virus) infection except Atlantic, Atlas, Spunta and Diamant. Regarding PVY (Potato Virus Y), varieties showed trace infection which ranged from 0.33-2.33%. Five varieties (Croste, Daifla, Quincy, Sassy and Diamant) were free from PVY. Varieties contained more than 10% dry matter were Atlas, Croste, Daise, Sagita, Sassy and Diamant.



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LIST OF ABBREVIATIONS

Abbreviation	Elaboration
BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agricultural Research Institute
RCBD	Randomized Complete Block Design
TCRC	Tuber Crops Research Centre
BBS	Bangladesh Bureau of Statistics
CDP	Crop Diversification Program
Cv	Co-efficient of Variance
DMRT	Duncan's Multiple Range Test
LSD	Least Significant Difference
t/ha	Ton per hectare
viz.	Namely
Kg	Kilogram (s)
Mm	Millimeter
Vs	Versus
Cm	Centimeter
M	Meter
Mstat	Michigan State
gm	Gram(s)
OFRD	On Farm Research Division
>	Greater than
<	Smaller than
PVX	Potato Virus X
PVY	Potato Virus Y

Chapter 1

§ Introduction



CHAPTER-I

INTRODUCTION

Potato (*Solanum tuberosum*) is an important vegetable crop of Bangladesh. It belongs to the family Solanaceae. The origin of potato is reported to be in South America especially Peru, Bolivia and Colombia.

The potato is the most popular non cereal crop of the world and ranks fourth in importance after rice, wheat and maize. It produces substantially more edible energy, protein and dry matter per unit area and time than many other crops. Potato tubers constitute a highly nutritious food. It provides carbohydrate, minerals, vitamin C, a number of B group vitamins, high quality proteins and dietary fibers (Paul *et al.*, 2003). People of several European and Latin American countries consume potato as staple food. Thinkers and planners of developing countries like Bangladesh recognize potato as the potential food crop for ensuring food and nutritional security to fight hunger and malnutrition.

Potato came to this sub-continent with the European colonizers about 400 years ago and emerged as an important food crop. People of this continent readily accepted potato as food because of their familiarity with other root and tuber crops.

Potato is the third important food crop in Bangladesh. It contains well-balanced protein and more calories per unit area and time compared to any other major food crops. This makes potato the most suitable non-traditional crop to ward off hunger and malnutrition. Bangladesh is nearly at the door of self-sufficiency in cereals but deficient in minor crops in general, fruits and vegetables in particular. Millions of people are suffering from malnutrition. Potato can play an important role in supplying vegetable throughout the year and can solve the nutritional problems to a great extent for the lower income group.

The area under this crop is increasing rapidly and the farmers are gradually adopting it as a cash crop. The national average of potato was 14.76 t/ha in 2004-2005 (BARI, 2005), which is lower as compared to other potato growing countries of the world. The major constraint to such low yield is the non-availability of better quality seed.

Potato is a vegetatively propagated, highly heterozygous, tetraploid and semi perishable crop (Paul *et. al.*, 2003). The genetic nature, propagation mode, vulnerability to diseases/pests and semi-perish ability of potato imposes several inherent limitations for its improvement, cultivation, seed production, storage and marketing. Despite this, there is a vast scope for increasing the yield per hectare with varieties that are high yielder, possess good keeping quality and are resistant to pest and diseases. The so called local and low yielding varieties that are existing in Bangladesh have become degenerated on account of various reasons and giving extremely poor yield.

Research activities for the improvement of potato varieties were initiated in the year 1960 through a small program of testing Dutch varieties. The program is still continuing as seeds of all new varieties evolved in that country are made available on a regular basis. As many tropical countries including Bangladesh do not have the proper climatic conditions for going into hybridization methods of any significance, they will have to remain contented with the introduction of varieties from colder region. Therefore, elaborate and extensive programs of variety-testing should be done and varieties most suited to different regions of the country can be obtained (Ahmad, 1977).

With the increase of population, the demand for potato in our country is increasing day by day but due to limitation of cultivable land, it is not judicious to raise the acreage of this crop. One of the important means to solve the problem is to increase per hectare yield. This can be done to a large extent with the introduction of high yielding exotic varieties in this country.

It is well known that evaluation of the varieties is important for development of any variety throughout the world (BARI, 2004). Every year new germplasm are coming through the government organization or by private sectors to evaluate their performance under the climatic condition of Bangladesh. Varieties recommended for a locality do not often suite to another due to some agro-ecological factors (Dungan and Ross, 1957). On the other hand, varieties differ greatly in respect of time of maturity, yield, quality, resistance to pests and diseases and also show differences in certain tuber characteristics which have very important effects on the market-value and local popularity (Thomson and Kelly, 1957).

Hence the present study was under taken with twelve exotic varieties to determine their suitability as a variety for Bangladesh condition.

Objectives:

1. To evaluate the performance of new germplasm under the climatic conditions of Bangladesh.
2. To find out the high yielding potato germplasm.

Chapter 2

Review of literature



CHAPTER-II

REVIEW OF LITERATURE

A trial was conducted with six varieties at six locations to be evaluated by the Technical Committee of the NSB when the variety Ultra was found to be the best in respect of yield and seed size (Anonymous, 2004). In this trial the varieties Asterix, Dura and Akira were also found to be good performer. On the basis of results of on farm and on station trials as well as previous years results Ultra, Dura and Asterix were proposed and approved by the Technical committee of the NSB for release. Based on the results of that year and previous generations, varieties Ultra and Dura were selected and proposed for release as export varieties while Asterix was proposed as an introduction variety.

Eight Exotic potato varieties were evaluated at their locations in their generation (Anonymous, 2004). Two varieties Carlita and Bellini were better performer than the checks. The two were suggested to be evaluated in the next season for specific characters for releasing as new variety.

A varietal trial was carried out at Joydebpur, Munshigonj, Jessore and Bogra with 23 exotic varieties in their 1st generation (Anonymous, 1980b). It was reported that Ukama was the earliest variety. In this trial, Diamant gave the highest yield (28.1 t/ha) followed by Cardinal (26.0 t/ha), Kronia (25.0 t/ha) and Elvira (25.0 t/ha). The highest proportions of medium sized tubers (28- 55mm) were produced by Elvira and Marijke (59%). Another trial was set up with 33 exotic varieties in 2nd generation at Joydebpur, Munshigonj, Pahartali, Bogra and Jessore. In this study Cardinal produced the highest yield of 25 t/ha. High proportions of medium size tubers (28- 55mm) were produced by several varieties like Micola, Patrones etc.

Ahmad (1980) conducted a trial with 12 and 16 exotic varieties of potato in their first and second generations, respectively at Jamalpur in 1979-1980. It was found that the mean per-hectare yield in the first and second generations were 23.79 tons and 22.50 tons, respectively. Estima gave the highest per-hectare yield (33.85 t/ha) in the first generation followed by Vulknao, Mirka, Kronia and Sinaeda. In the second generatins, Cardinal topped the list (28.54 t/ha) followed by Kronia, Colmo and Estima.

Ahmad (1980) reported that 41 varieties including the promising and new ones were tried against the commercially grown recommended varieties namely Cardinal, Mirka, Multa and Patrones and check variety Bintje. The yield trials were done in five stations on Potato Research Centre, BARI. Among the commercial varieties, Cardinal gave the highest mean yield (25.33 t/ha). It was also reported that the variety Ukama gave high yields with early emergence and short crop growing period.

Thirty-two exotic varieties of potato were tried at Jessore in three successive years starting from 1977-1978. From the results of this trial Rahman (1980) observed that the mean per-hectare yield at first, second and third generations were 20.22 tons, 22.14 tons and 20.22 tons, respectively. Cardinal was found to produce the highest overall mean yield (29.18 t/ha) followed by Mirka (26.35 t/ha), Kronia (24.88t/ha) and Baraka (24.43t/ha).

Rashid *et al.* (1980) observed the performance of 33 exotic varieties of potato in their second generation at five locations namely Joydebpur, Munshigonj, Pahartali, Bogra and Jessore in 1979-1980 growing season. On an average, the varieties produced 21.50 tons of tubers per hectare. They also found that cardinal gave the highest mean per hectare yield (28.54 tons) followed by Renova, Wilja, Arka and Mirka. They also reported that the highest number of shoots per hill was produced by Mirka (4.8) closely followed by Cardinal (4.7), Desiree (4.3) and Gracia (4.1). High proportions of tubers of grade 28-55 mm were produced by Nicola, Kufri Sindhuri, Patrones, bintje, Mirka, Desiree, Ukama and Cardinal.

Anam *et al.* (1980) conducted an experiment with six different potato varieties at seven different locations in co-operation with Potato Research Centre of Bangladesh Agricultural Research Institute. In these trials they found that on an average, the maximum yield was obtained by Cardinal (19.94 tons/ha) followed by Mirka, Kufri Sindhuri, Kronia, Multa and Patrones.

In a performance trial with 24 directly imported exotic potato varieties at four locations during 1979-1980 growing season, Hossain *et al.* (1980) observed that Ukama, Colmo, Diamant, Vulkano, Marijke, Cardinal and Multa were earliest of all. Diamant gave the highest per-hectare yield (24.79 tons/ha) followed by Kronia (23.97 tons/ha) and Cardinal (23.79 tons/ha). The largest proportion of medium grade tubers (28-55 mm) was produced by Elvira, Marijke, Vulkano and Patrones. The tallest plants were Ajax (60 cm), Estima (58 cm), Diamant (57 cm) and Nicola (56 cm).

Potato varieties introduced in Bangladesh were found to perform differently in different generations. Eight demonstration trials were conducted by Hossain (1981) with the first and second generation seeds of the recommended potato varieties, namely Baraka, Cardinal, Kronia, Mirka, Multa and Patrones at different locations in 1980-1981 growing season. In these trials it was found that Kronia was the top-most yielder (23.24 tons/ha) followed by Cardinal in the first generation. Cardinal gave the highest yield (15.83 tons/ha) followed by Mirka.

In a trial with 5 Holland and one Indian varieties of potato at BAU, Mymensingh Iqbal and Haque (1982) observed that the variety Kronia gave the highest yield (23.84 t/ha). The yield was statistically higher than the other five varieties, namely, Cardinal, Mirka, Multa, Patrones and Kufri Sindhuri. They also found that Kufri Sindhuri gave the highest number of tuber per hill (10.9).

Wustman (1982) studied the performance of 25 potato varieties at five sites and observed that Cardinal was the top most yielder and Elvira was the second best in respect of yield. On the other hand, in another trial at four sites of Potato Research Centre and four regional BARI research stations it was observed that among the ten varieties in their second generation, Elvira proved to be the top yielder.

