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Effects of Seedlings Transplanting Time and Variety on the Yield and Quality of Summer Onion (*Allium cepa* L.) Seed

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A b s t r a c t

The experiment was carried out at the Pakuria village under the Bagha Upazilla of Rajshahi district during the year of 2018-2019 to find out the effect of seedlings transplanting time on the yield and quality seed production of summer onion. The experiment was laid out in a Split-plot design with three replications in which seedlings transplanting times was used as main plots and varieties as sub-plots. These treatments include- Seedlings transplanted at November 20(D_1), Seedlings transplanted at December 10 (D_2) and Seedlings transplanted at December 30 (D_3) while the varieties treatments were BINA Piaz-1 (V_1), BINA Piaz-2 (V_2) and BARI PIAZ-3(V_3). The total number of unit plots in the entire experimental plot was 27 (3×3×3). The unit plot size was 2 m×2 m=4m^2. The plot to plot distance was 0.5m and the block to block distance was 1.0m. The soil p^H was 8.15. Results showed significant variations among the yield and quality characters of summer onion seeds due to seedlings transplanting time. The highest quality summer onion seed yield (802.83 kg ha^{-1}) was obtained from seedlings transplanted at December 10 (D_2) that was at par with seedlings planted at November 20 but the lowest seed yield (728.57 kg ha^{-1}) was found in late transplanting time at December 30(D_3). On the other hand, the variety BINA PIAZ-1 (V_1) produced the highest amount (816.82 kg ha^{-1}) quality seed and the lowest seed yield was obtained from BARI PIAZ-3(V_3). The combined effect of BINA PIAZ-1 with seedlings transplanted at December 10 (D_1V_1) give the highest yield (892.25 kg ha^{-1}) summer onion seed and the lowest (616.03 kg ha^{-1}) one was exerted from the combination of D_3V_3. From the study, it can be suggested that onion seedlings transplanted at early to middle of the growing season produced superior quality seeds summer onion while the late transplanting give the inferior quality and minimum seed yield of summer onion.

Keywords: Seedling, transplanting time, variety, quality, seed yield and summer onion.

Introduction

Onion (*Allium cepa* L.), a member of the Alliaceae family is one of the most significant spices as well as vegetable crops in the world including Bangladesh. Onion originated from Central Asia is one of the most important commercial crops grown throughout the world. It contributes about 7 per cent share in total vegetable production (Anonymous, 2011). Although the origin remains debatable, the middle Asiatic countries in the region of Iran and Pakistan are considered the primary centre of origin of onion. The near east Asiatic and Mediterranean regions are considered to be the secondary centre of origin (Anonymous, 2003). It has been grown throughout the world in at least 175 countries since around 5000 years ago (Pareek et al. 2017). Around 110 million tons of onions were produced worldwide on 5.96 million ha of land, of which 2.37 million ha were in South A sia and 4.14 million ha were in Asia. The yield of onion in South Asia is almost 16.33 t/ha which is comparatively lower than Asia's 18.45 t/ha and 18.53 t/ha world average yield. However, the average yield in Europe is around 30.38 t/ha, which is very high compared to the world average, commencing the potential yield of onion (FAOSTAT, 2024). In Bangladesh, Onion cultivation area is about 0.194 million hectares with a total production of 2.269 million metric tonnes per annum. Average yield of onion is low, being 11.67 t/ha (BBS, 2022) as compared to India where 16.80 t/ha (NHB, 2019). The government of Bangladesh imports about 1.0 million metric tonnes of onion per year expending a huge foreign currency for meeting the demand of the country (Khan et al., 2020). The ability of farmers to obtain better onion seed has previously been hampered by a lack of quality seed supply through the official system and lack of technical assistance for the promotion of informal seed systems. On the other hand, Onion crop is being grown over a greater area, which

Table 1. Effect of date of planting on the yield contributing characters of onion seed crop.

Date of Seedling transplanting	Length of Flower Stalk(cm)	Days to emergence 50% flowering stalk	No. of umbels plant^{-1}	No. of flowers umbel^{-1}	No. of seeded fruits umbel^{-1}	% Fruit set
November 20 (D_1)	39.07ab	60.40b	7.14ab	350.36ab	313.85b	89.30ab
December 10 (D_2)	42.64a	58.22c	7.64a	382.36a	356.17a	92.96a
December 30 (D_3)	37.66b	65.02a	6.73b	318.70b	275.03c	86.37b
LS	*	ns	*	*	*	*
CV(%)	7.97	8.53	9.59	7.27	5.74	4.02
+SE	1.4944	2.462	0.3242	12.021	8.5165	1.6934

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.
*= significant at 5% level of probability; ** = Significant at 1% level of probability;
NS = Not significant; LS = Levels of significance; CV=Co-efficient of variation

is increasing the need for high-quality seeds (Chengappa et al 2012). Achieving productivity targets depends on having healthy, viable, highest standard seed available during planting that enhances crop productivity and yield by 10-15% (Gaur et al 2020). As it continues to lose viability after 1-1.5 years of storage in an ambient environment, onion seed is regarded as an orthodox and poor store in this regard (Pritchard and Nadarajan, 2008). Promotion of seed production by the farmer to fulfil his seed requirement but low-quality seeds are the main constraint with onion crops because they cause sluggish and asynchronous germination as well as a significant proportion of aberrant seedlings (Borowski and Michaek 2006), so that seed production requires skills otherwise onion seed sold by private companies at very high rates.

