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Performance of Varieties on the Yield and Quality of Onion (*Allium cepa* l.) through Set to Bulb Method

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment was laid out at farm of Spices Research Sub-Centre (SRSC), Bangladesh Agricultural Research Institute (BARI), Faridpur, Bangladesh during the winter season of 2021-2022. The study comprised 3 new varieties viz. BARI Piaz-4, BARI Piaz-6 and LalTeer King, while BARI Piaz-1 was used in the study as check. The trial was conducted to explore potentialities of new developed varieties for getting higher yield and quality of onion in set to bulb method. The experiment was carried out in randomized complete block design with three replications. The finding depicted that the varieties responded significantly on the parameters studied except days to maturity of bulb and disease rating. The variety BARI Piaz-4 and LalTeer King showed the best performance on the basis of incidence of bolting, split bulb, diameter of bulb, individual bulb weight

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and yield of onion. On the other hand, BARI Piaz-1 had the highest dry matter content and total soluble solid content against other varieties. Finally, new developed varieties such as BARI Piaz-4 and LalTeer King would be used for getting higher yield of early green onions in set to bulb method.

Keywords: Cultivars; observation; quantitative and qualitative.

1. INTRODUCTION

The government of Bangladesh imports around 10 lakh metric tons onions per year expending foreign money for meeting the demand of the country [1]. To meet the annual demand farmers of Bangladesh grow their onion following three methods: a) transplanting of seedlings, b) direct seeding in line or broadcast and set (bulb to bulb) method [2]. Around 60-65% and 5-10% of total annual onion are produced using transplanting of seedlings and direct seeding, respectively while the rest by onion set [3]. Around 25-30% of total annual onion is produced by using sets. Hence in Bangladesh, bulbs produced from set method meet up a remarkable portion of annual demand [4]. In many countries, onions are largely planted as sets [5]. The bulbs produced in this method are entirely fresh (green onion) and these bulbs are immediately consumed before harvesting winter onions but not for store purpose. These crops come into the market quite early in the season and meets market demand for several months. However, early harvesting compensates by high price received for the crops. The sets are produced in previous season by seeding thickly and those sets are planted in September to October. The green bulbs are harvested in December to January. Growing onions through sets is a traditional method. Once a time farmers of Bangladesh were dependent on only one variety like BARI Piaz-1 for production of early onion crop in set method. Now-a-days, they have many alternative varieties to grow early crops. Besides BARI Piaz-1 Spices Research Centre (SRC), BARI, Bogura has released more two improved winter onion varieties viz. BARI Piaz-4 and BARI Piaz-6. LalTeer Seed Limited, Dhaka, Bangladesh also has released an improve variety namely LalTeer King which is grown by farmers. In the country, so far no research work was done comparing aforesaid varieties in set method.

The present experiment was, therefore, undertaken to explore potentialities of new released improved varieties under set to bulb method for getting higher yield and quality of onion.

2. MATERIALS AND METHODS

The present research work was laid out at the experimental field of Spices Research Sub-Centre (SRSC), Bangladesh Agricultural Research Institute (BARI), Faridpur during winter season of 2021-2022. The study was set up to explore potentialities of new developed varieties such as BARI Piaz-4, BARI Piaz-6, LalTeer King and BARI Piaz-1 (as check) for getting higher yield and quality of onion in set to bulb method. The experiment was carried out in randomized complete block design with three replications. The onion sets from each variety were planted in the trial plot maintaining 15 cm x 10 cm spacing. The size of sets was 4 ± 0.5 to 6 ± 0.50 g [2]. "The unit plot size was 5.00 m x 4.00 m. The experimental field was fertilized with 3 tones well-decomposed cowdung, 120 kg N, 50 kg P, 85 kg K and 40 kg S per hectare. Nitrogen, phosphate, potash and sulphur were supplied in the form of urea, TSP, MP and gypsum, respectively. The entire quantity of cowdung, P, K, S and one third of N were applied as basal dose during land preparation. The remaining N was used as top dress in two equal splits at 20 and 30 days after set planting. The fungicide mancozeb/iprodione @ 3 g/1 litre of water was sprayed at fortnightly interval commencing from one month after set planting. All other recommended management practices were followed for variety. The experimental site is belonging to Agro Ecological Zone (AEZ) no. 12 (Low Ganges River Floodplain). The geographic coordinates of the trial site are 23° 11′ N and 89° 09′ E. While, its elevation is about 12 meters above sea level. The soil was texturally clay loam. Soil samples were randomly collected at 0-30 cm soil depth for physical and chemical analysis before the commencement of the experiment" [5a]. The physico-chemical properties of the field experimental plot are summarized in the Table 1. "The data recorded were: plant height (cm), number of leaves per plant (no.), percent bolting (%), days to maturity of bulb, equatorial diameter of bulb (cm), individual bulb weight (g), percent split bulbs (%), dry matter content of bulbs (%), total soluble solid content (°brix), disease rating (0-5 scale), bulbs weight per plot (kg/ha) then calculated as fresh yield per hectare (t). Ten