Conducting an experiment with 26 directly imported exotic potato varieties at five research substations, Hossain *et al.* (1982) reported that among the varieties Ukama, Troubadour, Multa were the earliest of all in emergence (26-28 days). The tallest plants were recorded from Ajax, Famosa, Elvira, Mirka and Cardinal (60-68 cm). The maximum number of stems was found in Kronia, Theresa, and Elvira. They also found that Ukama was the early maturing variety followed by Troubadour, Hertha, Multa and Resay. The highest number of tubers per plant was recorded by the variety Theresa followed by Kufri Sindhuri, Elvira and Kronia. Cardinal produced the highest yield (24.5 tons/ha) followed by Diamant and Elvira.

Rashid (1982) conducted an experiment with 9 exotic promising varieties of potato in their second generation at the five research centres, namely, Joydebpur, Munshigonj, Pahartali, Bogra and Jessore. It was reported that Mirka produced the highest mean per-hectare yield (24.61 tons) followed by Ajax, Cardinal, Diamant and Multa. High proportion of tubers of grade 28-55 mm was produced by Kronia, Patrones, Vulkano and Ukama.

Rahman (1982) carried out performance trials during 1980-1981 growing season at the BARI sub-station, Bogra. In the first generation trial it was found that Elvira (28.25 tons/ha), Troubadour (25.8 tons/ha) and Diamant were the best yielder. Cardinal gave the highest yield (26.57 tons/ha) in the second generation. It was also reported that Mirka gave the highest yield (20.77 tons/ha) in the third generation and Cardinal gave the highest yield (22.55 tons/ha) in the fourth generation.

Conducting an experiment, Siddique *et al.* (1984) reported that the locally produced second-generation potato seed tubers of cv. Patrones and Diamant gave higher yields than the directly imported first generation seed. They also found that the locally produced second-generation seed of cv. Multa gave about 30% higher yield than the directly imported first generation seed.

A comparative performance trial with 16 exotic potato varieties in their first generation was conducted at six locations by Hossain *et al.* (1984). Elvira gave the highest yield (25.97 tons/ha), but was closely followed by Cardinal, Origa, Rode pipo, Diamant and Morene. They also found that the tallest plants were produced by Cardinal, Diamant and Elvira. The maximum number of stems was produced by Cardinal, Rode pipo, Ukama and Morene (3.40-3.96). In the same experiment they also reported that the highest number of tubers per plant was recorded in the varieties Patrones, Multa and Bright (12.4-17.3) and the highest proportion of medium sized tubers (28-55 mm) was produced by Elvira and Patrones (77-80%).

A trial with 17 varieties along with a locally maintained one at their first generation was conducted in the year 1985-1986 at 6 places of Potato Research Centre (Anonymous, 1986a). In this study the tallest plant was observed in Famosa (69.98 cm) whereas Premier was shortest (44.57 cm). Allard gave the maximum number of stem/hill (4.25). In this experiment only four varieties namely, Allard, Kufri Lalima, Diamant and Origo gave yields of more than 25 tons.

In a performance trial with 17 established varieties including six Indian, five recommended in Bangladesh and five temperate varieties it was found that Kufri Dewa gave the highest yield (440.3 g/plant) (Anonymous, 1986b). On the other hand, Kufri Badsha, Tasnum and Diamant gave yield 433.3 g, 430 g and 406 g/plant, respectively.

In 1988-1989 growing season, twenty-nine Dutch potato varieties were tried at five locations, namely, Joydebpur, Munshigonj, Jamalpur, Bogra and Pahartali in different generations (Anonymous, 1990a). In this trial the number of stems per hill varied from 2.9 (Roxy) to 6.2 (Desiree). The height of plants varied from 43.3 (Vital) to 77.5 (Timate). Only two varieties (Famosa and Timate) had stems taller than 70 cm and in ten varieties the stems were more than 60 cm. Foliage coverage of the varieties ranged from 67.0% (Escort) to 85.7% (Morene). In this study only seven varieties, namely. Alpha, Cardinal, Diamant, Flevostar, Forene, Multa and Obelix had more than 80% coverage. It was also found that the number of tubers per hill ranged from 6.0 (Tarzan) to 11.4 (Lutetia). The average yield per plant in different varieties ranged from 314.3 g (Tarzan) to 676.0 g (Nicola). In these trials, the highest yielder was Obelix with 23.4 tons in first generation.

Anonymous (1990b) reported that out of 39 potato varieties, Cinja was found to cover highest percentage of ground (96.7%). The variety Alkon gave the tallest plant (73.4 cm), while the variety Esperante gave the highest number of stems/hill (4.3). Highest number of tubers was produced by the variety Multa (9.2) while Ausonia gave the highest yield per plant (600 g). In this trial, Obelix gave the highest yield (24.7 tons/ha) in the first generation followed by Mondial (22.8 tons/ha) and Alkon (22.7 tons/ha). In the second generation, Cardinal gave the highest yield (20.2 tons/ha) followed by Morene (19.9 tons/ha), Mondial (18.5 tons/ha) and Bartina (18.5 tons/ha).

Haque (1993a) conducted an experiment at the Tuber Crops Research Sub-Centre, Bogra during the potato season of 1992-1993. In his experiment, 19 exotic potato varieties were tried. Medusa was found to be the highest yielder (22.7 t/ha). Maximum marketable yield was obtained from the variety Provento (89.8%) while Sante produced maximum amount (93.8%) of medium sized tubers (28-55 mm) by weight. The tallest plant was observed in Provento (64.8 cm). Diamant gave the maximum number of stem/hill (4.3). Ajiba gave the highest foliage coverage (93%). Hoque (1993b) set up a varietal trial with twelve exotic potato varieties in 1992-1993 at Bogra in their second generation. In this study, Modial gave the highest yield (33.2 tons/ha). Maximum marketable yield was obtained from Binella (97.8%). The highest amount of seed size (28-55 mm) of tubers was produced by the variety Ajiba (82.1).

Results of different yield contrasting characters and yield of twelve exotic potato germplasm have been presented and discussed in this chapter.

Arioglu (1986) evaluated the performance of eight varieties in 1981-1982 and 1982-1983 growing seasons. Data on tuber yield per plant, proportion of large, medium and small tubers and rejects, tuber number per plant, tuber weight and tuber yield/ha were recorded. On the basis of above characters, it was recommended that the best varieties were Vittorim, Cardinal and Diamant.

Trial with first, second and third generation seeds of 24 exotic potato varieties was conducted at different agro-climatic zones in Bangladesh during 1990-1991 crop season (Anonymous, 1991). The numbers of varieties were not the same in all three generations. The highest mean yield was obtained from Obelix (22.38 t/ha) in the first generation. The second highest yield was produced by the variety Thebes (20.58) closely followed by Arinda, Binella and Cardinal with a range from 19.77 to 18.90 tons per hectare. In the second generation, Bartina gave the highest average yield (24.3 t/ha) followed by Escort (22.3 t/ha) and Mondial.

Thirteen Dutch potato varieties were evaluated at different locations in Bangladesh during 1991- 1992 in their first, second and third generations (Anonymous, 1992). In the first generation, the mean yield over the locations showed that the variety Mondial was the top most yielder (28.1 t/ha) followed by Diamant (26.5 t/ha). Diamant produced the highest mean yield (26.2 t/ha) in second generation though Cardinal topped the list in relation to yield (28.2 t/ha) but it was not tested at other locations except Munshigonj. In the third generation, the highest mean yield was obtained from Bartina (25.1 t/ha) followed by Diamant (24.6 t/ha).

Varietal yield trial on five indigenous potato varieties in 1994-1995 growing season was carried out by Rabbani and Rahman (1995). They found that Ausha took the shortest time (12.3 days) for 80% emergence and the variety Dohazarilal took longest time (15.8 days) to complete 80% emergence. Maximum plant height was found in the variety Shadaguti (81.7 cm) while the variety Ausha was found to attain the minimum height (59.7 cm) at maximum vegetative growth stage. The highest foliage coverage at 80 DAP was found to be the highest in Shadaguti (97.5%) and the lowest in Ausha (87.5%). The highest number of tubers per hill (27.5) was found in the variety Shadaguti. On the other hand, the lowest number of tuber per hill (16.2) was found in the variety Lalpakri. The highest weight of tubers per hill was found in the variety Ausha (240.5 g). The lowest weight of tubers per hill was found in the variety Lalshil (210.3 g). They found that the variety Ausha gave the highest yield of tubers per hectare (26.20 t/ha) although there was no significant difference among Ausha, Dohazarilal, Lalpakri and Shadaguti in this respect. The lowest yield of tuber per hectare (22.92 t/ha) was found in the variety Lalshil.

Rabbani and Rahman (1995) studied the performance of 16 Dutch potato varieties in their third generation. They reported that the height of the plants significantly varied among the varieties. Plants of Provento (61.6 cm) attained the maximum height while the variety Stroma (33.4 cm) attained the minimum height. The highest foliage coverage at maximum vegetative growth stage was found in the variety Cardinal (93.3%) followed by Diamant while the lowest coverage (71.7%) was recorded in Stroma. They observed a significant variation in per hectare yield among the 16 varieties. The highest yield of tubers per hectare was obtained from Cardinal (35.19 t/ha) followed by Romano (30.09 t/ha) and the lowest from Stroma (11.11 t/ha).

Twenty varieties obtained from private companies and other sources were evaluated (Anonymous, 2003). All the varieties were planted at Joydebpur on 3m x 3m plots in 3 replicated RCBD design with spacing 25cm * 60cm, planting was done on 6th December and harvesting at full maturity. Earlier in growth and development was found in variety Processor, followed by Granola and Rivera. Disease incidence (virus) was low in the varieties Jaerla, Dura and Processor and high in Bintje, Fontane and Sinora. Jaerla, Dura, Carlita and Ultra produced vigorous plants. Maturity period varied from 77.3 to 93.3 days. Varieties Granola, Rivera, Processor, Sinora, Marlin and Carlita were early; while Derby, Baraka and Dura were late. Dura gave the highest yield (35.3 t/ha) while Fontane, Marlin, Sinora, Futura and Bintje were poor yielder. Tuber quality was very good in Rodeo, Ultra and Processor, poor in Futura and EOS, Dry matter was high in several varieties like Remarka, Marlin, Sinora, Jaerla and Ultra and low in Skira, Midas, Carlita and EOS. Ten varieties were suggested to be tested for confirmation of their performance at different locations in the next season.