climatic condition and cultural management might help solving shortage of onion production in the country. In Bangladesh, two types of onion variety such as winter and summer are cultivated. Formerly, Onion cultivation during summer season is constrained due to adverse weather along with absence of summer tolerant varieties and proper cultural practices. Recently Bangladesh Agricultural Research Institute (BARI) and Bangladesh Institute of Nuclear Agriculture (BINA) has released some summer onion varieties for growing in kharif (summer) season. Vegetative growth, bulb development, maturity and quality of onion seed also vary from variety to variety (Simon et. al., 2014).

The piece of research work was undertaken to find out the optimum planting time of seedlings and to achieve the best possible variety of summer onion for seed production under the existing agro-

Table 2. Effect of variety on the yield components of onion seed crop.

Variety	Length of Flower Stalk(cm)	Days to emergence 50% flowering stalk	No. of umbels plant^{-1}	No. of flowers umbel^{-1}	No. of seeded fruits umbel^{-1}	% fruit set
BINA Piaz-1 **(V_1)**	39.60ab	58.36b	7.48a	389.15a	357.77a	91.78
BINA Piaz-2 **(V_2)**	41.45a	61.03ab	7.15ab	346.92b	309.99b	89.39
BARI Piaz-3 **(V_3)**	38.33b	64.25a	6.87b	315.61c	277.29b	87.47
LS	*	*		*	*	ns
CV(%)	7.32	7.54	6.13	8.27	11.67	6.22
+_SE	1.3727	2.1746	0.2073	13.673	17.361	2.6251

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.
*= significant at 5% level of probability; ** = Significant at 1% level of probability;
NS = Not significant; LS = Levels of significance, CV=Co-efficient of variation

The productivity and quality of onion seed depend on many factors. Among them, date of seedling transplanting and variety are important factors. Several workers in the world found significant variation on the yield and quality of onion seed due to the date of seedling transplanting and varieties. Different transplanting times fall in different environment. Temperature and photoperiod are the major ecological factors influencing onion growth and development (Rabinowitch, 1985) as those control the onion plant in all phases (Coolong and Randle, 2003).

The planting time is playing important role since, onion is a photo thermal sensitive plant (Jones and Mann 1963) and a small fluctuation in environment can affect the yield and quality of seed. The planting time also affects the seed setting percentage because perfect matching of honey bee activities for pollination and anthesis of flowers is required for better seed setting, which is highly depends on range of temperatures prevailing in seed production areas (Teshome et al. 2014). High temperature during pollination and seed maturation, leads to more abortion of flowers resulting into less seed yield and quality. Introducing hot and rain tolerant onion variety in production or manipulation of prevailing summer climatic conditions of Bangladesh.

Materils and Methods

Experimental Site and Duration: The experiments were carried out at the Pakuria village under the Bagha Upazilla of Rajshahi district during the year of 2018-2019. Geographically the experimental field is located at $24^0$17'- $24^0$3l' N latitude and $88^0$28'-$88^0$43' E longitude at an elevation of 20 m above the sea level belonging to the High Ganges River Floodplain (AEZ-11). Three dates of Onion seedlings transplanting were considered under the study such as D_1: November 20, D_2: December 10 and D_3: December 30. While three varieties were tested in this trial as V_1: BINA Piaz-1, V_2: BINA Piaz-2 and V_3: BARI Piaz-3. The present research work was carried out at the Pakuria village under the Bagha Upazilla of Rajshahi district during the period from November 2018 to May 2019. The land was medium high, flat, well drained and above flood level. The soil p^H was 8.15.

Experimental Design and Treatment: The experiment was laid out in a Split-plot design with three replications in which seedlings transplanting times was used as main plots and varieties as sub-

plots. The total number of unit plots in the entire experimental plot was 27 (3×3×3). These treatments include-D_1=Seedlings transplanted at November 20, D_2= Seedlings transplanted at December 10 and D_3= Seedlings transplanted at December 30 while the varieties treatments were such as V_1=BINA Piaz-1, V_2=BINA Piaz-2 and V_3= BARI PIAZ-3. The unit plot size was 2 m×2 m=4m^2. The plot to plot distance was 0.5m and the block to block distance was 1.0m.