plants were randomly selected from each plot for data recording and averaging it. Plant height and number of leaves were recorded at 45 and 65 days after planting of sets. But average plant height and number of leaves were presented in the paper. The number of bolting plants was visually counted in each plot, recorded and expressed in percent in relation to the total number of plants. After counting the percent of bolting, the flower stalks are broken down. Bulbs were harvested at maturity when the pseudostem of non-bolted plants becomes flaccid and unable to support the leaf blades" [6]. Days to maturity were recorded considering days between planting of sets and harvesting of bulbs. The number of multiplier bulbs was visually counted in each plot, recorded and expressed in percent in relation to the total number of bulbs per plot. The percent dry matter content of bulbs was calculated by dry weight basis as per procedure of Walle et al. [7]. The total soluble solids (TSS) content of bulbs were recorded by hand refractometer (ATAGO, Master-53M, Japan) with a range of 0-53 °brix. The stemphylium leaf blight/purple blotch severity of onion was scored by following 0-5 scale, as described by Sharma [8]. The details of scales are as follows: 0-no disease symptoms, 1- a few spots towards tip covering 10% leaf area, 2- several dark purplish brown patch covering up to 20% leaf area, 3- several patches with paler outer zone covering up to 40% leaf area, 4- leaf streaks covering up to 75% leaf area or breaking of the leaves from centre and 5- complete drying of the leaves or breaking of the leaves from the centre. Observations were made at the first appearance of disease symptoms on leaves, till the harvest at weekly intervals. Equatorial diameter is the maximum width of the onion in plane perpendicular to the polar diameter and it was recorded with slide calipers. The recorded data were analyzed statistically as suggested by Gomez and Gomez [9] and the means were compared by least significant difference (LSD).

Table 1. Physico-chemical properties of initial soil at the experimental plot of SRSC, BARI, Faridpur in 2021-2022

Soil texture	Soil pH	OM (%)	K	Ca	Mg	Total N (%)	P	S	B	Zn	Fe	Cu	Mn
			meq/100 g				μg/g soil						
Clay loam	8.10	1.43	0.57	27.96	4.30	0.08	21.70	18.60	0.67	2.76	33.92	0.53	11.90
Critical level			0.12	2.0	0.5	0.12	7.0	10.0	0.2	0.6	4.0	0.2	1.0

3. RESULTS AND DISCUSSION

The results depicted that the parameters studied under the experiment were significantly affected by varieties except disease rating and days to maturity (Table 2).

Table 2. Effect of varieties on the growth, yield and quality of onion bulb in set to bulb method at SRSC, BARI, Faridpur during 2021-2022

Seed rate	Plant height (cm)	Number of leaves/plant	Days to maturity	Bolting (%)	Splitting (%)	Bulb diameter (cm)
V_1:BARI Piaz-1	48.64	7.86	82.83	40.08	72.16	3.32
V_2:BARI Piaz-4	51.94	8.51	84.12	31.58	50.21	4.03
V_3:BARI Piaz-6	47.67	8.00	81.69	28.39	69.04	3.53
V_4:LalTeer king	50.51	9.34	84.01	30.45	45.60	3.92
CV (%)	5.15	4.65	11.24	5.82	5.00	9.22
LSD (0.05)	4.012	0.783	-	3.795	5.920	0.682
Level of sig.	*	*	NS	**	**	*

*Footnote: ** Significant at 1% level of probability, * Significant at 5% level of probability and NS-Not significant*

Contd. Table 2.

Variety	Disease rating (0-5 scale)	Individual bulb weight (g)	Dry matter of bulb (%)	TSS (°brix)	Bulb yield (t/ha)
V_1:BARI Piaz-1	2.56	20.42	19.18	18.15	17.64
V_2:BARI Piaz-4	2.32	27.03	15.18	14.33	23.55
V_3:BARI Piaz-6	2.29	20.79	15.31	14.03	19.05
V_4:LalTeer king	2.08	24.60	14.13	14.97	21.54
CV (%)	13.45	5.00	9.54	3.37	6.69
LSD (0.05)	-	2.310	3.041	1.034	2.701
Level of sig.	NS	**	*	**	**

*Footnote: ** Significant at 1% level of probability, * Significant at 5% level of probability and NS-Not significant*

3.1 Plant Height

The variety BARI Piaz-4 exhibited the tallest plant height (51.94cm) insignificantly followed by LalTeer King (50.51 cm). The shortest plant height (47.67cm) was recorded in BARI Piaz-6 which was significantly differed with BARI Piaz-4. The variation in plant height might be due to genetic causes. The present result corroborates the findings of Walle et al. [7] and Sirajo and Namo [10].