Twenty one varieties along with two standard checks Diamant and Granola were evaluated at seven locations following RGB design with three replications (Anonymous, 2005). Whole tubers were planted on 3m x 3m plots at 60cm x 25cm spacing. Fertilizers were applied @ 325-220- 250 kg/ha of urea, TSP and MP respectively. Full amount of TSP and MP and 50% of urea were applied as basal and the remaining amount of urea was side dressed at 35 DAP. Weeding, irrigation, earthing up and other intercultural operation were done as per TCRC recommendation. The yields of the varieties varied from location to location as well as within location. Of all the stations, except Pahartoli, none crossed the check variety Diamant but comparatively higher yields were produced by the varieties Espirit, Courage, Innovator, Quincy, Matador, Markies, Laura and Lady Rosetha.

A experiment was conducted at Joydebpur and Jamalpur including three exotic varieties viz. Carlita, Adora and Cantate with Check Diamant (Anonymous, 2003). Significant variation was found among the varieties in respect of yield. At Joydebpur highest yield (23.5 t/ha) was obtained from the variety Carlita and it was identical to adora (22.22 t/ha) but significantly higher than check variety Diamant (20.98 t/ha). At Jamalpur check variety Diamant yielded the highest (24.10 t/ha) and it was identical to Cantate. On average, in two locations the check variety Diamant yielded the highest (27.22 t/ha) and among the new varieties Cantate yielded the highest (22.55 t/ha). Carlita produced the lowest proportion of seed size tuber (77%) of the total yield among all.



Materials and Methods

CHAPTER-III

MATERIALS AND METHODS

Experimental site

Experiment was conducted at the D-2 block of Breeder seed production centre, BARI, Debigonj, Panchagarh during the period from December 2006.

Soil of the experimental site

Soil of the experimental area is sandy loam in texture and belongs to the old Himalayan Piedmont soil (AEZ-1). The selected site is high land.

Climate of the experimental site

Experimental area is under the subtropical climate, with moderate rainfall during the months from April to September and scanty rainfall during rest of the months.

Land preparation

Land of experimental plot was first opened on 3rd November, 2007 with a tractor and it was exposed to the sun for 7 days prior to next ploughing. Afterwards it was prepared by ploughing and cross ploughing followed by laddering with the help of a power tiller. Weeds and stubbles were collected and big clods were broken into pieces manually.

Manure and Fertilizer Application

The crop was fertilized with the following **doses of manure and fertilizers:**

Cow dung	10 tons/ha
Urea	325 kg/ha
Triple super phosphate (TSP)	250kg/ha
Muriate of potash (MP)	275 kg/ha
Gypsum Zinc sulphate	138 kg/ha
Magnesium sulphate	10 kg/ha
Bone acid	100 kg/ha 5 kg/ha



Cow dung was applied during final land preparation. Half of the dose of urea and full dose of TSP, MP, gypsum, zinc sulphate Magnesium sulphate and Boric Acid were applied in furrows made on both sides of the seed rows and mixed properly with soil. The remaining half of urea was applied during earthing up as side dressing.

Planting Materials

The planting materials comprised of the sprouted seed tuber of thirteen different varieties. The varieties were

1. Atlantic
2. Atlas
3. Aziba
4. Bellini
5. Crosty
6. Daifla
7. Daisy
8. Delaware
9. Quincy
10. Sagita
11. Sassy
12. Spunta and
13. Diamant.

The seed tubers of the above varieties were collected from tuber Crop research center BARI, Joydevpur, Gazipur.

Layout and Design of the Experiment

The experiment was conducted in randomized complete block design with three replications. Each block consisted of 13 plots. Thus the total numbers of plots were 39. The size of unit plot was 3m x 3m. The gap between the plots was 50 cm and between blocks was 50 cm. Treatments of the experiment were assigned randomly to each block.

Delaware	Bellini	Daisy		
Spunta	Aziba	Daifla		N
Diamant	Atlas	Sassy	W	E
Quincy	Sassy	Atlas		S
Atlantic Daifla		Aziba		
Sagita	Daisy	Bellini		
Bellini	Crosty	Quincy		
Crosty	Sagita	Delaware		
Daisy	Atlantic	Spunta		
Daifla	Quincy	Diamant		
Atlas	Diamant Atlantic			
Sassy	Spunta	Sagita		
Aziba	Delaware	Crosty		

Field lay out of the experiment

Planting of Seed Tubers

Well sprouted healthy whole tubers were planted in furrows on 21st December, 2007 maintaining a spacing of 60 cm x 25 cm.

Weeding and Mulching

Manual weeding was done as and when necessary to keep the plots free from weeds. The soil was mulched by breaking the crust for easy aeration and to conservation of soil moisture.

Irrigation

First irrigation was done after 30 days after planting. Subsequently 3 irrigations were done at 20 days interval after first application.

Earthing up

Earthing up was done twice during the growing period. The first earthing up was done at 30 day of planting along with urea and second one after 45 days of planting.

Plant Protection

Dithane M-45 and Secure 80 WP at the rate of 2.25 kg/ha were sprayed regularly after complete emergence of crop at an interval of 15 days to control late blight disease. Admire @ 0.5ml/litre water was sprayed to control insect.

Harvesting

Haulm killing was done before seven days of harvesting. The crop was harvested depending upon the maturity of each variety.

Collection of data

Data on the following parameters were recorded from the sample plants during the course of experiment. The sampling was done randomly in each plot in such a way that the border effect was avoided for the highest precision. For this the other two lines and the border plants of the middle lines were avoided.

Percent emergence at 20, 25, 30 DAP

This was achieved by recording the emergence of tubers at 20 DAP out of 60 tubers planted and converting it to percentage.

Height of plant at 60 days after planting

The height of the sample plants was measured in centimeter from the ground level to the tip of the longest shoot.

Number of main stems per hill at 60 DAP

The numbers of main stems were counted at 60 days after planting and the average numbers of main stems produced per hill were counted.

Plant Diameter at 60 DAP

Diameter of the sample plants were measured in centimeter at 60 DAP.

Percent foliage coverage 60 days after planting

Percent crop coverage was recorded by eye observation at 60 days after planting.

Plant vigor at 60 DAP

Plant vigor was also measured by eye estimation. It was scored up to 8. Higher the vigor higher was the score.

Disease infection at 60 DAP

During the growth period late blight, stem canker, potato leaf roll virus and potato virus Y was found in the experimental plots. Stem canker, potato leaf roll virus and potato virus Y infected plants were recorded and was converted to percent plant infected. The following scale was used during recording of late blight disease data (Table 1).

Table 1. Disease scale for late blight

Score	% foliage infected	Description (lesion in leaf)
1	0	Apparently no lesion on leaf
2	3	More than 0% but less than 10%
3	10	More than 10% but less than 25%
4	25	More than 25% but less than 50%
5	50	Half of the foliage destroyed
6	75	More than 50% but less than 75%
7	90	More than 75% but less than 90%
8	97	Only few green areas of the leaf (< 10%)
9	100	Foliage completely destroyed

Average number of tubers per hill

Number of tubers per hill was recorded from the mean number of tubers found from the total harvested plants of each plot.

Weight of tubers per hill (kg)

Weight of tubers per hill was recorded from the mean weight of tubers found from the total harvested plants of each plot.

Yield of tubers per plot

Yield of tubers per plot was recorded from total tubers weight of all the plants from each unit plot.

Yield of tuber per hectare

Yield of unit plot was converted into per hectare yield.



Percent different grades of tubers (by weight)

Tubers collected from sample plant were grouped into five different grades. The grades were <28 mm, 28-35 mm, 35-45 mm, 45-55 mm and >55 mm, in diameter. Percent weight of five grades was recorded from the mean weight of tubers found from ten harvested plants.

Percent different grades of tubers (by number)

Tubers collected from each plot were grouped into four different grades. The grades were <28 mm, 28-45 mm, 45-55 mm and >55 mm in diameter. Percent numbers of four grades were recorded from the total number of tubers found from each harvested plots.

Percent different grades of tubers (by weight)

Tubers collected from each plot were grouped into four different grades. The grades were <28gm, 28-45gm, 45-55gm and >55 gm by weight. Percent weight of four grades was recorded from the total weight of tubers produced in each harvested plots.

Percentage of dry mater content of tubers

Hundred grams potato tuber cut into pieces were oven dried for 48 hours at 70-80°C in an oven after days of sun drying. Then the dried pieces were weighed.

Statistical analysis

The data obtained for yield contributing character and yield were statistically analyzed to find out the significance of differences among the treatments. The mean values of all the characters of thirteen varieties were evaluated and analysis of variance was performed by **Mstat** program. The significance of the differences among pairs of treatment means was calculated by DMRT. Correlation coefficient, correlation matrix and regression analysis were performed.

Chapter 4
Results and Discussion

CHAPTER-IV

RESULTS AND DISCUSSION

The results of yield contributing characters and yield of 13 exotic potato varieties have been presented in this chapter.

Percent emergence after 20, 25 and 30 days of planting

Significant variation among the varieties was found at 20 days after planting. It was found that only Atlantic got 90% emergence followed by Aziba (71.6%) and Delaware (67.2%). On the other hand, very poor emergence was observed in the varieties Daifla (6.1%), Sagita (9.4%), Atlas (10.5%), Daisy (11.6%) and Sassy (11.6%) at 20 days after planting. The Check variety Diamant contributed 32.2% emergence which was not statistically different from Crosty (28.8%). Quincy showed 65% emergence which was not significantly different from Spunta (61.6%). The variety Bellini showed 43.3% emergence after 20 days of planting (Fig. 1).

At 25 DAP all the varieties performed well compared to the emergence at 20 DAP ranging from 41.1 to 100%. The highest germination percentage was performed by Delaware (100%) which was statistically similar to that of Quincy(97.2%),Atlantic (96.6%),Aziba(94.4%) and Spunta(92.7%).The lowest was observed in the variety Daifla(41.1%) which was statistically similar to that of Sagita(45.55%), while the check variety Diamant performed 81.1% emergence at 25 DAP (Fig. 1).