Table 3. Effect of date of planting on the seed yield and quality of onion seed crop

Date of Seedling transplanting	Seed weight umbel^{-1} (g)	Seed yield ha^{-1} (Kg)	Thousand seed weight (g)	Germination % of seed	Vigour index (VI)
November 20 (D_1)	2.54ab	728.57ab	3.30ab	87.51a	1120.80a
December 10 (D_2)	2.73a	802.83a	3.60a	91.25a	1231.60a
December 30 (D_3)	2.40b	678.48b	3.06b	76.63b	845.70b
LS	*	*	*	**	**
CV(%)	6.39	8.14	9.71	7.47	3.42
+_SE	0.0771	28.253	0.1522	2.9972	51.407

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.
*= significant at 5% level of probability; ** = Significant at 1% level of probability; NS = Not significant; LS = Levels of significance, CV=Co-efficient of variation

Plant materials: BINA Piaz-1: The summer onion variety Binapiaz-1 developed by Bangladesh Institute of Nuclear Agriculture (BINA) in 2018. It can produce seed in same year. It requires 180-190 days from seed to seed, 110-120 from seed to bulb and 100-110 from seedling to bulb. Number of leaves 8-10 per plant and individual bulb weight is 15 -20 gram. Plant height is 39-42 cm. Planting time and season: Mid-February to 1st week of March for bulb production, last week of October to 2nd week of November for seed production. Yield is 8.21-9.71 t/ha (bulb) and 635-1160 kg/ha (Seed) approximately.
BINA Piaz-2: BINA Piaz-2 (a mutant of BARI Piaz-2) is released by Bangladesh Institute of Nuclear Agriculture (BINA) in 2018. It is a specialized summer onion variety in Bangladesh, designed for Kharif-II season cultivation to ensure year-round supply. It is characterized by its adaptability to high temperatures, red-colored bulbs, and moderate to high pungency. It requires 210-215 days from seed to seed, 115-120 from seed to bulb and 110-120 from seedling to bulb. Number of leaves 5-6 per plant and individual bulb weight is 15 -20 gram. Plant height is 38-42 cm. Planting time and season: Mid- February to 1st week of March for bulb production, last week of October to 1st week of November for seed production. Yield is 8.68-9.45 t/ha (bulb) and 698-1370 kg/ha (Seed) approximately.
BARI Piaz-3: BARI Piaz-3 is a high-yielding, short-duration summer onion variety released by the Bangladesh Agricultural Research Institute (BARI) in 2000, specifically for Kharif/summer cultivation. Its key characteristics include round, reddish bulbs, Individual bulb weight is roughly 50-70 gm, plant height is 35050 cm. It is characterized by its adaptability to humid, off-season conditions and improved pungency (TSS:12-15%). Yield is 14-16 t/ha (bulb) and 259-300 kg/ha (Seed) approximately.

Cultivation practices: The land was prepared by ploughing and cross ploughing with a power tiller and subsequently leveled by laddering. The sprouted seeds (3-4 in number) of onion were sown directly in the raised seedbed. 45 days old seedlings were uprooted from the seedbeds and transplanted in the main field with the spacing of 20 cm × 15 cm in the afternoon on November 20, December 10 and December 30 respectively. Intercultural operations were done whenever required like gap fillings, weeding and mulching. First irrigation was given just after transplanting and 2nd was given at 20 DAT followed by 3rd irrigations was given at 40 DAT. Insect and diseases were controlled with appropriate control measures. Staking was provided in each plot using bamboo sticks and ropes to keep the plants and flower stalk erect as well as protecting the plants from influenced by storm and strong wind.

Data collection: Data were taken on plant height, number of leaves plant^{-1}, number of tillers plant^{-1}, length of flowering stalks plant^{-1}, number of umbels plant^{-1}, number of flowers umbel^{-1}, number of seeded fruits umbel^{-1}, percentage of fruit set, seed yield umbel^{-1}, seed yield ha^{-1}, thousands seed weight, germination percentage and vigour index. The matured seed umbels were harvested in three times when 15-20 % of the capsules were splitted and exposed their black seeds (Vander Meer and Van Bennecom, 1968). Umbels were harvested with a small portion of flower stalks in the morning to shattering of seed. Harvested onion umbels were dried in open sunlight on brown papers for 4-5 days. Threshing was done manually. Seeds were cleaned and dried again until the required moisture content (9-10%). Seeds were then kept in polythene bag. The experiment plots were observed frequently to record changes in plant characters at different stages of growth. Ten sample plants were selected randomly from each plot and data were recorded and their mean values were calculated for each of the following characters.

Table 4. Effect of variety on the seed yield and quality of onion

Variety	Seed weight umbel^{-1} (g)	Seed yield ha^{-1}(Kg)	Thousand seed weight (g)	Germination % of seed	Vigour index (VI)
BINA Piaz-1 **(V_1)**	2.88a	816.82a	3.53a	88.59a	1170.30a
BINA Piaz-2 **(V_2)**	2.55b	729.94b	3.30ab	85.36ab	1058.70b
BARI Piaz-3 **(V_3)**	2.26c	663.11c	2.68b	81.45b	845.70c
LS	**	**	*	*	*
CV(%)	6.05	8.10	7.68	5.44	7.67
+SE	0.0730	28.11	0.1203	2.1833	37.212

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.
*= significant at 5% level of probability; ** = Significant at 1% level of probability; NS = Not significant; LS = Levels of significance, CV=Co-efficient of variation

Statistical Analysis: Data were checked for all ANOVA assumptions. Analysis of variance (ANOVA) was done using Statistics 10.0 Software. Mean separations were done using LSD All-Pairwise Comparisons Test at 5% probability level.

