American Journal of Plant Sciences, 2025, 16(11), 1133-1144
https://www.scirp.org/journal/ajps
ISSN Online: 2158-2750
ISSN Print: 2158-2742

Phenotypic Evaluation of Twenty Heat Tolerant Potato Lines for Variety Development

Sanowar Hossain[1], Md. Kawser Ali[1], Md. Mosharof Hossain Molla[2], Md. Mukhtar Hossain[1,3]*, Md. Imran Ali[1,4]

[1]Department of Crop Science and Technology, Faculty of Agriculture, University of Rajshahi, Rajshahi, Bangladesh
[2]Bangladesh Agricultural Research Institute, On-Farm Research Division, Region-1, Agriculture Research Division, Rajshahi, Bangladesh
[3]The United Graduate School of Agricultural Sciences, Kagoshima University, Kagoshima, Japan
[4]Graduate School of Environment, Life, Natural Science and Technology, Okayama University, Okayama, Japan
Email: *mhossain@ru.ac.bd

How to cite this paper: Hossain, S., Ali, M.K., Molla, M.M.H., Hossain, M.M. and Ali, M.I. (2025) Phenotypic Evaluation of Twenty Heat Tolerant Potato Lines for Variety Development. *American Journal of Plant Sciences*, **16**, 1133-1144.
https://doi.org/10.4236/ajps.2025.1611074

Received: May 17, 2025
Accepted: October 26, 2025
Published: October 29, 2025

Abstract

Twenty heat-tolerant potato (*Solanum tuberosum* L.) lines were evaluated during the 2021-2022 winter season at the Regional Wheat Research Centre (RWRC), Bangladesh Agricultural Research Institute (BARI), Rajshahi, to identify superior lines for variety development under heat and drought-prone conditions. The experiment was conducted using a randomized complete block design with three replications. The study assessed both qualitative and quantitative traits, focusing on plant growth, maturity, and yield parameters to determine the effect of heat stress on performance. Plant height, stem number per plant, and plant maturity at 70, 80, and 90 (indicates advanced plant maturity) days after planting (DAP) were recorded, along with tuber weight per hill, tuber weight per line, and overall yield per hectare. The evaluation revealed significant variation among the lines, highlighting differences in growth and productivity under the tested environmental conditions. Among the twenty lines, TB19-23 demonstrated superior performance, with the highest plant height at 60 DAP (54.33 cm), advanced plant maturity at 90 DAPS (score 3.00 on a 1 - 5 scale), highest tuber yield per line (4.00 kg), yield per plant (0.8133 kg), and overall productivity (53.36 t/ha). These results indicate that TB19-23 possesses promising agronomic traits for heat and drought tolerance and could be considered a candidate for further breeding and variety development programs in the Rajshahi region and similar environments. This study provides valuable insights for selecting heat-tolerant potato lines to enhance productivity under abiotic stress conditions, contributing to the development of resilient potato cultivars suitable for changing climatic scenarios in Bangladesh.

Keywords

Heat Tolerant Potato, Phenotypic Evaluation, Potato Line, Variety Development

1. Introduction

Potato (*Solanum tuberosum* L., 2n = 4x = 48) is one of the most important non-grain crops globally and the third most consumed food crop, after rice and wheat [1]. First domesticated in the Andes, potato is primarily propagated vegetatively to produce 5 - 20 tubers per plant, although true seeds from berries can generate genetically distinct progeny (CIP). According to FAO, 2022 [2] global potato production reached 376 million metric tonnes in 2021, China is the largest producer of potatoes, with its acreage and total production accounting for 28.2% and 23.6% of the world, respectively, as of 2011 [3]. In Bangladesh, potato production increased in yield but decreased in cultivated area compared to previous years, with 10.14 million tonnes produced from 1.15 million acres in 2021-2022; Rajshahi Division alone contributed 3.55 million tonnes from 162,578 hectares [4]. The agroecological conditions of Bangladesh are favorable for high-quality potato production, provided that plant nutrient supply and water management are adequate [5] [6]. Potatoes are nutrient-dense, providing dietary fiber, vitamins, minerals, and carbohydrates, with 100 g of fresh tuber containing 16.3 g starch, 2.8 g protein, 0.5 g crude fiber, and 25 mg vitamin C. Globally, potatoes play a vital role in food security, as exemplified during the Irish famine of 1845 when late blight devastated crops [7].

Despite being a temperate crop, potatoes adapt to diverse climates; however, key growth stages such as stolonization and tuberization are highly sensitive to water and heat stress [8]. Soil moisture management through irrigation techniques, strategies, and mulching significantly influences tuber development and yield [9] [10]. Optimal tuber production occurs at 22˚C - 24˚C, whereas exposure to higher temperatures during tuberization (e.g., 30/20˚C Day/night) can substantially reduce yield [11]-[13]. Heat stress also affects branch distribution and tuber quality, limiting productivity in regions with high temperatures such as North Africa [14]-[16]. In Bangladesh, the combination of high temperatures and periodic water stress poses a significant challenge for potato production, particularly in regions like Rajshahi, which are prone to drought and heat stress. Developing heat- and drought-tolerant potato varieties adapted to local agroclimatic conditions is therefore a key objective for sustainable production.