At 30 DAP all the varieties had satisfactory emergence. Highest was noted from Delaware (100%) and the lowest was found in Atlas (76.6%) while the check variety Diamant gave 92% emergence at 30 DAP (Fig. 1).

n 20 DAP □ 25 DAP □ 30 DAP

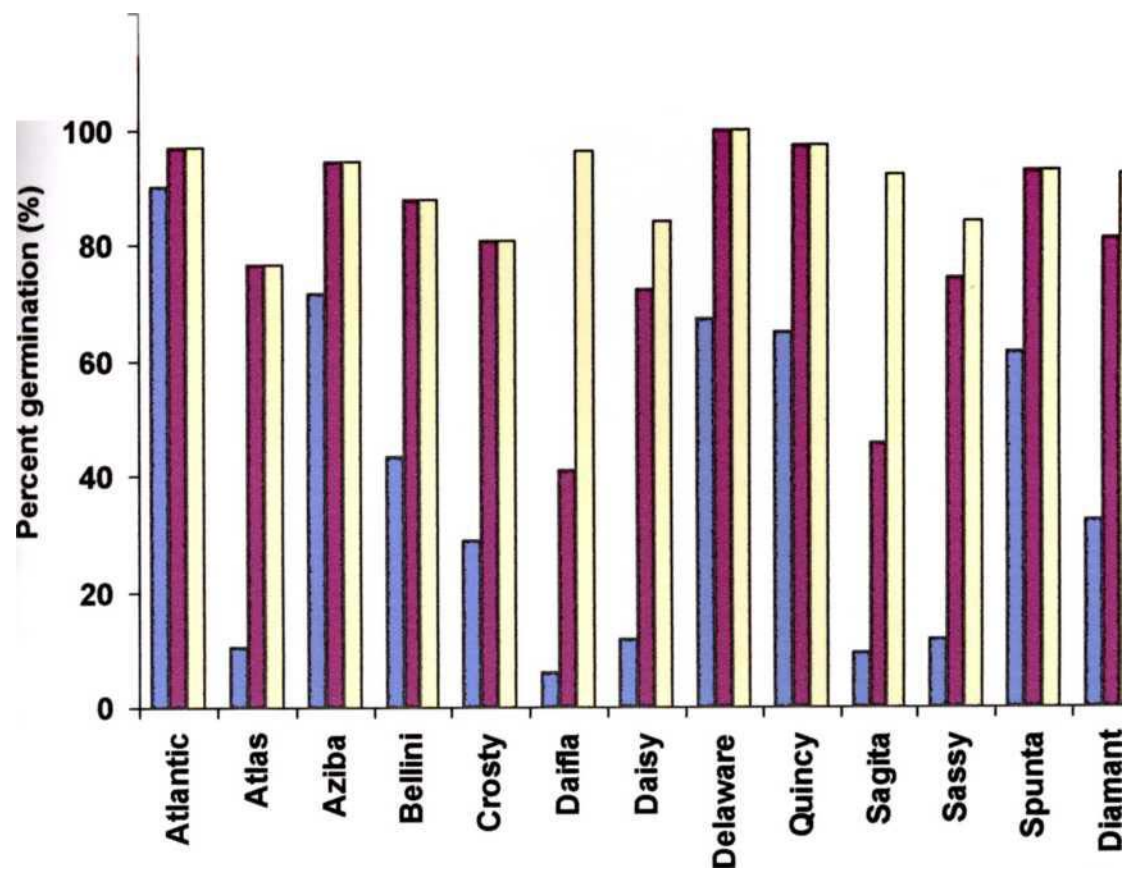


Fig. 1. Bar graph showing germination percentage of different exotic potato germplasm at 20,25 and 30 days after planting

Plant characters

The exotic germplasm exhibited different distinct features in their leaf color, leaf margin, stem color, growth characters, appearance of leaf, tuber color, size and shape (Table 2).



Plate 1. View of the experimental field,

2. Plant growth characters

Table

Variety	Stem color	Plant growth characters	Leaf color	Leaf margin	Appearance of leaf	Presence of hairs on leaf/stem
Atlantic	green	Flat to erect	green	normal	Smooth curling tendency	present
Atlas	Brown but nodal region green	Erect	Dark green	normal	rough	present
Aziba	Greenish brown	Flat	Light green	wavy	rough	present
Bellini	green	Erect	Dark green	normal	Smooth to rough	Present
Crosty	Greenish brown	Upright	Dark green	normal	Rough, curling	Present
Daifla	Greenish brown	Upright	Light green	normal	Smooth ,curling	Present
Daisy	Greenish brown	Flat to upright	Pale green	wavy	rough	Present
Delaware	Green with slight brown	Flat	Light green	normal	Smooth	Not Present
Quincy	Brownish green	Erect	Light green	wavy	Rough	Present
Sagita	Green	Erect	Dark green	normal	Smooth	Not Present
Sassy	Brownish green	Flat	green	normal	Rough	Present
Spunta	Dark brown	Erect	Dark green	normal	Rough, curling in lateral leaf	Present
Diamant	Green	Flat	Dark green	normal	Rough to smooth	present