Results

Plant height: The result of the data depicted that dates of seedlings transplanting and variety had significant effect on the characters under the study (Graph 1a). The highest plant height (43.57 cm) was obtained from transplanting of seedlings on December 10 (D_1) followed by D_2 (November 20) but the lowest value (36.68cm) was recoded from late planting December 10 (D_3). The present results corroborate the findings Ojha et al. (2019). They also found maximum plant height from earlier transplanting

of seedlings. The plant height was found to be significantly influenced by the varieties. The variety BINA Piaz-1 exhibited the maximum plant height (43.83 cm) and the shortest plant (38.54 cm) shown by the variety BARI Piaz-3 (Graph 2a). Mathanakar et al. (1990) opined that the varieties had profound influence on number of leaves/plant.

Number of leaves plant^{-1}: Number of leaves plant^{-1} was influenced significantly at 5 % level of significance by the seedling transplanting time. The highest number of green leaves (8.11) plant^{-1} was obtained from the planting date December 10 (D_2) that was statistically identical to planting date November 20 (D_1), while planting date December 30 (D_3) produced the lowest number of leaves (6.94) plant^{-1}(Graph1b). Singh and Korla (1991) reported that delay in transplanting onion seedlings caused decreased in number of leaves. The effects of different onion varieties were highly significant on number of leaves per plant. The highest number of leaves (8.22) was recorded for the plants obtained from the variety BINA Piaz-1(V_1), which was statistically similar to the variety BINA Piaz-2 (V_2) and the lowest (6.93) was recorded for the plants obtained from the variety BARI PIAZ-3(V_3) (Graph 2b). Tolessa (2017) who opined that the varieties had profound influence on number of leaves/plant.

of onion (Table 1). The BINA Piaz -1 produced the tallest (41.45 cm) flowering stalk followed by the BINA Piaz -2 (39.07 cm) while the BARI Piaz-3 produced the shortest (38.33 cm) flowering stalk. The BINA Piaz -2 showed statistically identical with the BINA Piaz -1(Table 2).

D**ays to emergence of 50% flowering stalk:** Planting seedling time of onion did influence significantly the Days to emergence 50% flowering stalk. The planting time December 20 (D_3) showed the longest time (65.02) to emerge of 50% flowering stalk while the planting time November 20 (D_1) showed the lowest time (58.22) to emerge of 50% flowering stalk (Table 1). Significant variation was observed to be due to the effect of different varieties on days to emergence of 50% flowering stalk (Table 1). The longest time (64.25 days) was noticed for BARI Piaz-3 (D_3) and the shortest time (58.36 days) was noticed for the BINA Piaz-1(D_1) (Table 2).

Number of umbels plant^{-1}: The seedling transplanting date had marked influence on the number of umbels plant^{-1} at 5% level of significance. The highest number of umbels plant^{-1} (7.64) was counted in the planting date December 10 (D_2), which was statistically identical to November 20 (D_1), whereas the lowest (6.73) was found in the planting date December 30 (D_3). The planting date November 20 showed the second performance (2.86)

Table 5. Combined effect of planting date and variety on the yield components of onion.

Date of seedling transplanting x Variety	Length of Flower Stalk(cm)	Days to emergence 50% flowering stalk	No. of umbels plant^{-1}	No. of flowers umbel^{-1}	No. of seeded fruits umbel^{-1}	% fruit set
D_1V_1	40.66abc	57.61bc	7.42abc	388.87ab	356.32ab	91.63ab
D_1V_2	38.84abc	60.13abc	7.12abc	343.94bc	305.38bc	88.79ab
D_1V_3	37.72bc	63.45abc	6.87abc	319.04cd	279.13cd	87.49ab
D_2V_1	44.64a	55.28c	7.96a	426.36a	404.53a	94.88a
D_2V_2	42.57ab	58.13bc	7.65ab	379.52ab	352.42ab	92.86ab
D_2V_3	40.71abc	61.24abc	7.32abc	341.21bc	310.94bc	91.13ab
D_3V_1	39.05abc	62.18abc	7.06abc	352.22bc	312.84bc	88.82ab
D_3V_2	37.39bc	64.83ab	6.70bc	317.29cd	272.33cd	85.83ab
D_3V_3	36.55c	68.06a	6.43c	286.59d	240.11d	83.78b
LS	*	*	*	*	*	*
CV(%)	7.32	7.54	6.13	8.27	11.69	6.22
+_SE	2.4499	3.9395	0.4371	22.768	25.987	4.0805

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.
*= significant at 5% level of probability; ** = Significant at 1% level of probability;
NS = Not significant; LS = Levels of significance, CV=Co-efficient of variation.

Number of tillers plant^{-1}: The seedling transplanting date had highly significant effect on the number of tillers per plant. The maximum number of tillers plant^{-1} (3.29) was produced by the planting date December 10 (D_2) followed by that of the planting date November 20 (3.14). The minimum number of tillers plant^{-1} (2.87) was obtained from the planting time December 20 (Graph 1c). The varieties had highly significant influence on the number of tillers plant^{-1} (Graph 2c). The Maximum number of tillers plant^{-1} (3.33) was produced from the BINA Piaz-1(V_1) followed by the BINA Piaz-2 (3.10) and the minimum number of tillers plant^{-1} (2.84) was obtained from the BARI PIAZ-3(V_3) (Graph 2c).