Genetic variability among different lines is a fundamental resource for breeding programs aimed at enhancing yield, stress tolerance, and quality [17]-[22]. Evaluating phenotypic traits such as plant height, stem number, tuber weight, and maturity allows breeders to identify superior lines with favourable growth and yield characteristics. Understanding the relationship between these traits and yield potential is essential for selecting high-performing genotypes and guiding hybridization programs [23]. Furthermore, planting time, day length, and duration of the growing season significantly influence tuber development and overall productivity [24]-[26]. Early or delayed planting can affect the number and size of tubers, as well as the total yield per hectare, highlighting the importance of optimizing agronomic practices in conjunction with varietal selection.

Considering these challenges and opportunities, this study was undertaken to evaluate twenty heat-tolerant potato lines for their phenotypic performance under the climatic conditions of the Rajshahi region. The primary objectives were to assess growth parameters such as plant height and stem number, determine plant maturity, and quantify yield attributes including tuber weight per plant, per line, and per hectare. The ultimate goal is to identify promising lines suitable for variety development that combine heat tolerance, high yield potential, and adaptability to local environmental conditions.

2. Materials and Methods

2.1. Plant Materials and Cultivated Conditions

The field experiment was conducted at Bangladesh Agricultural Research Institute, On-Farm Research Division, Region-1, Agriculture Research Division, Shyampur, Rajshahi-6212. Bangladesh during the period from 9th December 2021 to 16th March 2022 to find out the effect of heat on the growth and yield of potato. On 9th December 2021 minimum and maximum temperature were 13˚C and 25˚C respectively. Minimum temperature was 9˚C from 29th to 30th January 2022 and maximum temperature was 34˚C on 16th March 2022 throughout the cultivation period of these potato lines. Average minimum-maximum temperature from 1st December, 2021 to January, February 29th March,2022 were 12.8˚C - 23.1˚C, 10.7˚C - 23.8˚C, 14.3˚C - 26.7˚C, 24.1˚C - 36.9˚C respectively. Maximum temperature was between 28˚C to 34˚C throughout 1st March to 16th March during cultivation. Details about maximum and minimum temperature as reported by Bangladesh Rice Research Institute R.S, Rajshahi. The experimental site located in the 11th AEZ of Bangladesh named High Ganges River Floodplain [27]. The soils of this AEZ have been formed from the calcareous Ganges River alluvium [28]. The chosen location's analytical results for the soil sample were P^{H}; 7.5, total nitrogen (%); 0.07, P; 32.0 ppm, K; 0.28 Cmole/kg; S; 24.2 ppm, Zn; 1.86 ppm, B; 1.00 ppm. Result obtained from the mechanical analysis of the initial soil sample was done in the (SRDI) Soil Resource Development Institute, Regional Research Station, Shyampur, Rajshahi.

2.2. Land Preparation and Fertigation, Irrigation and Cultural Practices

A fertilizer does of N, P, K, Zn, S and B was supplied in the form of Urea (192 - 300 Kg/ha), Triple Super phosphate (105 - 150 Kg/ha), Muriate of potash (180 - 270 Kg/ha), Zinc sulphate (8 - 12 Kg/ha), Gypsum (60 - 82 Kg/ha) and Boric acid

(3 - 5 Kg/ha) as recommended doses for AEZ 11 [29]. Row to row distance and plant to plant distance was 60 cm and 25 cm, respectively. Three replications were done with Randomized complete block design. Seed tubers were planting on 09th December 2021. The twenty potato lines for heat tolerant are named TB15A-51, TB15A-118, TB15A-120, TB15A-141, TB15A-146, TB15B-05, TB15B-12, TB15B-19, TB16-09, TB16-10, TB16-11, TB19-01, TB19-06, TB19-07, TB19-09, TB19-17, TB19-23, TB19-25, TB19-39, TB19-19-40 were collected from Bangladesh Agricultural Research Institute. The heat tolerance lines were selected and used in this study on the previous screening by BARI and their recommendation. The sprouted seed tubers were treated with Dithane M-45 @ 2.5 g/L solution. Earthing up was done at 30, 40 and 60 DAP and the furrows turn into ridges up to 20 cm height. The second top dressing was completed 30 days after planting. First irrigation was done on 11th December 2021 after sowing and second irrigation was done at 17th January 2022. On 4th February 2022 heavy rainfall and on 10th February along with 24th February 2022 light rainfall happened. To protect the crop from diseases especially late blight and insect pest (particularly aphids) Malathion @ 2 ml/liter and (Maladan 50 EC) with water were applied for control aphids at 40 DAP and Dithane M-45 @ 2 g/liter was done at 60 DAP. Weeding was done when required. Haulm cutting of the crop was completed 90 days after planting. From 7 days after haulm cutting, digging was done. Mature potatoes were harvested on 16th March 2022.