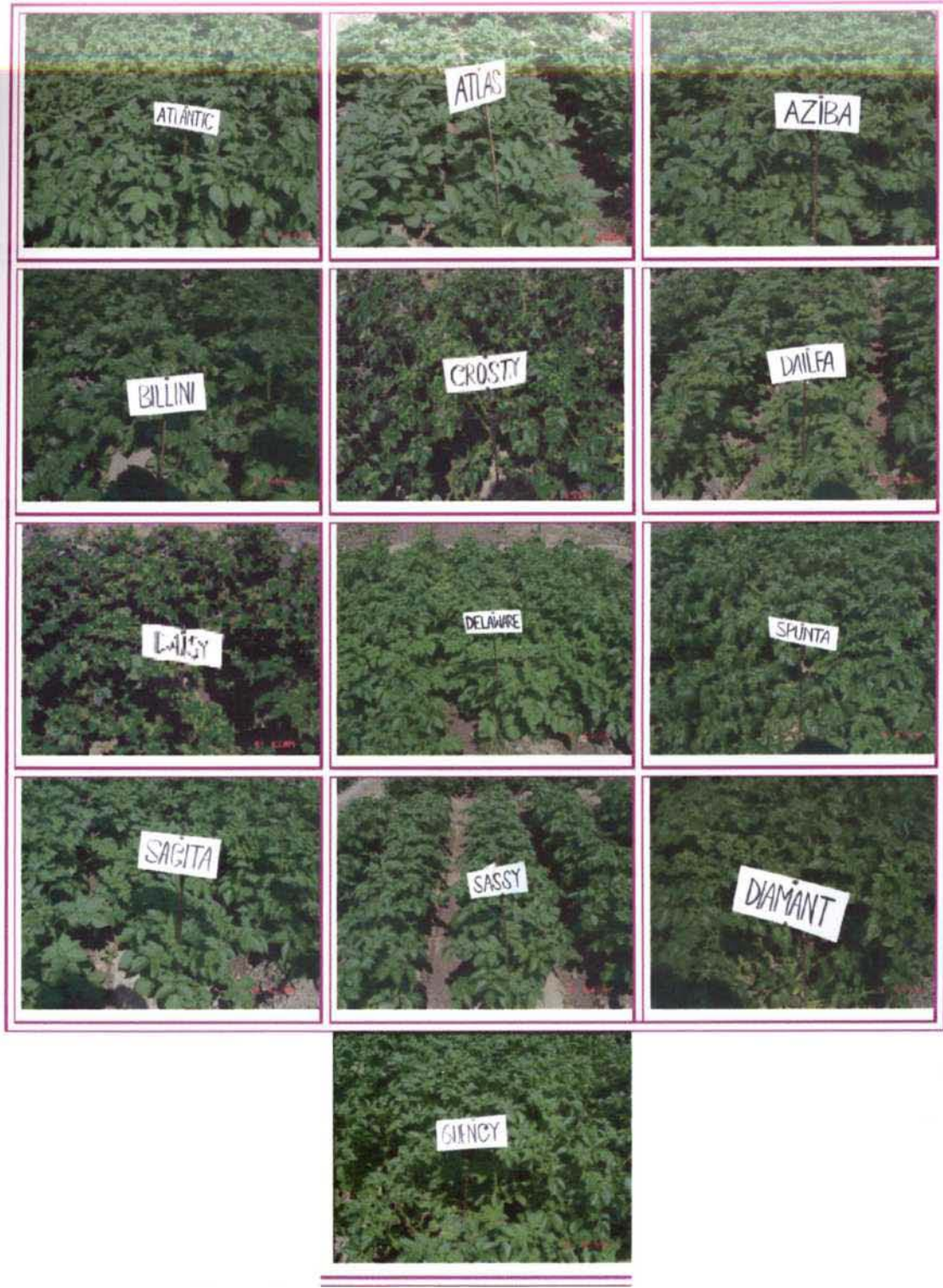


Plate 5. View of exotic potato germplasm at 35 days after planting



Plate 6. View of exotic potato germplasm at 60 days after planting

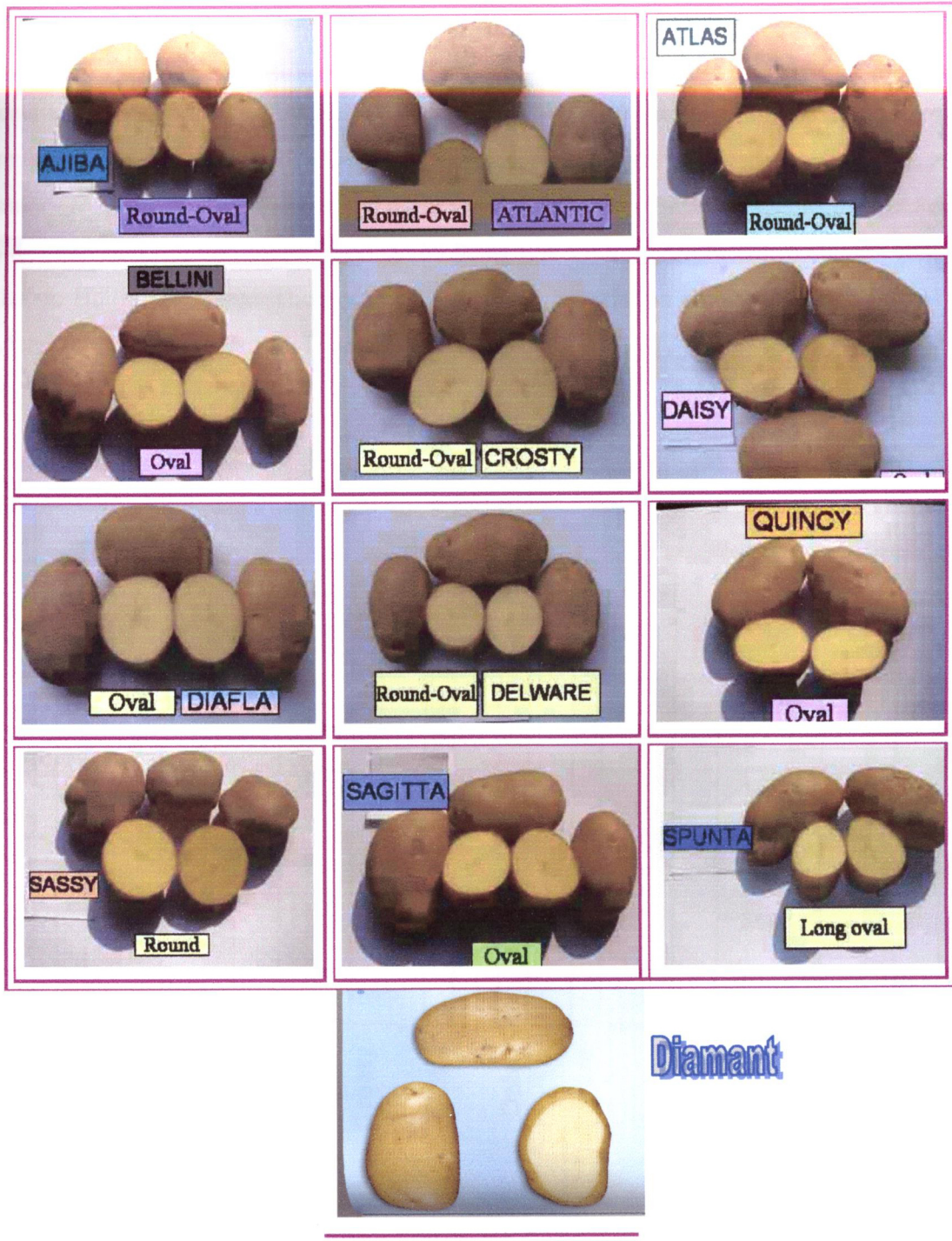


Plate 7. Showing transverse section different exotic potato germplasm.

Plant height (cm) at 60 days after planting

The results relating to the plant height (Fig.2). indicated that there was significant variation among the potato germplasm under trial at maximum vegetative growth stage at 60 DAP. The tallest plants were produced by the variety Quincy (87.8cm). On the contrary, the shortest plants were found in the variety Atlas (57cm). There was no significant difference among the varieties Atlantic (75.2cm), Crosty (75.6cm), Daifla (71.7cm), Daisy (74.0cm), Delaware (75.8cm) and Spunta (71.5cm) in this respect . Aziba (69.8cm) was lowest performer which was statistically similar to Bellini(75.2cm). There was no considerable variation among Sagita (65.8cm), Sassy (64.4cm) and the check variety Diamant (62.6cm)

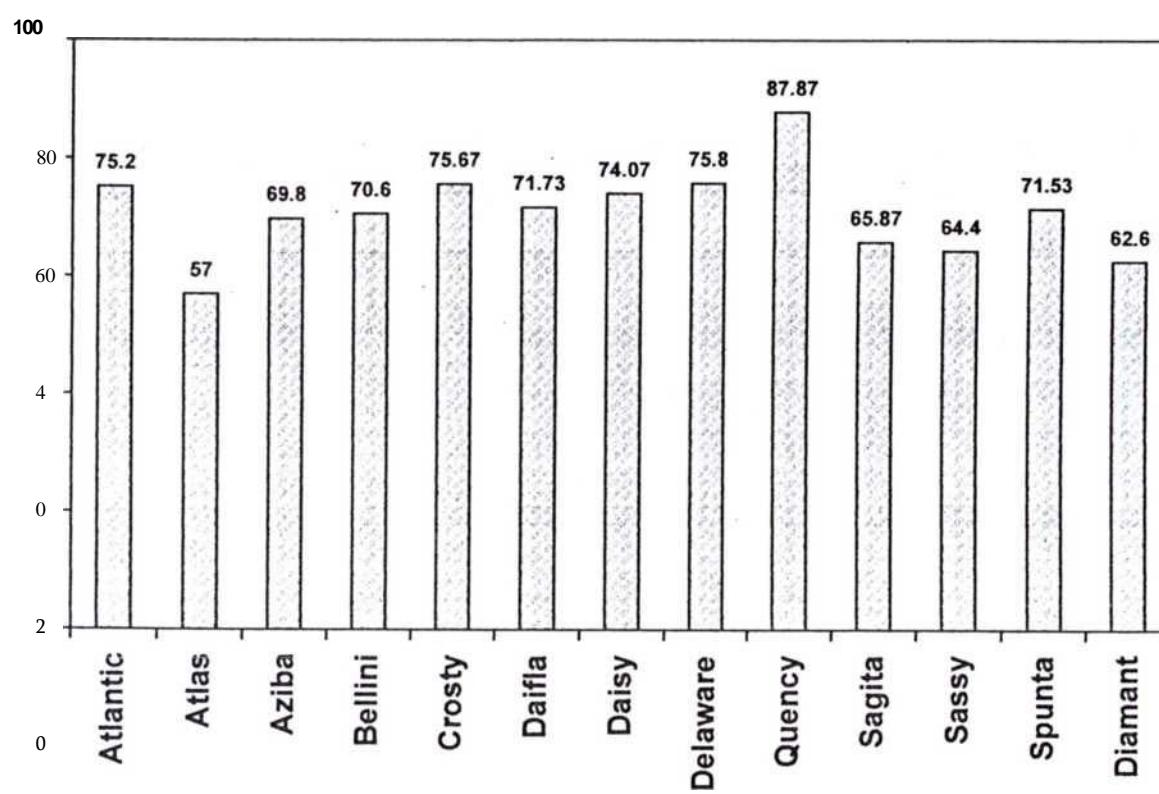


Fig. 2. Bar graph showing height of different exotic potato

Number of stem per hill

The number of stem per hill varied significantly among the varieties. The maximum stem/hill was recorded from Diamant (7.2) followed by Delaware. However there was no statistically significant variation among the varieties Quincy, Sagita, Atlantic and Aziba. The minimum number of stem per hill was recorded in Daifla, Daisy, Sassy crosty and Atlas varieties (Table 3).

Plant Diameter at 60 days after planting

Significant variation in plant diameter of the varieties became evident (Table 3). The highest plant diameter was observed in the variety Atlas (5.9 cm) followed by Daifla. The variety spunta also performed more or less same compared to Daifla. The exotic varieties Sagita, Atlantic, Bellini Crosle, Daisy and Quincy did not show any significant variation in stem diameter. The lowest stem diameter was observed in the check variety Diamant (2.6 cm).

Percent Foliage Coverage at 60 days after planting

Although there was a significant variation among the varieties in foliage coverage but all showed more than 90% foliage coverage at 60 DAP. Again 100% foliage coverage was observed in the varieties Daifla and Sagita, which were statistically similar than that of Diamant, Delaware and Bellini. The varieties Quincy, Daisy, Atlas, Spunta and Atlantic had no significant variation in respect of foliage coverage at 60 DAP. The lowest foliage coverage was recorded in the variety Sassy followed by Crosty.

Plant Vigor at 60 days after planting

All the varieties showed excellent plant vigor at 60 DAP. The varieties Atlas, Crosty, Daifla, Daisy and Sagita were found to be most vigorous. The varieties Atlantic, Aziba, Bellini, Quincy, Sassy, Spunta and Diamant did not show significant variation in this respect (Table 3).

Table 3. Showing number of stem per hill, Plant diameter, foliage coverage and plant vigor of different exotic varieties at 60 days after planting

Variety	No of stem/hill	Plant dia (cm)	% foliage coverage	Plant vigor
Atlantic	3.8 cd	3.7 efg	94.0 cde	7.3 ab
Atlas	2.0 f	5.9 a	95.0 bed	8.0 a
Aziba	3.8 cd	3.6 g	100 ,0a	7.3 ab
Bellini	3.4 de	3.9 cdef	98.3 ab	7.6 ab
Crosty	2.6 ef	3.8 defg	91.6 de	8.0 a
Daifla	2.0 f	4.4 b	100.0 a	8.0 a
Daisy	2.1 f	3.9 cdef	95.6 be	8.0 a
Delaware	6.4 b	3.7 fg	98.3 ab	7.0 b
Quincy	4.5 c	3.7 efg	96.6 abc	7.6 ab
Sagita	4.4 c	4.0 cde	100.0 a	8.0 a
Sassy	2.3 f	4.1 cd	90.6 e	7.3 ab
Spunta	4.0 cd	4.2 be	94.3 cde	7.6 ab
Diamant	7.2 a	2.6 h	98.3 ab	7.6 ab
Cv %	12.8	4.1	2.0	5.1

Means bearing same letter within the same column do not differ significantly by DMRT at 5% level of significance.

Disease infection

Significant variation was observed among the varieties at 60DAP. The variety Atlas (2.6) was found to be more susceptible to late blight. It did not differ significantly from the variety Daisy (2.3). Atlantic, Daifla, Quincy and Sassy showed same level of susceptibility (1.6) to late blight infection in the field condition while the variety Spunta scored the lowest which was statistically similar to that of Crosty, Aziba, Diamant and Delaware.

