



Temperature Effect on Seed Germination Performance of a Local Variety of Onion in Bangladesh

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ABSTRACT: Seed germination performance test of Taherpuri onion (a local variety of onion) under six different temperatures (15, 20, 25, 30, 35 and 40°C) was the main goal of this experiment. Germination percentage (GP) was calculated at highest 60.25% at 25°C, and the highest germination rate 20.08 was observed in the same temperature condition. The lowest germination performance (13.25 % germination and 3.32 seeds per day as germination rate) was found at 40°C temperature. Finally, the authors mentioned the temperature 20 to 30°C as optimum range, and suggested the temperature 25°C as best suited for obtaining highest results in case of both germination percentage and germination rate of these seeds. To produce maximum seedlings of the local variety of onion, the mentioned temperature should be followed by the local farmers.

Keywords: Onion seed, Seed germination, Taherpuri, Temperature.

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Onion (*Allium cepa* L.) is considered as one of the most important bulbous spicy vegetables in the world (1). It has been taken for a long time as a member of the Liliaceae family, but according to current taxonomic reports, it belongs to the family Amaryllidaceae (2-4). It has foods, spices, and medicinal importance, and it becomes an integral part of our daily life (5-8). In Bangladesh, it is in the first position in respect of average production, although the mean yield is very low as compared to world average (9,10). The demand is increasing day by day due to increasing population; at the same time, there is still lack of high yielding domestic varieties compare to other countries (11). Every year Bangladesh has to import a big amount of onion from

India and China to meet up the demand (6). Onions are generally grown from seeds which are convex on one side, flattened on other side with black coated cover and having the viability of maximum one year. Smallholder farmers of Bangladesh gradually started onion seed production initiatives (12). The major factors are different varieties, spacing climate, and date of planting which are influenced onion seed productions (13).

In life cycle of plants germinations and seedling emergence are the two most important stages, and temperature is the major factor affecting the stages (14,15). Suitable germination conditions are helpful to produce overall healthy and vigorous seedlings.



Temperature plays a vital role in determining the periodicity of seed germination (16-18). The percentage, and rate of germination of onion seeds are vary notable stages in their life cycle, which are leads to difficulties if faces any problems during establishing optimum plant populations in the field (19). However, Bangladeshi scientists are trying to make and select an adaptive variety to enlarge the production capability to meet the country's demand (20).

Therefore, Taherpuri is regarded as less disease affected comparatively and trialed as a model crop in outdoor hydroponic production system earlier (21-24). Seed germination performance of this variety was assessed applying different natural water sources (25). As the variety found promising for low cost outdoor hydroponic farming in Bangladesh, there is a need to know the perfect environmental conditions for seed germination profitably prior to make any commercial alternative farming approach. The study aimed to know the effect of temperatures on germination performance of this local variety.

MATERIALS AND METHODS

Plant materials

In this experiment seeds of onion (*Allium cepa* L.) var. Taherpuri were used as model plant materials. Seeds were collected from authentic seed shop Talukdar Beej Vander of Barishal City. Seeds were collected at November, 2018.

Germination study

To evaluate the temperature effect on germination, the seeds were soaked with water for 24 h then the seeds were divided into four groups of 100 seeds in four replicates (Figure 1). Seeds were then allowed to germinate on petriplates with spread a layer of cotton wool and two layers of filter paper, wetted with water if necessary. Germination experiments were carried out under six different temperature (15, 20, 25, 30, 35 and 40°C) for 10 days. Incubator was used to continue the fixed temperature and mercury thermometer was placed in incubator to detect the temperature accuracies. Seeded petriplates arranged randomly in four blocks inside each incubator. Seeds of germinated radical were daily counted to the end of the experiment and were started from the first day after sowing. The seeds were considered to have germinated when the primary root protrusion attained a minimum length of 2 mm. At the end of the

days, the number of germinated seeds was taken for analysis according to the following formula.

$$GP = \frac{\text{No. of seeds germinated at final count}}{\text{No. of seeds placed for germination}} \times 100$$

$$\text{Germination rate (GR)} = \frac{\sum n}{\sum Dn}$$

Here, 'D' is the number of days from the start of germination and 'n' is the number of germinated seeds in D days. All collected data for germination were subject to "Analysis of variance" (ANOVA) using Microsoft excel 2010 software. Whenever the results were found significant through the 'F' test, means were adjudged by LSD at 5% level of probability.