Length of flowering stalks: The length of flowering stalk was influenced significantly by the planting date. Planting date November 5 produced the tallest scape (56.76cm) followed by planting time November 5 while the planting date December 15 produced the shortest scape (47.75cm) (Table 2). The length of flowering stalk was noticed to be highly significant as influenced by different varieties

(Table 1). Different varieties had marked influence on number of umbels plant^{-1} (Appendix II). Among onion varieties, the highest number of umbels plant^{-1} (7.48) was counted in the BINA Piaz-1 (V_1), whereas the lowest (6.87) was found in BARI PIAZ-3 (V_3) (Table 2).

Number of flowers umbel^{-1}: Number of flowers umbel^{-1} was significantly influenced by the seedlings transplanting date and variety at 5% level of significance. The highest number of flowers umbel^{-1} (382.36) was found in the planting date December 10 (D_2) followed by that of the planting date November 20 (Table 1). The lowest number of flowers umbel^{-1} (318.70) was obtained from the planting date December 30 (D_3). The maximum number of flowers umbel^{-1} (389.15) was found in BINA Piaz-1 (V_1) followed by the BINA Piaz-2 (346.92). The lowest number of flowers per umbel^{-1} (315.61) was obtained from the BARI PIAZ-3 (V_3) (Table 2). Mohanty *et al.,* (1998) and Mohanty (2000) reported similar results.

Number of seeded fruits umbel^{-1}: There was highly significant variation among the seedling transplanting date and variety in respect of number of seeded fruits umbel^{-1}. The highest number of seeded fruits umbel^{-1}(356.17) was recorded from December 10 (D_2) followed by planting date November 20 (313.85). The lowest number of seeded fruits umbel^{-1} (275.03) was produced by the planting date December 30(D_3) (Table 1). The highest number of fruits per umbel (357.77) was recorded from the BINA PIAZ-1(D_1) followed by the BINA Piaz-2 (309.99). The lowest number of seeded fruits per umbel (277.99) was produced from the and BARI Piaz-3(D_3) (Table 2).

calculated on the basis of per umbel seed yield, the seed yield per hectare exactly followed the same trend as found in seed weight per umbel. Among three planting dates December 10 (D_2) gave significantly the highest estimated yield ha^{-1} (816.82 kg), which was statistically at par with the yield obtained with the planting date November 20 (D_1) but the lowest yield was recorded from the planting date December 30 (D_3) (Table 3). Seed production of onion with different varieties caused marked influences in seed yield per hectare. Among three onion varieties, the BINA Piaz-1(V_1) gave the highest estimated seed yield per hectare (816.82 g) and this was markedly superior to the yield obtained using the BARI

Table 6. Combined effect of planting date and variety on the seed yield and quality of onion

Date of seedling transplanting x Variety	Seed weight umbel^{-1} (g)	Seed yield ha^{-1}(Kg)	Thousand seed weight (g)	Germination % of seed	Vigour index (VI)
D_1V_1	2.84ab	810.38ab	3.50ab	91.78ab	1244.54ab
D_1V_2	2.51cde	719.58bcd	3.28bc	87.49abc	1106.79bc
D_1V_3	2.28ef	655.74cd	3.13bc	83.27bcde	1011.11cd
D_2V_1	3.12a	892.25a	3.85a	95.09a	1347.03a
D_2V_2	2.73bc	798.69ab	3.58ab	92.51ab	1236.53ab
D_2V_3	2.36def	717.55bcd	3.38bc	86.16bcd	1111.19bc
D_3V_1	2.67bcd	747.84bc	3.23bc	78.89cde	919.41de
D_3V_2	2.41de	671.56cd	3.04bc	76.08de	832.81de
D_3V_3	2.13f	616.03d	2.92c	74.92e	784.84e
LS	*	*	*	*	*
CV(%)	6.05	8.10	7.68	5.44	7.67
+SE	0.4239	48.781	0.2283	4.3031	73.568

In each column, figures having similar letters or without letters do not differ significantly, whereas figures bearing dissimilar letters differ significantly as per DMRT.

*= significant at 5% level of probability; ** = Significant at 1% level of probability;
NS = Not significant; LS = Levels of significance, CV=Co-efficient of variation

Percentage of fruit set: Percentage of fruit set varied significantly due to the different seedling planting date. The highest percentage of fruit set (92.96) was counted in the planting date December 10 (D_2), which was at par with the planting date November 20 (Table 1); whereas, the lowest (86.37) was in planting date December 30 (D_3). The effect of varieties on percentage of fruit set was not found to be significant. The percentage of fruit set of onion varieties ranged from 87.47 to 91.78. Numerically the highest percentage of fruit set (91.78) was observed from the variety BINA PIAZ-1 (V_1) followed by the BINA Piaz-2 (87.47) and the minimum fruit set (87.47) was found from BARI Piaz-3 (V_3) variety (Table 2).