2.3. Data Collection

Data on growth yield and yield contributing characters were recorded from the sample plants of each plot during experiment. The sampling was done randomly from each plot to record the data. Eight plants per plot were measured for sampling. Plant height and stem number were measured at 60 DAPS. Plant maturity was recorded at 70 DAP, 80 DAP and 90 DAP respectively due to heat /water shortage in 1 - 5 scale where 1 = Dead and 5 = very green. Plant maturities were recorded at 70 DAP, 80 DAP and 90 DAP due to heat /water shortage (1 - 5 scale, 1 = Dead and 5 = very green). To measure the yield tuber weight in a line was measured then yield per plant and Ton/Hectare were obtained.

$$\text{Yield per plant} = \frac{\text{Total tuber weight in line in kg}}{\text{Total number of plants in line}};$$

$$\text{Ton/Hectare} = \frac{\text{Yield per plant in kg} \times \text{Number of plants in one hactare}}{1000\ \text{kg}};$$

$$\text{Number of plants in One Hectare} = \frac{10000\ \text{m}^2}{\text{Area needed in m}^2\ \text{for one plant}}$$

2.4. Statistical Analysis

To find out the significance of experimental results the data on different parameters were analyzed statistically by using STATISTIX 10 package program.

3. Results and Discussion

3.1. Effect of Twenty Different Heat Tolerant Potato Lines on the Growth Physiology

3.1.1. Plant Height (cm)

The growth parameter of plant influence by various physiological process [30] [31]. Plant height exhibited significant variation among the evaluated lines. Measurements taken 60 days after planting (DAP) revealed that the highest mean plant height (54.33 cm) was recorded in the line TB19-23, which was statistically identical to TB19-39, TB15A-146, TB19-07, and TB16-10. The lowest plant height (33.00 cm) was observed in the line TB15A-51, which was statistically similar to TB15A-120 (**Figure 1**). [32] also reported significant differences in plant height among genotypes, with values ranging from 33.33 to 52.80 cm at 45 DAP. Although the present findings are comparable in magnitude, the observation period differs. In the same study, plant height at 60 DAP ranged from 38.60 to 64.67 cm, further supporting the genotypic variability in growth performance. Similarly, [33] reported that the cultivar "Asterix" exhibited the tallest plants (69.6 cm), while "Granola" showed the shortest (53.8 cm) at 60 DAPS, which differs from the present results in terms of absolute values. [34] observed that the highest plant height (56.68 cm) occurred in BARI Alu-40 with a December 20 sowing date, whereas the lowest (34.35 cm) was recorded for the same cultivar sown on November 20, consistent with the current study in terms of overall growth range. Moderate plant height and bushy growth habit are generally desirable traits for achieving higher yields (Rahman *et al.*, 2014). Variations in plant height are primarily influenced by the plant's genetic makeup and its corresponding growth characteristics [35].

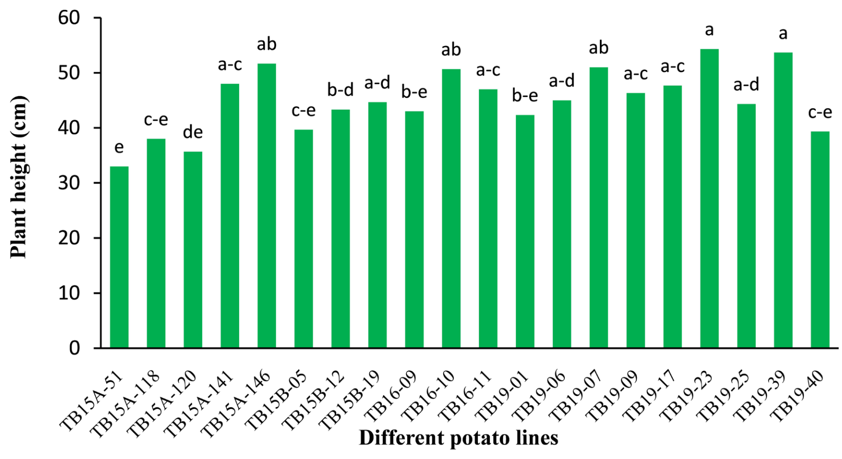

Figure 1. Plant height varies under different heat tolerant potato lines. Plant height was measured at 60 days after planting. Different letters indicate significant differences ($p < 0.05$; Turkey's HSD test). Values are the mean ± SD, n = 8.

3.1.2. Stem Number

Stem number was found to differ significantly among the evaluated potato lines.

Stem number per line was recorded 60 days after planting (DAP). The highest mean stem number (25.67) was observed in line TB19-25, which was statistically identical to TB16-10, TB15B-12, TB16-09, and TB16-11. The lowest mean (9.67) was recorded in TB15B-05, which was statistically similar to TB15A-141 (**Figure 2**).