3.2 Number of Leaves per Plant

The maximum number of leaves per plant was counted in LalTeer King (9.34) significantly followed by BARI Piaz-4 (8.51 cm). The variety BARI Piaz-1 had the minimum numver of leaves (7.86). The variation in pungency of onion among the genotypes/varieties might be due to their genetic potential. The similar finding in onion was also reported by Ratan et al. [11]. On the contrary, Sirajo and Namo [10] stated that differences in mean number of leaves per plant among the genotypes were not significant.

3.3 Days to Maturity

Though days to maturity of bulb were not responded by variety but BARI Piaz-6 matured earlier (81.69days) than those of other varieties. Delayed maturity was noted in BARI Piaz-4 (84.12days) which was at par with LalTeer King (84.01days). The apparent cause of the insignificant variation among varieties might have been due to their genetic potential. The earlier reports of Walle et al. [7] and Arya et al. [12] showed significant differences among the variety in days to maturity.

3.4 Bolting

The variety in bolting was significantly differed with each other. The maximum incidence of bolting was occurred in BARI Piaz-1 (40.08%) followed by followed by BARI Piaz-4 (31.58%). The least incidence of bolting was computed in BARI Piaz-6 (28.39%). The difference in maturity of bulbs could be due to genetic character among varieties. Abu-Rayyan and Abu-Irmaileh [13] reported that onion required cool weather during inflorescence initiation and seed stalk development. All varieties studied were grown in a same environment. So, this difference in bolting percent could be due to hereditary causes of varieties. The result is in consent with the finding of Lancaster et al. [14].

3.5 Splitting of Bulb

The highest percent of split bulbs was observed in BARI Piaz-1 (71.16%) insignificantly followed by BARI Piaz-6 (69.04%). However, the lowest percent split bulb (45.60%) was registered in LalTeer King. It is hypothesized that the variation in split bulb among varieties might be attributed to their genetic factor. The result is in accordance with the earlier report of Arya et al. [12].

3.6 Diameter of Bulb

The greatest size of bulb was obtained from BARI Piaz-4 (4.03 cm) which was non-significantly followed by LalTeer King (3.92 cm). The BARI Piaz-1 demonstrated the smallest size of bulb (3.32 cm). The variation in multiplier bulb was mainly attributed to the genetic effect of varieties. The similar claims were also made by Arya et al. [12] and Walle et al. [7].

3.7 Incidence of Disease

Though the incidence of disease was not affected by varieties, BARI Piaz-1 was the most susceptible (2.56) to diseases. While, LalTeer King had the least susceptible (2.08). Insignificant difference might also happen due to

genetic differences among the varieties screened. The present result is on the contrary to the finding of Ruth [15] who found significant difference among the varieties in incidence of diseases.

3.8 Individual Bulb Weight

The difference among the varieties in bulb weight was markedly influence with each other. The BARI Piaz-4 yielded the heaviest bulb (27.03 g) followed by LalTeer King (24.60 g). The BARI Piaz-1 produced the lightest bulb (20.42 g). The apparent cause of the variation in bulb weight among the varieties might have been due to their genetic potential. The similar results have also been reported by Sirajo and Namo [10].

3.9 Dry Matter Content of Bulb

The BARI Piaz-1 gave the highest dry matter content of bulb (19.18%) significantly followed by BARI Piaz-6 (15.31%). The lowest dry matter content (14.13%) was noted from LalTeer King (14.13%). The difference in dry matter bulb could be attributed due to genetic potential of the varieties. The result concurs with that of Arya et al. [12] who reported that varieties significantly influenced the percent dry matter of bulbs.

3.10 Total Soluble Solid Content of Bulb

The BARI Piaz-1 exhibited the maximum reading for total soluble solid (TSS) content (18.15°brix) significantly followed by LalTeer King (14.97°brix). The TSS content among BARI Piaz-4 (14.33°brix), BARI Piaz-6 (14.03°brix) and LalTeer King were mutually insignificant. Similarly, the fluctuation in TSS content among the varieties might happen due to similar causes as found for the dry matter content. The result agrees with the finding of Arya et al. [12].

3.11 Yield

The BARI Piaz-4 gave rise to the highest yield (23.55t/ha) which was insignificantly followed by LalTeer King (21.54t/ha). Nevertheless, the lowest yield was recorded in BARI Piaz-1 (17.64t/ha). The variation between BARI Piaz-6 (19.05t/ha) & BARI Piaz-1 and LalTeer King & BARI Piaz-6 were not statistically significant. The variation in yield might have due to their differences in bulb weight along with their inherited wealth. The similar result was also provided by Walle et al. [7], Dwivedi et al. [16] and Lancaster et al. (14). Besides, the reason for lower yield from BARI Piaz-1 might be due to producing higher bolting in BARI Piaz-1. Khan and Shanmugashundaram [17] stated that bolting reduced the bulb weight of onion.