Seed weight umbel^{-1}: Seed weight umbel^{-1} was found to be significant due to the different seedling transplanting date. The highest seed weight (2.73g) umbel^{-1} was observed from the December 10 (D_2) followed by the planting date November 20 and the lowest (2.40g) was observed from the December 30 (D_3) (Table 3). Seed weight per umbel was also found to be highly significant at 5% level of significance on account of different varieties (Appendix III). The highest seed weight per umbel (2.88 g) was observed from the BINA PIAZ-1(V_1) followed by BINA PIAZ-2 (2.55 g) and the lowest (2.26 g) was observed from the variety BARI Piaz-3 (V_3) (Table 4).

Seed yield ha^{-1}: Seed production of onion with different seedling transplanting date caused marked influences in seed yield ha^{-1} at 5% level of significance. Since the seed yield per hectare was

Piaz-3 (663.11g) and variety BINA Piaz-2 (V_2) (729.94g) (Table 4). The results were agreed with Mollah *et al.,*1987; *Nehra et al.,* 1988 ; Gill *et al.,* 1989 Bhardwaj 1991; Ali *et al.,* 1998; Dadhnia and Gajipara,1998 ; Abedin *et al.,* 1999; Singh and Sachan 1999 ; Muktadir 2000 and Muktadir *et al.,*2001, reported seed yields vary with the cultivars.

Thousand seed weight: The planting date had significant effect on 1000-seed weight. The highest 1000-seed weight (3.60g) was obtained from the planting dates December 10 (D_1) and the lowest was (3.06g) from December 30(D_3) (Table 3). Different varieties had also significant effect on 1000-seed weight (Appendix III). The mean weight of 1000-seed was found to be the maximum (3.53 g) with the BINA PIAZ-1 (Table 6). The lowest value (2.68g) was recorded from the BARI Piaz-3(V_3) (Table 4).

Germination percentage of harvested seed: Germination percentages of harvested seeds were significantly influenced by the planting date. Significantly higher germination percentage (91.25) was counted in planting date December 10 (D_2) over other planting time, which was statistically similar with the planting time November 20. The lowest germination percentage (76.63) was obtained from December 30 (D_3) (Table 3). Germination percentage of harvested seeds were significantly influenced by different varieties. Higher germination percentage (88.59%) was counted in the BINA Piaz-1 (V_1) but the lowest percentage (81.45%) seed germination was obtained from the BARI Piaz-3 (V_3) variety (Table 4).

Vigour index (VI):
Seed vigour was found to be significant due to the different seedling transplanting date. The highest seed vigour (1231) was observed from the December 10 (D_2) that was statistically identical to the planting date November 20 and the lowest (845.70) was observed from the December 30 (D_3) (Table 3). Seed weight per umbel was also found to be highly significant at 5% level of significance on account of different varieties. The highest seed vigour (1170) was observed from the BINA PIAZ-1(V_1) followed by BINA PIAZ-2 (1058.70) and the lowest (845.70) was observed from the variety BARI Piaz-3 (V_3) (Table 4).

Combined effect seedling transplanting time and variety on the yield and quality of summer onion seed
The result of the data depicted that Combined effects of seedling transplanting time and different varieties had significant effect on all the characters under studied except number of leaves per plant (Table 5 & 6). The longest plant (46.78 cm) was recorded from the treatment combinations of transplanting seedlings of BINA Piaz-1 on December 10 (D_2V_1) and the smallest plant (36.50 cm) was recorded from the combinations of planting time December 10 and the variety BARI Piaz-3 (D_3V_3). Numerically, the highest number of leaves per plant (8.74) was obtained from the treatment combinations of seedling transplanting on December 10 (D_2V_1) with the variety BARI-3. The maximum number of tillers per plant (4.85) were observed from the treatment combinations of seedling transplanting on December 10 (D_2V_1) with the variety BARI-3 and the minimum number of tillers per plant (2.52) was obtained from the variety BARI Piaz-3 when transplanted on December 20 (D_3V_3) (Table 8). The seedlings of BARI Piaz-3 variety when transplanted at December 10 produced the highest length of flower stalk (44.64 cm), maximum number of umbels^{-1}(7.96), highest number of flowers umbel^{-1}(426.36), maximum number of seeded fruits umbel^{-1} (404.53), maximum percent fruit set (94.88), highest seed weight umbel^{-1}(3.12), highest seed yield^{-1}(892.25kg), maximum thousand seed weight (3.85 g), maximum germination percentage of seed (95.09) and vigour index (1347.03) but the maximum days to emergence 50% flower stalk (68.06) was obtained from the interaction effect of seedling transplanting at December 30 with variety BARI Piaz-3. On the other hand the minimum length of flower stalk (36.55 cm), minimum number of umbels^{-1}(6.43), lowest number of flowers umbel^{-1}(286.59), lowest number of seeded fruits umbel^{-1} (240.11), lowest percent fruit set (83.78), minimum seed weight umbel^{-1}(2.13), lowest seed yield^{-1}(616.03kg), lowest thousand seed weight (2.92 g), minimum germination percentage of seed (74.92) and vigour index (784.84) were found in the interaction effect of seedling transplanting at December 30 with variety BARI Piaz-3 but the minimum days to emergence 50% flower stalk (68.06) was observed in the interaction effect of the seedling transplanted at December 30 with BARI Piaz-3 variety(Table 5 & 6).