In terms of stem canker, highest number of plant was infected in Daifla (6). The second highest infection was found in the variety Spunta (5.6) which was statistically similar to that of the variety Quincy (4.6), Atlantic (4.3), and Crosty (3.6). Both Daisy and Sagita showed the lowest stem canker infection. (Fig. 3)

The highest potato leaf roll infection was found in the variety Atlantic (1.6) which was statistically similar to that of Spunta (1.3). Atlas Diamant and Sassy showed negligible infection (0.3). The other variety did not show potato leaf roll infection. (Fig. 3)

Highest number of potato virus Y infected plant was found in the variety Delaware (2.3) which was statistically similar to other varieties of the trial. (Fig. 3)

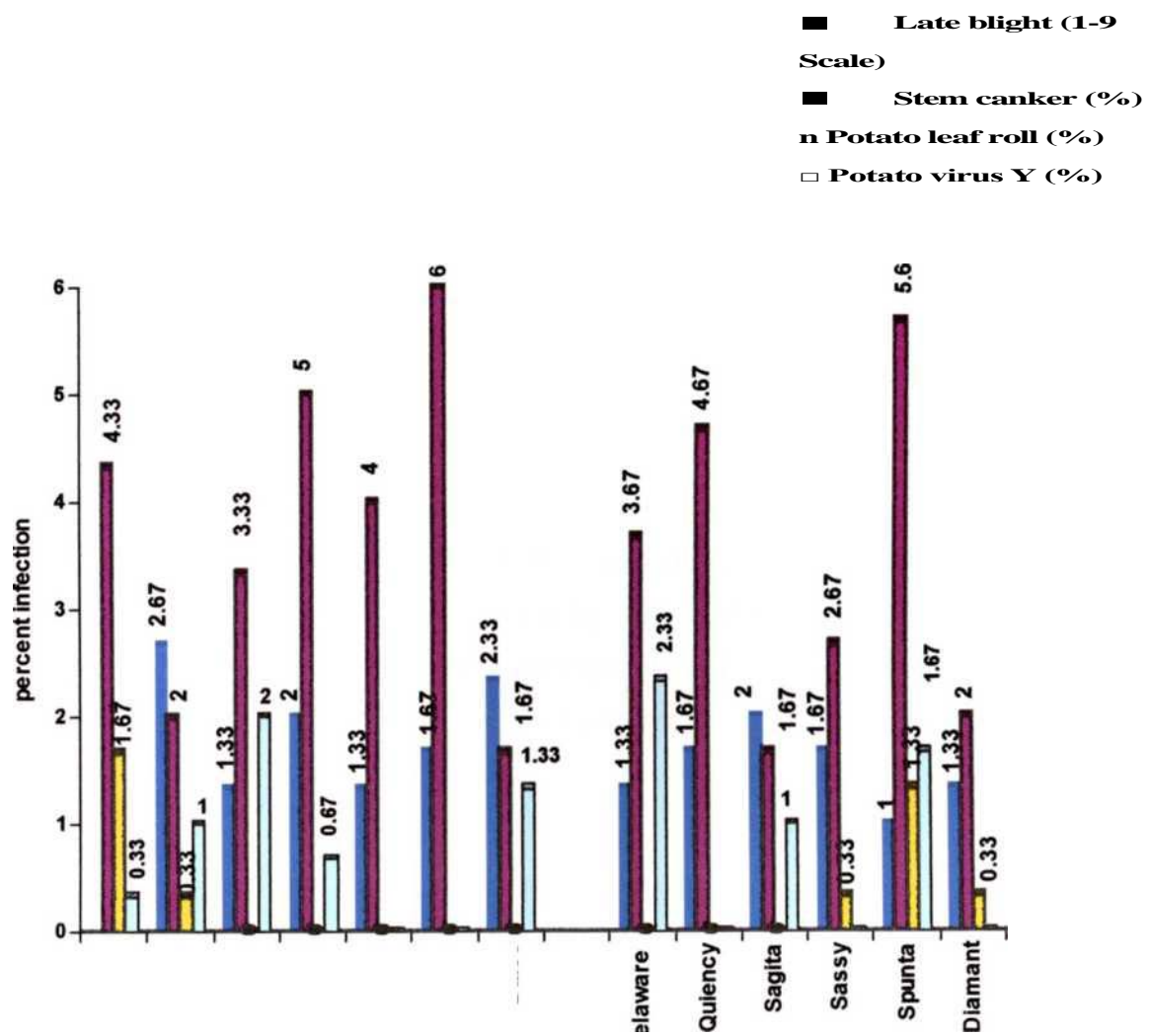


Fig. 3. Disease reaction of different exotic potato varieties in field condition

Percent size grade distribution of tubers (by number)

The results on percent size grade distribution of tuber (by number) have been presented in Fig.4 and described below.

Percent tuber below 28 mm in size

The percent number of tubers below 28 mm in size ranged from 8.9 to 33.1. The highest percentage of tubers below 28 mm in size was recorded in the variety Diamant (33.1) followed by Delaware (31.5). On the other hand, the lowest percentage of tubers below 28 mm was found in Crosty (8.9) followed by Daisy (12.8) in size.

Per cent tubers between 28-45 mm in size

The highest percentage of tubers between 28-45 mm in size (by number) was found in the variety Sassy (62.6) Atlantic (59.6) and Diamant (55.2). On the other hand, the lowest percentage of tubers between 28-45 mm in size was observed in the variety Atlas (41.6%).

Per cent tubers between 45-55 mm in size

Considerable variation was observed among the varieties under trial in per cent tubers between 45-55 mm in size. It ranged from 11.0% to 35.5%. The highest percentage of tuber between 45- 55 mm was found in Crosty (35.9%) followed by Atlas (33.3%), Bellini (32.3%), Quincy (31.76%) and Daisy (31.6%). The lowest percentage of seed tubers between 45-55 mm was found in the variety Diamant (11.0%) followed by Delaware (14.1%).

Percent tubers above 55 mm in size

There was remarkable variation among the varieties in production of tubers above 55 mm in size (by number). The highest percentage of tubers above 55 mm in size was found in the variety Quincy (11.9%) followed by Sagita (6.3%). On the other hand, Delaware (0.4%) produced the lowest percentage of tubers above 55 mm in size followed by Diamant (0.6%) and Sassy (0.8%).

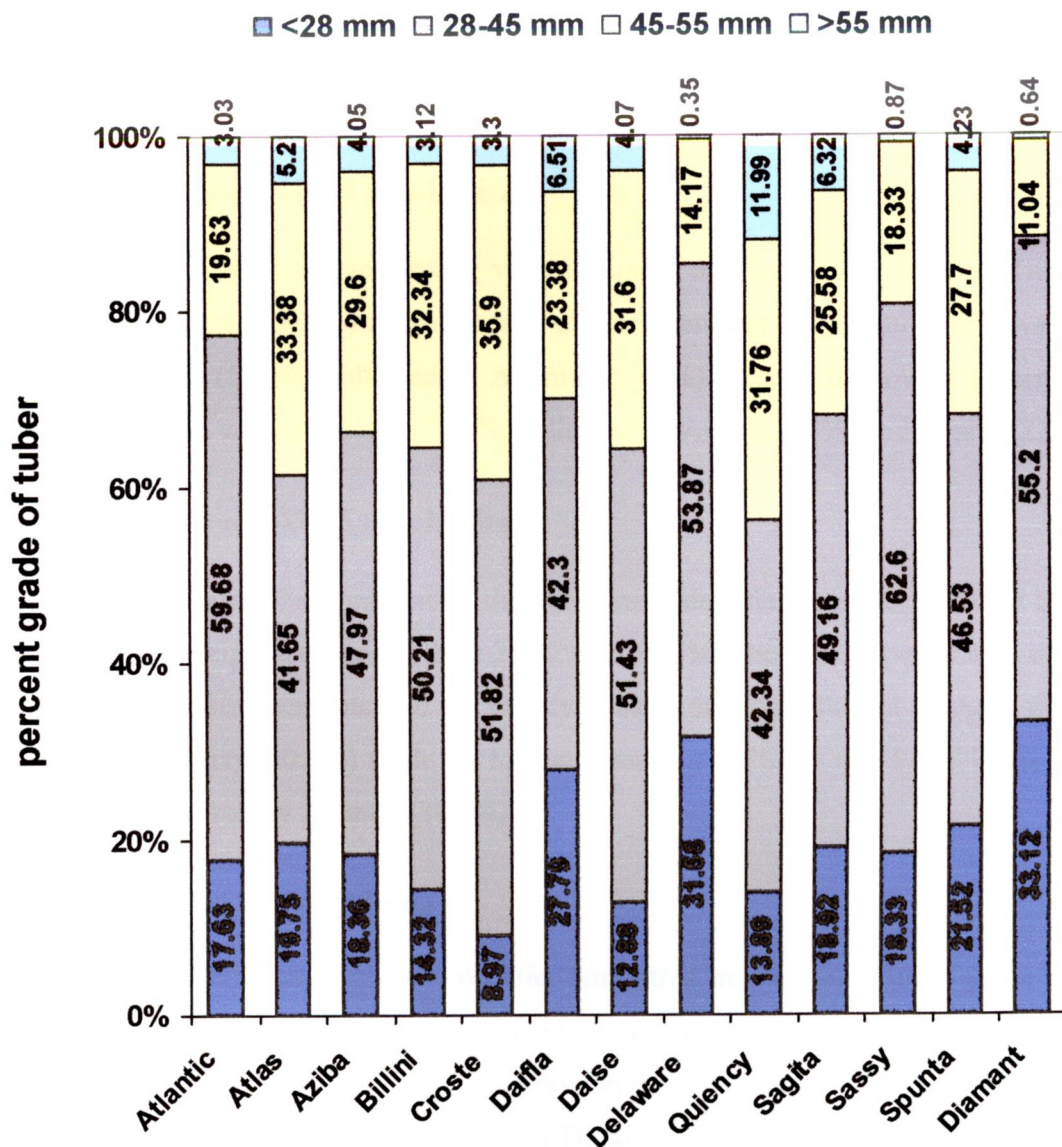


Fig. 4. Grade of potato by number(%)

Percent size grade distribution of tubers (by weight)

The results on Per cent size grade distribution of tubers (by weight) have been presented in Fig. 5.

Per cent tubers below 28 mm in size

The percent size grade distribution of tuber of tubers below 28 mm in size ranged from 1.39 to 10.88. The highest percentage of tubers below 28 mm in size by weight was recorded in the

variety Diamant (10.8%) followed by Sassy (4.1%). On the other hand, the lowest percentage of tubers below 28 mm in size was found in Bellini (1.3%) followed by Daisy (1.6%), Crosty (1.9%) and Atlas (1.9%).

Per cent tubers between 28-45 mm in size

Considerable variation was observed among varieties under trial in per cent tubers between 28- 45 mm in size by weight. The highest percentage of tuber between 28-45 mm in size was found in the variety Diamant (57.5%) followed by Atlantic (53.1%) whereas the lowest percentage of tubers was found in the variety Quincy (23.1%) followed by Atlas (25.5%) and Crosty (27.0%).

Per cent tubers between 45-55 mm in size

Remarkable variation was observed among the varieties under trial in per cent tubers between 45-55 mm in size by weight and ranged from 29.02% to 60.0%. The highest percentage of tubers between 45-55 mm in size was found in the variety Crosty (60.0%) followed by Atlas (56.9%), Bellini (52.2%) and Daisy (50.9%) while the lowest percentage of tuber was found in the variety Diamant (29.0%) followed by Atlantic (34.4%).

Per cent tubers above 55 mm in size

There was noticeable variation among the varieties under trial in per cent of tuber above 55 mm in size (by weight). The highest percentage of tubers above 55 mm in size was found in the variety Quincy (28.5%) followed by Daifla (22.4%). On the other hand, the lowest percentage of tuber above 55 mm in size was found in the variety Diamant (2.5%) followed by Sassy (3.5%).