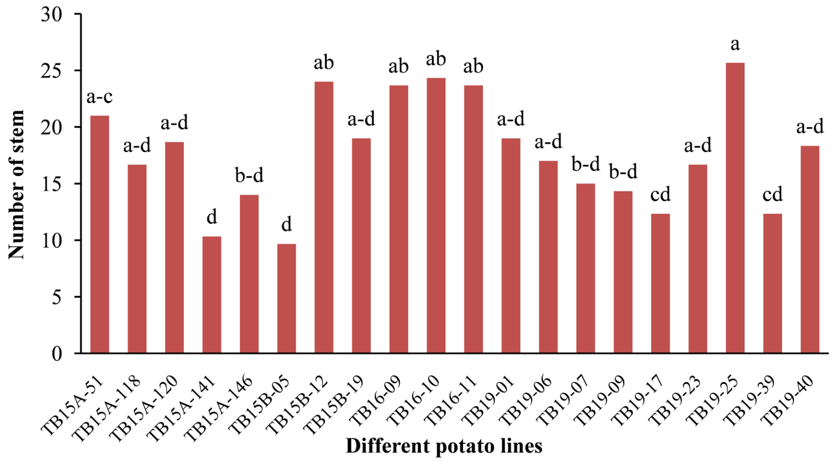

Figure 2. Different heat tolerant potato lines were found significant differences on the number of stems. Different letters indicate significant differences ($p < 0.05$; Turkey's HSD test). Values are the mean ± SD, n = 8.

In a previous study, Asterix exhibited the highest number of stems per plant (6.66) at 60 DAP, while Lady Rosetta showed the lowest (3.67) [36]. However, that study was conducted using different potato varieties, whereas the present study focused on potato lines, with five plants established per line. Therefore, the observed range of stem numbers per plant in this study differs from the findings of [36]. Similarly, Hossain (2011) reported that Asterix had the highest number of stems per hill (7.10) and Granola the fewest (4.09) at 60 DAPS in the same agro-climatic zone. [37] also noted that the maximum number of stems per hill (5.70) occurred in BARI Alu-41, followed by BARI Alu-40 (5.60) and BARI Alu-37 (5.30), while BARI Alu-36 produced the fewest stems (3.80).

3.1.3. Plant Maturity

Plant maturity was assessed at 70, 80, and 90 days after planting (DAP) using a 1 - 5 scale, where lower values indicated early senescence and higher values represented greener, late-maturing plants. Significant variation in maturity was observed among the tested potato lines across all observation stages, reflecting differences in growth duration and physiological responses to environmental conditions. At 70 DAP, lines TB16-11, TB15A-141, TB16-10, and TB19-39 exhibited the highest maturity score (5.00), remaining vigorous and green, and were statistically identical to TB15B-12, TB19-07, and TB19-23. Conversely, the lowest score (2.67) was recorded in TB15A-51, which was statistically similar to TB15A-120, TB19-09, TB19-40, and TB15A-118, indicating early senescence. Most other lines displayed intermediate scores between 3.0 and 4.0, suggesting moderate maturity levels. These findings imply that genotypic variation significantly influenced foliage longevity and growth duration during early reproductive stages (**Figure 3**).

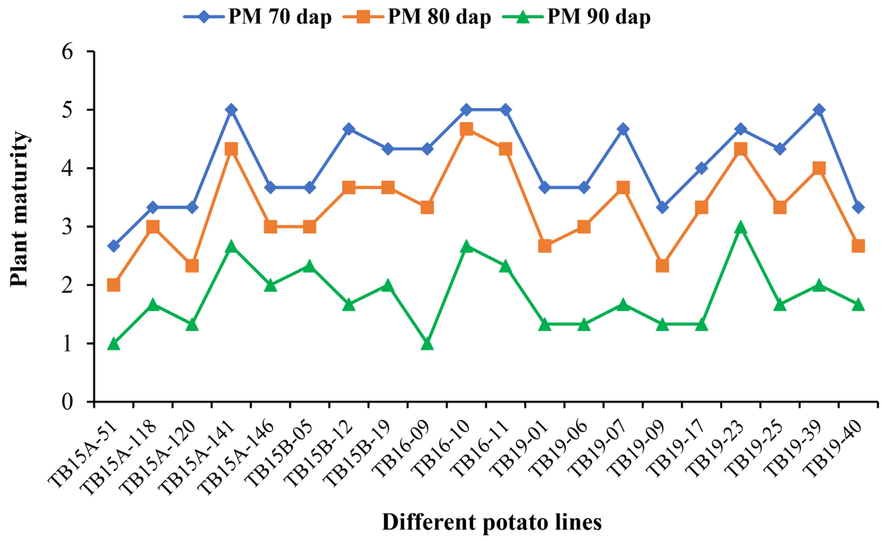

Figure 3. Plant maturity varies among different heat tolerant lines of potato at 70 DAP, 80 DAP and 90 DAP, PM = Plant Maturity, DAP = Days After Planting. 1 - 5 scale; 1 = Dead and 5 = very green. Different letters indicate significant differences ($p < 0.05$; Turkey's HSD test). Values are the mean ± SD, n = 8.