Discussions
The plants obtained from early planted seedlings were taller as compared to the plants obtained from late planted seedlings. The probable reason could be the undesirable temperature, which do not permit the onion plant to grow with its optimum height compared to early planting dates. The increase in plant height could mainly be due to early planting which might have provided plants with relatively cooler period compared to the latter planting. The cooler period stimulates cytokine and gibberellin accumulation, modifying the hormonal balance and leading the plant to increase the plant development and responsible for elongation of flower stalk (Rakhimbaev and Ol'Shaskaya, 1976). This difference could be attributed to climatic (temperature) variation among the study site. The taller plant height provides more photosynthetic capacity to the plant than shorter height. Similar results were also reported by Mollah et al. (2015) and Manna et al. (2016) in onion.

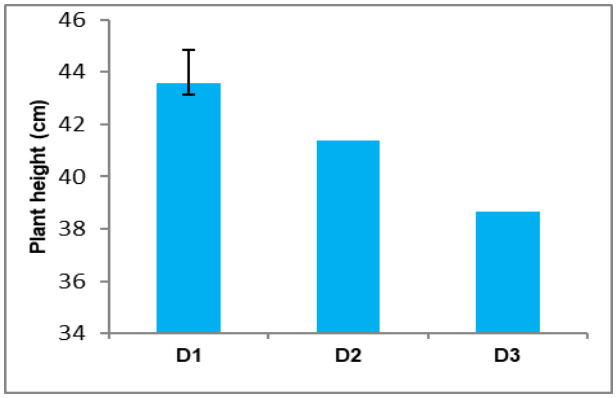

Figure 1a. Effect of seedlings transplanting time on plant height

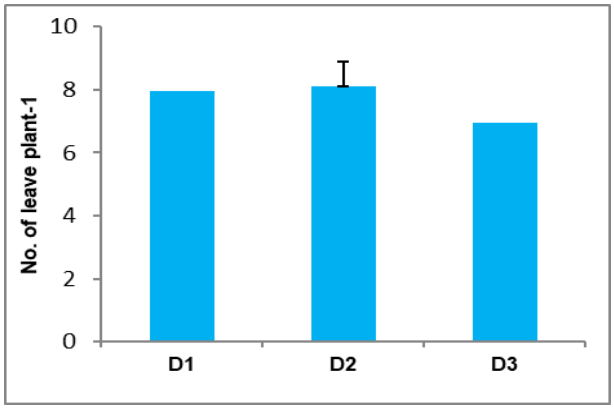

Figure 1b. Effect of seedlings transplanting time on no. of leaves plant^{-1}

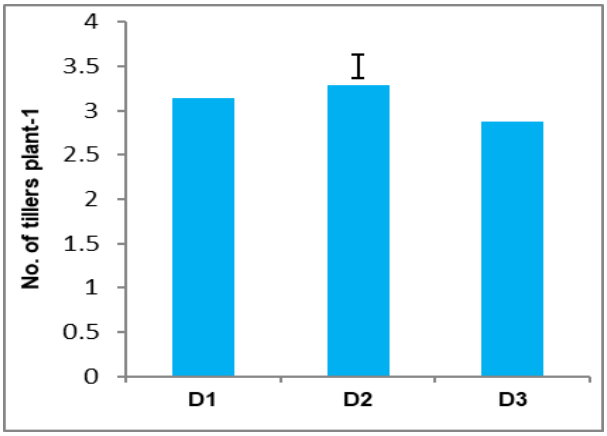

Figure 1c. Effect of seedlings transplanting time on no. of tillers plant^{-1}

Singh and Korla (1991) transplanted onion seedlings at fortnightly intervals starting from November 16 to December 31 and concluded that delay in transplanting caused decreased in number of leaves. Temperature and photoperiod are the major ecological factors influencing onion growth and development (Rabinowitch,1985) as those control the onion plant in all phases