Table 3. Showing Percent size grade distribution of tubers of different varieties (by weight)

Variety	Below 28 mm	28 - 45mm	45 -55mm	Above 55mm
Atlantic	5.01	53.11	34.44	7.44
Atlas	1.99	25.57	56.94	15.48
Aziba	2.9	35.74	47.38	13.96
Bellini	1.39	36.38	52.23	9.98
Crosty	1.93	27.03	60.00	11.03
Daifla	3.83	29.56	44.16	22.44
Daisy	1.6	38.93	50.96	8.49
Delaware	10.31	47.47	40.02	21.95
Quincy	2.04	23.17	46.25	28.52
Sagita	3.27	39.24	37.49	19.97
Sassy	4.12	53.82	38.99	3.55
Spunta	4.0	37.15	42.94	15.89
Diamant	10.88	75.55	29.02	2.53

Number of tubers per hill

There was significant variation among the thirteen varieties under trial in number of tubers produced per hill (Table 3.) and the highest number of tubers per hill was found in Delaware (14.1) followed by Diamant (13.06), both were statistically similar. The lowest was produced by the variety Crosty (6.56) followed by Quincy (6.71).

Yield of tuber per hill

Significant variation was found among the varieties in respect of tuber yield per hill (Table 3) which ranged from 0.48kg to ,70kg. The highest yield per hill was obtained from the variety Aziba (0.70kg) followed by Quincy (0.64kg) and Sagita (0.63kg). The lowest tuber yield per hill was found in Sassy (0.48kg) followed by Diamant (0.49kg).



Dry matter content

The highest dry matter content among the exotic variety under trial varied significantly. It ranged from 18.60% to 21.20%. The highest was recorded in the variety Crosty (21.2%) followed by Daisy (21.10%). The lowest dry matter content was estimated in both the variety Atlantic and Aziba by 18.6%.(Table 3.)

Table 4. Number and weight of tubers per plant of different exotic potato varieties and percent dry matter content

Variety	Number of tuber / plant	Weight of tuber / plant (kg)	Percent dry matter content
Atlantic	8.66 bed	0.58 bede	18.6
Atlas	7.26 de	0.56 bede	20.4
Aziba	10.28 b	0.70 a	18.6
Bellini	7.83 cde	0.59 bed	19.0
Crosty	6.56 e	0.52 cde	21.2
Daifla	8.95 bed	0.59 bed	19.6
Daisy	7.53 cde	0.59 bed	21.1
Delaware	14.1 a	0.54 bede	18.0
Quincy	6.71 e	0.64 ab	18.5
Sagita	8.34 cde	0.63 abc	20.8
Sassy	9.27 be	0.48 e	20.4
Spunta	8.26 cde	0.58 bede	18.8
Diamant	13.06 a	0.49 de	20.1
Cv. %	10.83	9.30	

Means bearing same letter within the same column do not differ significantly by DMRT at 5% level of significance.

Yield of tuber/ha:

Yield of tubers / ha varied significantly among the varieties under trial. It was found that Aziba gave the highest yield (44.55 t/ha). Next highest yield was found from the variety Quincy (41.55t/ha) followed by Sagita (41.1 Ot/ha). Khatun (1995) got 33.2 t/ha tubers yield from the variety Aziba. But in the present study it was observed that the variety Aziba gave the highest yield.

The variety, Bellini (39.70t/ha), Spunta (38.89t/ha), Daifla (38.88 t/ha), Daisy (39.80t/ha) variety Aziba and Atlantic (37.85t/ha) did not show significant variation in yield. The exotic variety Sassy yielded the lowest (32.29 t/ha) which was statistically similar to that of the check variety, Diamant (32.70t/ha). The other variety Delaware (36.27 t/ha), Crosty (35t/ha) and Atlas (37.07t/ha) showed no significant variation in terms of yield.

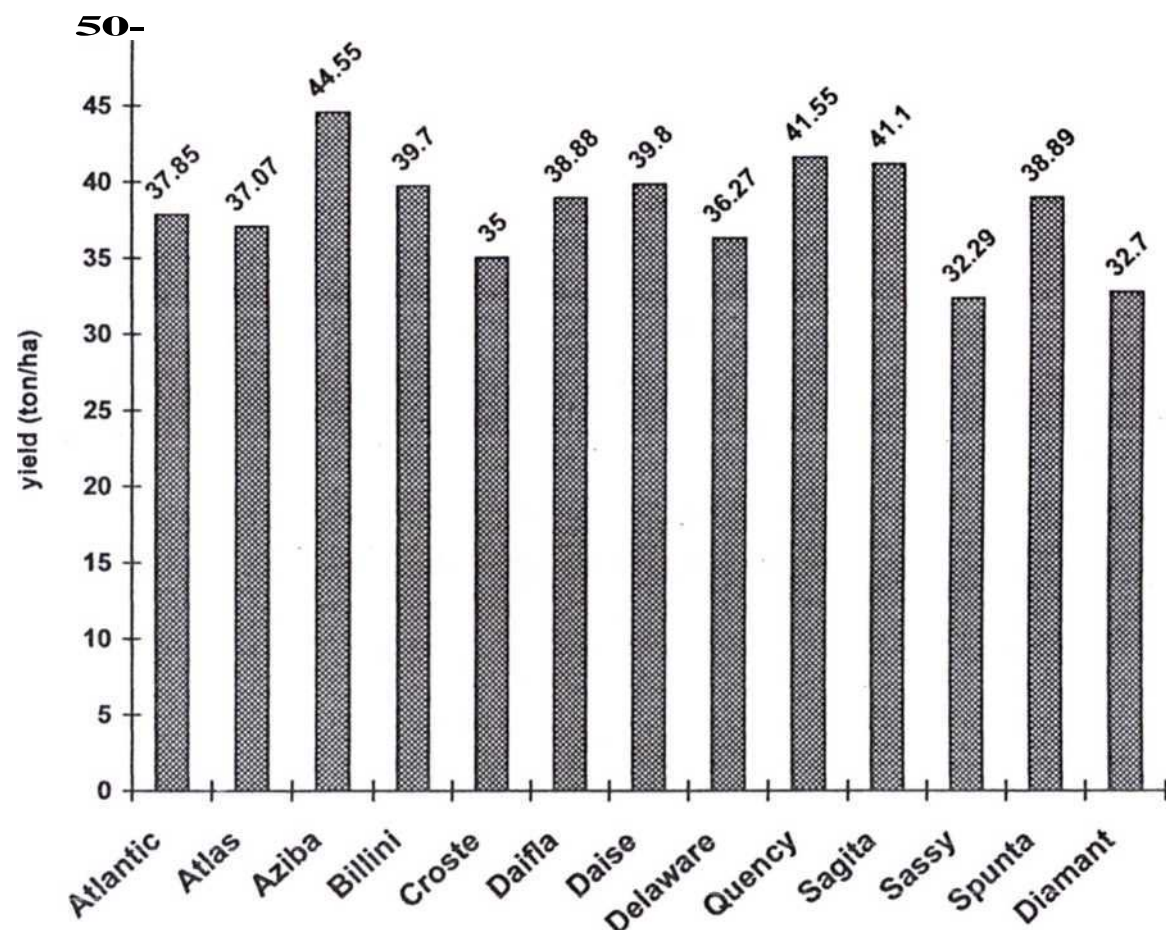


Fig. 6. Tuber yield of exotic potato varieties

Correlation Matrix

- ^ From the correlation study (Appendix XIII) it was found that percent emergence at 20 days after planting had positive correlation with yield. It indicated that the higher percentage of germination at 20 DAP helped in increasing yield. Percent germination at 20DAP also showed significant positive association with foliage coverage. Plant height showed positive association with yield at 60 days after planting. It revealed that higher the plant height, higher would be the yield. Plant height also had considerably positive correlation with large sized tuber (>55mm) production. There was significant negative association between number of stem per hill and large sized (>45mm) tuber production but positive correlation with small (<28mm) size seed production. Number of stem per hill was negatively associated with yield. This is due to higher number of small tuber production. Plant diameter showed positive association with tuber yield due to positive correlation with medium sized (45-55mm) tuber production. Percentage of foliage coverage was found negatively correlated with yield. That might be due to the higher vegetative growth. Significant positive correlation with yield was observed with size grade of tubers between 45mm and above 55mm. There was significant negative association of large size tuber with number of tubers/ plant. It indicated that higher the tuber per plant caused lowering the large sized tuber production. That might be due to improper growth of tubers. Strong positive correlation of weight of tuber per plant with tuber yield was observed.

DISCUSSION

The results on yield contributing characters and yield of 12 exotic potato varieties have been discussed in the present chapter.

The present investigation indicated that there was considerable variation among the varieties at 20, 25 and 30 days after planting. In this trial, it was found that the germination percentage of the variety ranged from 6.11 to 90. The variety Atlantic performed highest (90) and Daifla showed the minimum percentage of germination (6.11). After 25 DAP Delaware showed highest germination percentage (100) while Daifla showed the lowest (41.11).

Most the varieties showed above ninety per cent emergence at 30 DAP. Several authors (Ahmad 1980; Hossain et al. 1980; Siddique et al. 1984) reported the similar results from their experiments on performance of Dutch varieties under Bangladesh conditions. This is due to the fact that crop emergence in the field is a varietal character, (Beukema and Vander Zaag, 1979) and considerable variation at 20, 25 and 30 DAP is quite expected. Generally, the directly imported first generation seed from Netherlands is usually harvested in the month of August and often remained physiologically under-aged at the time of planting during November-December in Bangladesh.

There was significant variation among the varieties tested in the present study in respect of stem per hill. It was observed that the variety Diamant (7.27) and Delaware (6.4) produced the highest number of stem/hill. Similar results were reported by Bashar (1978), Roy and Nafziger (1978). Haque (1993a) reported that the variety Diamant (4.3) gave the highest number of stem/hill.

In case of plant height, there was considerable variation among the varieties under trial. In the present investigation, it was found that the variety Quincy produced the tallest plant (87.87cm). Atlas produced the lowest plant (57cm). In this investigation, other varieties also performed well in terms of plant height. This variation in plant height may be due to the environmental condition of the experimental site during crop growth stage.

In case of number of tubers /hill, there was significant variation among the varieties. It was observed that Delaware produced the highest number of tubers/ hill (14.1). Quasem (1970) found that the number of tubers varied from 5.02 to 12.18 while in the present study it varied from 6.56 to 14.1.