At 80 DAP, overall maturity scores declined compared with 70 DAPS, indicating progressive senescence. However, significant differences among lines persisted (**Figure 3**). TB16-10 recorded the highest mean score (4.67), statistically identical to TB19-23, TB16-11, and TB15A-141, demonstrating superior foliage retention and delayed leaf yellowing. In contrast, TB15A-51 exhibited the lowest maturity score (2.00), similar to TB15A-120 and TB19-09, reflecting early senescence and reduced vegetative activity. The moderate-performing lines TB15B-12, TB15B-19, and TB19-07 maintained intermediate scores between 3.5 and 4.0. Notably, TB16-10 remained the greenest at this stage, suggesting high photosynthetic persistence and stress tolerance under late-season conditions. By 90 DAP, senescence progressed substantially across all genotypes. The highest mean score (3.00) was recorded in TB19-23, statistically identical to TB16-10 and TB15A-141 (**Figure 3**), indicating relatively delayed maturity. The lowest score (1.00) was observed in TB15A-51 and TB16-09, denoting complete senescence and maturity completion. Several lines, including TB15A-120, TB19-01, TB19-06, TB19-09, and TB19-17, scored between 1.0 and 1.5, representing nearly mature plants. Only TB19-23 maintained a comparatively higher maturity score, suggesting a slower aging process and prolonged canopy activity.

Overall, the findings demonstrate clear genotypic differences in maturity behavior. Lines such as TB15A-51 showed consistent early maturity across all stages, which may be advantageous for short-duration cultivation or early harvesting. In contrast, TB16-10, TB15A-141, TB16-11, and TB19-23 retained green foliage for a longer period, reflecting delayed senescence and potentially higher assimilate production during late growth stages. These genotypes could therefore be promising candidates for environments favoring extended growth duration and high yield potential. The variation in maturity patterns may be attributed to genetic factors influencing leaf longevity, chlorophyll degradation, and stress tolerance mechanisms, aligning with earlier studies highlighting genotypic variability in physiological aging among potato cultivars.

3.2. Effect of Heat Tolerant Potato Lines on Yield Performance

Significant differences in yield were observed among the tested potato lines. For yield per line, the highest mean (4.00 kg) was recorded in TB19-23, which was statistically identical with TB16-10, TB16-11, and TB19-25. The lowest mean (1.25 kg) was observed in TB15A-120, statistically similar to TB19-09, TB15A-51, and TB15-01. Yield comparison across different harvesting times showed that tuber yield was maximized at 90 DAP, confirming this stage as the most appropriate for harvesting [36]. In contrast, harvesting at 100 DAP reduced yield due to increased soil and air temperatures, which adversely affect tuber bulking [38]. For yield per plant, TB19-23 again showed the maximum performance (0.81 kg), statistically identical with TB16-10, TB16-11, and TB19-25, while TB15A-120 produced the lowest yield per plant (0.26 kg), statistically similar to TB19-01. In terms of yield per hectare, TB19-23 achieved the highest mean yield of 53.36 t/ha, which was statistically identical with TB16-10 and TB19-25. In contrast, TB15A-120 recorded the lowest mean yield (16.59 t/ha), statistically identical with TB19-01 and TB15A-51 (**Figure 4**).

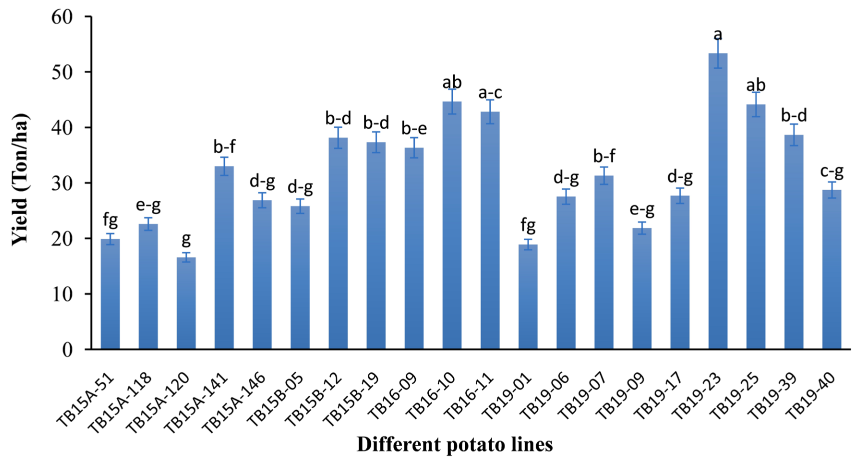

Figure 4. The average yield of twenty heat tolerant potato lines. Different letters indicate significant differences ($p < 0.05$; Turkey's HSD test). Values are the mean ± SD, n = 8.