4. CONCLUSION

The finding of the current study concluded as follows:

New varieties such as BARI Piaz-4 and LalTeer King exhibited the better performance on the basis of yield, incidence of bolting and splitting bulb as compared to BARI Piaz-1. Hence these new varieties would be used to obtain higher yield of early green onions in set to bulb method.

However, BARI Piaz-1 had the highest dry matter and TSS content against other varieties.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Khan MA, Rahman MM, Ara R, Mozumder SN, Mohanta HC and Brahma S. Application of good agricultural practices in controlling abiotic disorders of onion (in Bengali). A Folder, Publication No. SRSC/BARI/Farid.02/2022. Spices Research Sub-Centre, Bangladesh Agricultural Research Institute, Bangladesh. 2022;1-8.
2. Khan MA, Rahman MM and Rinky S. Effects of set size and plant population density on the yield attributes, yield and quality of onion (*Allium cepa* L.). North American Academy Research Journal. 2021;4(7):93-109.
3. Khan MA, Wohab MA, Rahman MM and Alam MM. Use of high-speed rotary tiller and power tiller operated seeder for onion (*Allium cepa* L.) cultivation. Archives of Agriculture and Environmental Science. 2021;6(3):334-340.
4. Rahim MA, Hakim MA, Begum A and Islam MS. Scope for increasing the total yield and fulfilling the demand for onions during the period of shortage in Bangladesh through the bulb to bulb (set) method of production. Onion Newsletter for the Tropics. 1992;4:4-5.
5. Khokhar KM, Hussain SI, Mahmood T, Hidayatullah and Laghari MH. Bulb yield

and quality as affected by set size in autuman season onion crop. Asian Journal Plant Sciences. 2002;1:657-658.

5a. Khan M, Rahman M, Sarker R, Haque M, Mazumdar S. Effects of transplanting time on the yield and quality of onion (*Allium cepa* L.). Archives of Agriculture and Environmental Science. 2020;5(3):247-253.

6. Brewster JL. The influence of cultural and environmental factors on the time of maturity of bulb onion crops. Acta Horticulturae. 1990;267:289-96.

7. Walle Brewster JL. The influence of cultural and environmental factors on the time of maturity of bulb onion crops. Acta Horticulturae. 1990;267:289-96.

8. Sharma SR. Effect of fungicidal sprays on purple blotch and bulb yield of onion. Indian Phytopathology. 1986;39(1):78-82.

9. Gomez KA. and Gomez AA. Statistical Procedures for Agricultural Research (2nd edition). John Wiley and Sons, New York, USA. 1984;680.

10. Sirajo SA and Namo OAT. Morphogenetic studies of some genotypes of onion (*Allium cepa* L.) in Jos, Nigeria. Sustainable Agricultural Research. 2019;8(1):33-41.

11. Ratan D, Gowda RV and Himanshu H. Evaluation of different onion (*Allium cepa* L.) genotypes for yield and quality parameters in kharif season under Bengaluru conditions, India. International. Journal Current Microbiology and Applied Science. 2017;6(11):2393-2398.

12. Arya JS, Singh N, Arya P and Kant A. Morphological variation and relationship among onion germplasm for quantitative and qualitative traits at trans-Himalaya Ladakh, India. Australian Journal Crop Sciences. 2017;11(3):329-337.

13. Abu-Rayyan AM and Abu-Irmileh BE. Onion development and yield responses to manual cultivation, herbicides or colored mulchus. J. Vegetable Crop Prodduction. 2004;10(1):37-49.

14. Lancaster JE, McCartney EP, Jermyn WA and Johnstone JV. Identification of onion cultivars for commercial production in Canterbury, New Zealand. New Zealand Journal of Crop & Horticultural Science. 1995;23(3):299-306.

15. Ruth C. Screening and evaluation of onion varieties against fungal diseases in onion (*Allium cepa* L.). International. Journal Applied & Natural Science. 2017;6(5):135-140.

16. Dwivedi YC, Kushwah SS and Sengupta SK. Evaluation of onion varieties for growth, yield and quality traits under agro-climatic conditions of Kymore plateau region of Madhya Pradesh, India. Agriculture Science Digest. 2012;32(4): 326-328.

17. Khan MA and Shanmugashundaram S. Effects of day length on bolting and its effects on growth and development of short day onions. Journal of the Bangladesh Society for Agricultural Science and Technology. 2013;13(3&4): 127-130.

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