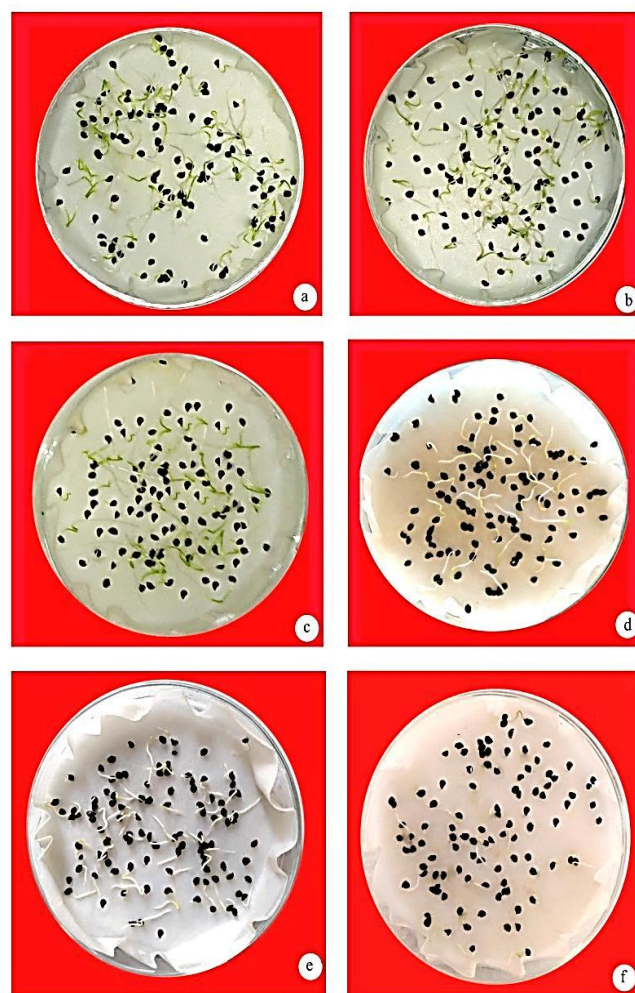


Figure 1. Effect of temperature on onion seed germination by (a) 15°C, (b) 20°C, (c) 25°C, (d) 30°C, (e) 35°C, (f) 40°C.

RESULTS AND DISCUSSION

The experiment at 6 different temperatures (15 to 40°C) was implicated in this study on onion seeds and found different results in germination. It was

observed that different induce temperatures statistically showed high significance among GP and GR. In the case of GP, the temperature 15 to 35°C showed no significant difference that means the temperature range 15–35°C was the good for this seeds germination than 40°C. This temperature observed a very low percentage of germination (13.25%), which was 45.25% at 15°C (Table 1). In terms of germination rate, at the beginning (15°C) gave 11.32 germination per day that increases with increasing temperatures till 25°C (rate of 20.08). Then the rate fall down when the temperature increased to 30°C and the rate was 17.08, although the changes were not significant that means the temperature range 20 to 30°C gave an almost the same result in germination rate.

Table 1. Mean performance of the germination percentage (GP) and germination rate (GR) values for six temperatures.

SL	Temperature	GP (%)	GR
1	15°C	45.25a	11.32b
2	20°C	58.00a	19.34a
3	25°C	60.25a	20.08a
4	30°C	51.75a	17.08a
5	35°C	43.00a	10.75c
6	40°C	13.25b	3.32d
7	F-value	30.671	52.929

Note: Values with different letters are significantly different at $P < 5\%$ by LSD test.

The other two temperatures (35 and 40°C) showed a drastic reduction in case of germination rate with significance at 5 percent probability levels, 10.75 and 3.32, respectively. GP and GR, both were lowest at 40°C, which indicated the temperature was fully unsuitable for germination of these experimented seeds. The authors concluded the temperature 20 to 30°C as optimum for germination performance considering both germination percentage and germination rate. Besides, the authors also suggested the temperature of 25°C as best suited for these seeds, although the germination performance was statistically almost the same with the optimum temperature range. To produce the highest amount of seedlings farmers should follow the mentioned temperatures for this local variety of onion in Bangladesh.

CONFLICT OF INTEREST

No any conflict of interest.

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Author's contributions

Irani Khatun performed this experiment and prepared the manuscript. Riyad Hossen planed, design and participated in data analysis, and finally edited the manuscript.

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