These results considerably surpass the yields reported for established varieties such as Asterix (31.46 t/ha) and Granola (24.82 t/ha) [39]. Previous studies have reported yield ranges of 25 - 35 t/ha for Asterix, 25 - 40 t/ha for Cardinal and

Diamant, and 20 - 30 t/ha for Granola [40]. The observed variation in tuber yield among lines may be attributed to genotypic differences, plant growth vigor, crop duration, and adaptability to prevailing environmental conditions, as supported by earlier findings [41]-[45]. Overall, TB19-23 consistently demonstrated superior yield performance across all parameters, with 53.36 t/ha yield exceeding that of widely cultivated commercial varieties, highlighting its strong potential for variety development under heat stress conditions. However, multi-environment trials are necessary to confirm the stability and adaptability of the promising TB19-23 line

4. Conclusion

The present study on the phenotypic evaluation of twenty F_1 populations of heat-tolerant potato revealed significant variation among the lines for all observed traits, including plant height, stem number, plant maturity, and yield attributes. Among the tested lines, TB19-23 consistently exhibited superior performance, recording the highest plant height (54.33 cm), maximum stem number per plant, optimal plant maturity at 90 DAP (scale 3), and the greatest yield per plant (0.81 kg), per line (4.00 kg), and per hectare (53.36 t/ha). In contrast, TB15A-51 and TB15A-120 showed poor performance across several traits, particularly in plant maturity and yield. These results indicate that TB19-23 is a promising candidate for the development of heat-tolerant, high-yielding potato varieties. To further validate its potential, future research should include molecular and physiological characterization to identify genes associated with heat tolerance and yield stability. Additionally, pre-release multi-location trials across different agroecological zones are recommended to evaluate the adaptability, stability, and performance of TB19-23 under diverse environmental conditions. Such studies will provide comprehensive data to support its advancement toward official release as a new heat-tolerant potato variety.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Tiwari, J.K., Buckseth, T., Challam, C., Zinta, R., Bhatia, N., Dalamu, D., *et al.* (2022) CRISPR/CAS Genome Editing in Potato: Current Status and Future Perspectives. *Frontiers in Genetics*, **13**, Article 827808. https://doi.org/10.3389/fgene.2022.827808

[2] FAO (2022) World Food and Agriculture—Statistical Yearbook 2022. https://doi.org/10.4060/cc2211en

[3] Zhu, C. (2013) Development Course and Current Situation of Potato Production in China. *Journal of Anhui Agricultural Sciences*, **27**, 11121-11123. https://en.cnki.com.cn/Article_en/CJFDTOTAL-AHNY201327089.htm

[4] BBS (Bangladesh Bureau of Statistics) (2024) Year Book of Agricultural Statistics—2023 (35th Series ed.). Dhaka, Bangladesh: Statistics and Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh.

[5] Sarker, M., Moslehuddin, A., Jahiruddin, M. and Islam, M. (2019) Effects of Micro-

nutrient Application on Different Attributes of Potato in Floodplain Soils of Bangladesh. *SAARC Journal of Agriculture*, **16**, 97-108. https://doi.org/10.3329/sja.v16i2.40262

[6] Hossain, M.E.M. (1995) Nitrogen Requirement for Raising Cut Shoot Potato Crop. *Journal of the Indian Potato Association*, **22**, 52-55.

[7] Birch, P.R.J., Bryan, G., Fenton, B., Gilroy, E.M., Hein, I., Jones, J.T., *et al.* (2012) Crops That Feed the World 8: Potato: Are the Trends of Increased Global Production Sustainable? *Food Security*, **4**, 477-508. https://doi.org/10.1007/s12571-012-0220-1

[8] Begum, M., Saikia, M., Sarmah, A., Ojah, N.J., Deka, P., Dutta, P.K., *et al.* (2018) Water Management for Higher Potato Production: A Review. *International Journal of Current Microbiology and Applied Sciences*, **7**, 24-33. https://doi.org/10.20546/ijcmas.2018.705.004

[9] Chukalla, A.D., Krol, M.S. and Hoekstra, A.Y. (2015) Green and Blue Water Footprint Reduction in Irrigated Agriculture: Effect of Irrigation Techniques, Irrigation Strategies and Mulching. *Hydrology and Earth System Sciences*, **19**, 4877-4891. https://doi.org/10.5194/hess-19-4877-2015

[10] Sharma, R. and Bhardwaj, S. (2017) Effect of Mulching on Soil and Water Conservation—A Review. *Agricultural Reviews*, **38**, 311-315. https://doi.org/10.18805/ag.r-1732

[11] Momčilović, I., Pantelić, D., Zdravković-Korać, S., Oljača, J., Rudić, J. and Fu, J. (2016) Heat-Induced Accumulation of Protein Synthesis Elongation Factor 1A Implies an Important Role in Heat Tolerance in Potato. *Planta*, **244**, 671-679. https://doi.org/10.1007/s00425-016-2534-2

[12] Pantelić, D., Dragićević, I.Č., Rudić, J., Fu, J. and Momčilović, I. (2018) Effects of High Temperature on *in Vitro* Tuberization and Accumulation of Stress-Responsive Proteins in Potato. *Horticulture, Environment, and Biotechnology*, **59**, 315-324. https://doi.org/10.1007/s13580-018-0043-x