In the present investigation significant variation was found among the varieties in respect of tuber yield per hill. The tuber yield per hill was found in the range of 480 gm to 7000gm. It was reported (Anonymous, 1986b) that the variety Diamant gave the yield of 406 gm/ hill. It was also observed that all the imported varieties except Sassy (480.0 gm) gave higher yield compared to that of check variety Diamant. This is due to the genetical characteristics and suitable agro- ecological conditions.

Yield of tubers / ha varied significantly among the varieties. It was found that Aziba gave the highest yield (44.5 t/ha). Next highest yield was found from the variety Quincy (41.5t/ha), and Sagita (41.1 Ot/ha). Khatun (1995) got 33.2 t/ha tubers yield from the variety Aziba. In the present study it was observed that the variety Aziba gave the highest yield. The higher yield of the variety Aziba might be due to proper physiological maturity of seed tubers and better adaptability of this variety under the climatic condition of Bangladesh.

There was considerable variation among the varieties tested in respect of proportion of seed size. It was observed that the variety Sassy produced the highest proportion of seed size (62.6). Similar results were reported by Hoque (1993b).

From the correlation study it was found that percent emergence at 20 days after planting had positive correlation with yield. It indicated that the higher percentage of germination at 20 DAP helped in increasing yield. Percent germination at 20DAP also showed significant positive association with foliage coverage. Plant height showed positive association with yield at 60 days after planting. It revealed that higher the plant height, higher would be the yield. Plant height also had considerably positive correlation with large sized tuber (>55mm) production. There was significant negative association between number of stem per hill and large sized (>45mm) tuber production but positive correlation with small (<28mm) size seed production. Number of stem per hill was negatively associated with yield. This is due to higher number of small tuber production.

Plant diameter showed positive association with tuber yield due to positive correlation with medium sized (45-55mm) tuber production. Percentage of foliage coverage was found negatively correlated with yield. Significant positive correlation with yield was observed with size of tubers between 45mm and above 55mm. There was significant negative association of large size tuber with number of tubers/ plant. Higher the tuber per plant lower was the large size tuber production. Strong positive correlation of weight of tuber per plant with tuber yield was observed.

Chapter 5

Summary and conclusion



CHAPTER-V

SUMMARY AND CONCLUSION

An investigation was carried out to study the comparative performance of the twelve exotic potato germplasm with check Diamant, at D-2 block of Breeder Seed Production Centre, Debigonj, Panchagorh, during the period from 21 December, 2006 to 28 March, 2007. The planting materials comprised of the sprouted seed tuber of thirteen different varieties. The varieties were Atlantic, Atlas, Aziba, Bellini, Crosty, Daifla, Daisy, Delaware, Quincy, Sagita, Sassy, Spunta, and Diamant.

Varietal differences were observed in all plant characteristics studied, such as germination percentage at 20, 25 and 30 days after planting, plant height, number of stem per hill, plant diameter, percent foliage coverage, plant vigor, disease infection, number of tuber per plant, weight of tuber per plant, grade of tuber, dry matter content and yield.

All the varieties gave more than 90% emergence at 20-35 DAP (Days after Planting). Significantly higher plant height was recorded in Quincy. The maximum of 7.27-stem number per hill was counted in Diamant followed by Delaware. Stem number per hill ranged from 2.0- 7.27. Although there was significant variation among the varieties in foliage coverage but all showed more than 90% foliage coverage at 60 DAP. Significant variation in stem diameter among the varieties became evident. In case of plant vigor, all the varieties showed excellent vigor. Number of tuber per plant ranged from 6.56 to 14.1. Significantly higher yield of 44.55 t/ha was harvested by Aziba and it showed statistically insignificant difference with Atlantic, Bellini, Daifla, Daisy, Quincy, Sagita and Spunta. Irrespective of varieties, all produced maximum percent of seed tuber (grade) both by number and by weight (Table 3). All the varieties showed late blight infection even after receiving two times fungicidal spray. All the varieties were free from PLRV infection except Atlantic, Atlas, Spunta and Diamant. Regarding PVY, varieties showed trace infection (0.33-2.33%). Five varieties namely; Crosty, Daifla, Quincy, Sassy and Diamant were free from PVY. More than 20% dry matter content varieties were: Atlas, Crosty, Daisy, Sagita, Sassy and Diamant.

Conclusion: All the exotic varieties under trial were higher yielder, except Sassy. Government of Bangladesh has recently changed the seed policy and the private sector has come forward to participate in the potato variety release program through introduction along with the Public Sector i.e. Tuber Crops Research Centre. Among the varieties under trial the check Diamant is still a good one and the topmost yielder Aziba was introduced previously. The variety Aziba, Quincy, Sagita Daifla and Spunta can be cultivated in Bangladesh condition. To select the most suitable one and for more confirmation further trial should be conducted.

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Appendices

Appendix I. Analysis of Variance Table for emergence of exotic potato varieties at 20 days after planting.

K	Value Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	244.291	122.146	8.9034	0.0013
2	Factor A	1	30229.778	2519.148	183.6255	0.0000
-3	Error	2	329.255	13.719		
		4				
	Total	38	30803.324			

Coefficient of Variation: 9.45%

Appendix II. Analysis of Variance Table for emergence of exotic potato varieties at 25 days after planting.

K	Value Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	3.558	1.779	0.0977	
2	Factor A	12	12628.901	1052.408	57.7672	0.0000
-3	Error	24	437.234	18.218		
	Total	38	13069.694			

Coefficient of Variation: 5.33%

Appendix III. Analysis of Variance Table for plant height of exotic potato varieties at 60 days after planting.

K	Value Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	38.008	19.004	1.1228	0.3419
2	Factor A	12	2046.119	170.510	10.0736	0.0000
-3	Error	24	406.232	16.926		
	Total	38	2490.359			

Coefficient of Variation: 5.12%

Appendix IV . Analysis of Variance Table for plant diameter of exotic potato varieties at 60 days after planting.

K	Degrees of Freedom	Value Source	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.037	0.019	0.6780	0.000
2	Factor A	12	18.750	1.562	56.5975	0
-3	Error	24	0.663	0.028		
Total			38	19.450		

Coefficient of Variation: 4.16%

Appendix V. Analysis of Variance Table for number of stem per hill of exotic potato varieties at 60 days after planting.

K	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.001	0.000	0.0011
2	Factor A	12	97.787	8.149	35.0522
-3	Error	24	5.579	0.232	0.0000
Total		38	103.367		

Coefficient of Variation: 12.80%

Appendix VI. Analysis of Variance Table for plant vigor of exotic potato varieties at 60 days after planting.

K	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.974	0.487	3.1667
2	Factor A	12	4.000	0.333	2.1667
-3	Error	24	3.692	0.154	0.0602
Total		38	8.667		0.0517

Coefficient of Variation: 36.94%

Appendix VII. Analysis of Variance Table for percent foliage coverage of exotic potato varieties at 60 days after planting.

K	Value Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	56.359	28.179	6.9741	0.0041
2	Factor A	12	347.333	28.944	7.1634	0.0000
	-3 Error	24	96.974	4.041		
Total		38	500.667			

Coefficient of Variation: 2.09%

Appendix VIII. Analysis of Variance Table for late blight of exotic potato varieties at 20 days after planting.

K	Value Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.615	0.308	0.7347	
2	Factor A	12	7.641	0.637	1.5204	0.1845
	-3 Error	24	10.051	0.419		
Total		38	18.308			

Coefficient of Variation: 38.24%

Pro
b

Appendix IX. Analysis of Variance Table for stem canker of exotic potato varieties at 20 days after planting.

1	Replication	2	7.128	3.564	2.0267	0.1537
2	Factor A	1	82.103	6.842	3.8906	0.0022
	-3 Error	2	42.205	1.759		
Total		4	131.436			

K
Value Source Freedom Squares Square Value

Coefficient of Variation: 5.12%

Appendix X. Analysis of Variance Table for PLRV of exotic potato varieties at 20 days after planting.

K	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	0.154	0.077	0.3564	
2	Factor A	12	10.974	0.915	4.2376	0.0013
-3	Error	24	5.179	0.216		
Total		38	16.308			

Coefficient of Variation: 150.98%

Appendix XI. Analysis of Variance Table for PVY of exotic potato varieties at 20 days after planting.

K	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	4.051	2.026	1.1776	0.3252
2	Factor A	12	25.026	2.085	1.2124	0.3302
-3	Error	24	41.282	1.720		
Total		38	70.359			

Coefficient of Variation: 165.00%

Appendix XII. Analysis of Variance Table for yield of exotic potato varieties at 20 days after planting.

K	Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
1	Replication	2	86.932	43.466	3.0023	0.0686
2	Factor A	12	446.780	37.232	2.5717	0.023
-3	Error	24	347.465	14.478		
Total		38	881.177			

Coefficient of Variation: 9.98%

Appendix XIII.

Correlation matrix for different yield contributing characters of exotic potato varieties.

%Emergence
at 20 DAP
at 30 DAP

Emergence height (cm) at
60 DAP

Plant
diameter

%Foliage
coverage at

No. of stem
/hill at 60
DAP

Plant No. of
vigor at tuber/
Wt. of tuber Yield

%Emergence	1													
20 DAP														
% Emergence at 30 DAP	0.829	1.000												
Plant height (cm) at 60 DAP	0.526	0.376	1.000											
No. of stem /hill at 60 DAP	0.461	0.387	0.097	1.000										
Plant diameter (cm) at 60 DAP	-0.375	-0.260	-0.350	-0.673	1.000									
%Foliage coverage at 60 DAP	0.505	0.884	0.129	0.183	-0.161	1.000								
<28 mm	0.020	-0.095	-0.320	0.609	-0.218	-0.190	1.000							
28-45 mm	0.150	0.218	-0.114	0.210	-0.483	0.292	0.047	1.000						
45-55 mm	-0.138	-0.023	0.201	-0.638	0.489	0.061	-0.811	-0.576	1.000					
>55 mm	-0.013	-0.179	0.472	-0.240	0.275	-0.324	-0.369	-0.736	0.551	1.000				
Plant vigor at 60 DAP	-0.692	-0.663	-0.181	-0.479	0.373	-0.458	-0.336	-0.538	0.571	0.455	1.000			
No of tuber /plant	0.235	0.195	-0.196	0.741	-0.501	0.102	0.849	0.378	-0.846	-0.618	-0.645	1.000		
Wt. of tuber / plant (kg)	0.324	0.025	0.336	-0.102	0.085	-0.208	-0.283	-0.554	0.467	0.626	0.068	-0.275	1.000	
Yield (t/ha)	0.293	0.020	0.359	-0.136	0.110	-0.198	-0.318	-0.575	0.520	0.620	0.110	-0.312	0.990	1.000