[13] Hancock, R.D., Morris, W.L., Ducreux, L.J.M., Morris, J.A., Usman, M., Verrall, S.R., *et al.* (2013) Physiological, Biochemical and Molecular Responses of the Potato (*Solanum tuberosum* L.) Plant to Moderately Elevated Temperature. *Plant, Cell & Environment*, **37**, 439-450. https://doi.org/10.1111/pce.12168

[14] Fahem, M. and Haverkort, A.J. (1988) Comparison of the Growth of Potato Crops Grown in Autumn and Spring in North Africa. *Potato Research*, **31**, 557-568. https://doi.org/10.1007/bf02361845

[15] Fleisher, D.H., Timlin, D.J. and Reddy, V.R. (2006) Temperature Influence on Potato Leaf and Branch Distribution and on Canopy Photosynthetic Rate. *Agronomy Journal*, **98**, 1442-1452. https://doi.org/10.2134/agronj2005.0322

[16] Sterrett, S.B., Henningre, M.R. and Lee, G.S. (1991) Relationship of Internal Heat Necrosis of Potato to Time and Temperature after Planting. *Journal of the American Society for Horticultural Science*, **116**, 697-700. https://doi.org/10.21273/jashs.116.4.697

[17] Hossain, M.M., Azad, M.A.K., Eaton, T.E. and Siddquie, M.N. (2021) Assessment of Different Traits to Evaluate Genetic Divergence in Some Wheat (*Triticum aestivum* L.) Genotypes under Late Sowing Condition. *American Journal of Plant Sciences*, **12**, 734-747. https://doi.org/10.4236/ajps.2021.125050

[18] Hossain, M.M., Azad, M.A.K., Alam, M.S. and Eaton, T.E. (2021) Estimation of Variability, Heritability and Genetic Advance for Phenological, Physiological and Yield Contributing Attributes in Wheat Genotypes under Heat Stress Condition. *American Journal of Plant Sciences*, **12**, 586-602. https://doi.org/10.4236/ajps.2021.124039

[19] Arifuzzaman, M., Kabir, M.S., Hossain, M.M., Hoque, M.A., Baki, M.A., Kabir, M.H., *et al.* (2022) Analysis of Genetic Diversity in Some Rice Varieties and Their Performance in Bangladesh. *International Journal of Advances in Agricultural Science and Technology*, **9**, 59-80. https://doi.org/10.47856/ijaast.2022.v09i12.003

[20] Mohamud, M.A., Hoque, A., Hassan, A.H., Hossain, M.M., Monira, S. and Muse, M.I. (2022) The Study of Genetic Divergence in Rice (*Oryza sativa* L.) Genotypes with Grain Yield and Different Morpho-Physiological Traits Using Mahalanobis' D2 Analysis. *International Journal of Advances in Agricultural Science and Technology*, **9**, 20-33. https://doi.org/10.47856/ijaast.2022.v09i10.003

[21] Mohamud, M.A., Hoque, A., Hassan, A.H., Hossain, M.M., Monira, S. and Muse, M.I. (2022) Estimation of Genetic Variability, Heritability and Genetic Advances for Short Duration and High Yielding Rice Genotypes. *International Journal of Advances in Agricultural Science and Technology*, **9**, 34-55. https://doi.org/10.47856/ijaast.2022.v09i10.004

[22] Karikor, M.A.S., Kabir, M.S., Hossain, M.M., Azad, M.A.K., Mohamud, M.A., Rahman, M.H., *et al.* (2022) Estimation of Combining Ability and Heterosis in Wheat. *International Journal of Advances in Agricultural Science and Technology*, **9**, 1-46. https://doi.org/10.47856/ijaast.2022.v09i12.001

[23] Hossain, M.M., Kaium, M.A., Al Amin, M., Ali, T.B., Jahan, N. and Uddin, M.N. (2023) Evaluation of Genetic Divergence in Various Potato Genotypes Grown in Bangladesh through Different Traits Assessment. *American Journal of Plant Sciences*, **14**, 1235-1247. https://doi.org/10.4236/ajps.2023.1411084

[24] Chadha, K. (2009) Handbook of Horticulture. Indian Council of Agricultural Research (ICAR).

[25] Akhter-Ul-Alam, M., Ferdous, Z., Islam, K., Khatun, M., Akter, M., Laily, U., *et al.* (2017) Sustainable Water Management for Potato Production in Drought Prone Areas in Bangladesh. *Annual Research & Review in Biology*, **21**, 1-9. https://doi.org/10.9734/arrb/2017/37622

[26] Pruthvi Raju, K., Soniya, K., Tigga, A., Balraj, G., Suresh, K., Sri, G., Singh, M. and Majaw, T. (2025) Correlation and Path Analysis of Potato Genotypes for Morpho-Physiological Traits under Indo-Gangetic Plain. *Plant Archives*, **25**, 2856-2860. https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.412

[27] Ripon, M.N., Moslehuddin, A.Z., Hoque, A.M., Ahmed, I.U. and Egashira, K. (2004) Mineralogy of Soils from Different Agroecological Regions of Bangladesh: Region 11-High Ganges River Floodplain. *Clay Science*, **12**, 197-203. https://doi.org/10.11362/jcssjclayscience1960.12.197

[28] FAO-UNDP (1988) Land Resources Appraisal of Bangladesh for Agricultural Development. Report 2.

[29] The Bangladesh Agricultural Research Council (2005) Fertilizer Recommendation Guide-2005. Farmgate, New Airport Road, Dhaka-1215. The Bangladesh Agricultural Research Council.

[30] Hossain, M., Shibasaki, Y. and Goto, F. (2025) Enhancement of Growth and Quality of Winter Watermelon Using LED Supplementary Lighting. *Horticulturae*, **11**, Article 262. https://doi.org/10.3390/horticulturae11030262

[31] Hossain, M.M., Shibasaki, Y., Nakao, R., Nitano, K. and Goto, F. (2025) Optimization of Ionic Strength of Nutrient Solution for Enhanced Hydroponic Watermelon Yield and Quality in Greenhouse. *Scientific Reports*, **15**, Article No. 25976. https://doi.org/10.1038/s41598-025-07250-9

[32] Rahman, M., Alam Patwary, M., Barua, H., Hossain, M. and Nahar, S. (2014) Evaluation of Yield and Yield Contributing Characters of Heat Tolerant Potato (*Solanum tuberosum* L.) Genotypes in Bangladesh. *The Agriculturists*, **12**, 50-55. https://doi.org/10.3329/agric.v12i1.19580

[33] Hoque, M., Yeasmin, T., Sweety, M. and Reza, M. (2023) Evaluation of Some High Yielding Potato Varieties at Various Growth Stages. *Bangladesh Journal of Horticulture*, **31**, 1-14.

[34] Ahmed, B., Sultana, M., Chowdhury, M., Akhter, S. and Alam, M. (2017) Growth and Yield Performance of Potato Varieties under Different Planting Dates. *Bangladesh Agronomy Journal*, **20**, 25-29. https://doi.org/10.3329/baj.v20i1.34878

[35] Heuer, B. and Nadler, A. (1995) Growth and Development of Potatoes under Salinity and Water Deficit. *Australian Journal of Agricultural Research*, **46**, 1477-1486. https://doi.org/10.1071/ar9951477

[36] Mokarroma, N., Ahmed, I., Zonayed-Ull-Noor, A. and Rahman, K. (2017) Effect of Harvesting Time on Growth and Tuber Formation in Processing Potato. *International Journal of Sustainable Crop Production*, **12**, 17-25.

[37] Islam, M.T., Arshad, F., Hossain, M.I., Kanta, R.A., Shaum, A.K. and Uddin, A.F. (2024) Adaptive Yield Performance of BARI Potato Varieties at Hill Valleys of Bandarban. *Journal of Bioscience and Agriculture Research*, **32**, 2629-2635.

[38] Gregory, L.E. (1956) Some Factors for Tuberization in the Potato Plant. *American Journal of Botany*, **43**, 281-288. https://doi.org/10.2307/2438945

[39] Howlader, O. and Hoque, M. (2018) Growth Analysis and Yield Performance of Four Potato (*Solanum tuberosum* L.) Varieties. *Bangladesh Journal of Agricultural Research*, **43**, 267-280. https://doi.org/10.3329/bjar.v43i2.37330

[40] Hoque, M., Abdullah, S., Hossain, M. and Bhuiyan, M. (2010) Processing Characteristics of Different Potato Varieties (In Bengali). Tuber Crops Research Sub Center, BARI.

[41] Sinha, N.K., Cash, J.N. and Chase, R.W. (1992) Differences in Sugars, Chip Color, Specific Gravity and Yield of Selected Potato Cultivars Grown in Michigan. *American Potato Journal*, **69**, 385-389. https://doi.org/10.1007/bf02877489

[42] Patel, C.K., Patel, P.T. and Chaudhari, S.M. (2013) Effect of Physiological Age and Seed Size on Seed Production of Potato in North Gujarat. *Potato Journal*, **35**, 1-2. https://epubs.icar.org.in/index.php/PotatoJ/article/view/32818

[43] Alam, M.K., Zaman, M.M., Nazrul, M.I., Alam, M.S. and Hossain, M.M. (2002) Performance of Some Exotic Potato Varieties under Bangladesh Conditions. *Asian Journal of Plant Sciences*, **2**, 108-112. https://doi.org/10.3923/ajps.2003.108.112

[44] Asakaviciute, R., Zelya, A., Andriychuk, T. and Razukas, A. (2025) Evaluation of Potato Varieties for Yield, Quality, and Late Blight Resistance. *Life*, **15**, Article 1378. https://doi.org/10.3390/life15091378

[45] CIP: Potato Facts and Figures. https://cipotato.org/potato/potato-facts-and-figures/