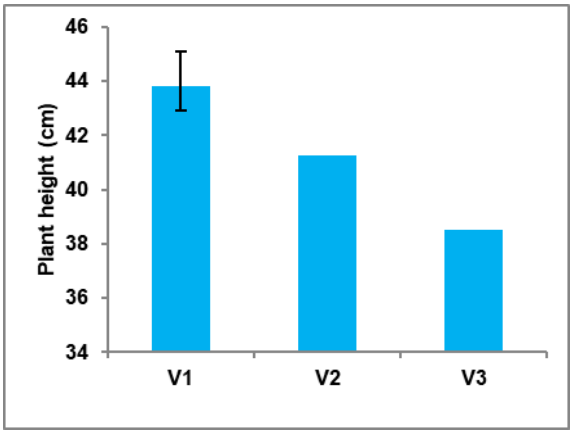

Figure 2a. Effect of variety transplanting time on plant height

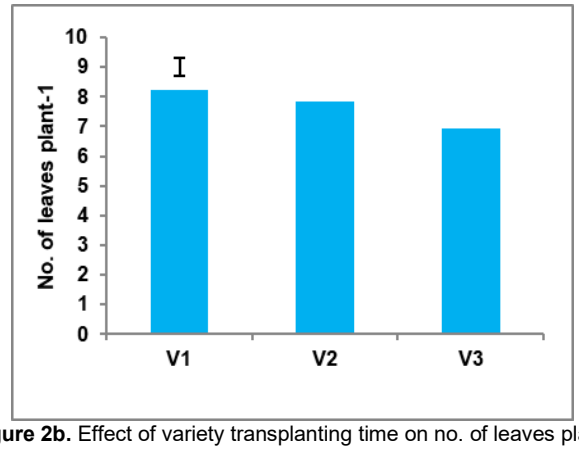

Figure 2b. Effect of variety transplanting time on no. of leaves plant^{-1}

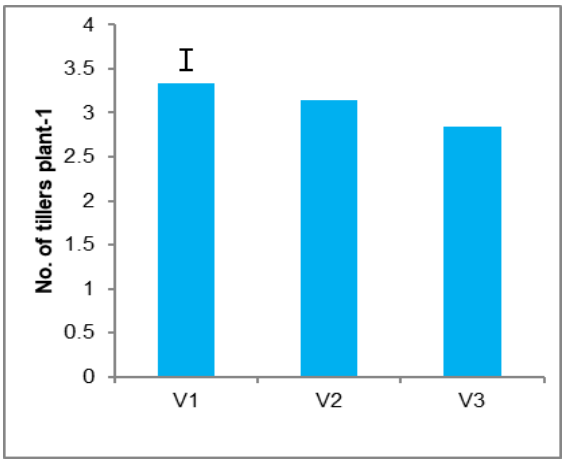

Figure 2c. Effect of variety transplanting time on no. of tillers plant^{-1}

(Coolong and Randle, 2003). The delay in sowing adversely influences the growth and development of plants due to shortened growth period with high temperature (Mohamed ali and Nourai, 1988).

Onion plants grown from transplanting seedlings on 20 November receives colder weather condition than those of later transplanting ones. The results further illustrated that maximum temperature started rising after 15 February and continued up to the end of crop season. The maximum values for plant height, number of leaves plant^{-1} and number of tillers plant^{-1} from earlier transplanting might be due to longer cold period prevailing. The present results concur with those of Ojha et al. (2019). They also found maximum plant height, number of leaves plant^{-1} and number of tillers plant^{-1} from earlier transplanting of seedlings.

The variation among three varieties on plant height, number of leaves plant^{-1} and number of tillers plant^{-1} might happen due to varietal genetic causes. Simon et al. (2014) and Kandil et al. (2013) also found significant difference on the plant height. The result on leaf number is supported by Deshi et al. (2018) and Demisie and Tolessa (2017) who opined that the varieties had profound influence on number of leaves plant^{-1}. The result agrees with the findings of Singh and Sachan (1999). They found wide variability among varieties in respect of number of tillers per plant. Quite similar results were found by Mollah et al. (2015) under Bangladesh conditions, Manna et al. (2016) under West Bengal conditions, and Maria et al. (2018) in onion, under conditions of North-Eastern Ethiopia.

The more number of days required for emergence of primary and secondary umbels in the present study with earlier planted bulbs might be thus insured that, during the growth period October planted bulbs received required temperature range, however, those planted later i.e. in the month of November to January received earlier, which might be the reason for difference in the time taken by plant for emergence of flower stalk. These results are in line with the findings of Jagtap et al. (2014), Lamani and Deshpande (2017) in onion. This might be attributed to the coincidence of growth stage of the crop and occurrence of cold weather to induce flower stalk. This might be the reason that in early planting there was low temperature which might have contributed for the enhancement of bolting and flower stalk development and subsequent flower development, while at late planting, the temperature increased which in turn might have delayed bolting and subsequent flowering. The variation in days to flowering among the treatments might be due to the relative low temperature observed in the early growth stages (Tesfu and Charles, 2010). Thus, the duration the plants exposed to the low temperature decreased progressively as planting was delayed. This result agrees with finding of Teshome et al. (2014) who reported that planting time had marked influence on the number of days required for 50% flowering. Onion planted in September took maximum number of days to mature. On the other hand, onion planted in December required minimum number of days to reach maturity. This indicates that onion planted in relatively hot climatic (temperature) condition (19.30C) matured early compared to those planted in relatively cold condition (14.20C). This result agrees with the findings of Ud-Deen (2008).

Significantly the highest number of umbel^{-1}, number of flowers umbel^{-1}, number of seeded fruits umbel^{-1} and percent fruit set were recorded from early seedlings transplanted time planting date. On the other hand, minimum number of those parameter was recorded from December 30th planting date. High temperature during flowering also resulted in flower abortions and hence lower seed yield. So, selection of appropriate months in a given locality is crucial in onion seed production. Teshome et al. (2014) reported that, variation in number of seeds per umbel might be due to flower abortion caused by high temperature, lack of efficient pollinators of all the flowers in the umbel, shortage of nutrition which caused high competition and death of the weak florets in the umbel. This might have happened in the onion bulbs, the apex of main axis and apices of many lateral buds developed into inflorescence in combination with appropriate climatic conditions, which might

produce more number of umbels per plant in onion. These results are in line with findings of Jagtap et al. (2014) and Mathankar et al. (1990). This results are in agreement with the findings of Singh and Sachan (1999). They stated that number of umbels per plant had wide variation among different varieties.

The maximum seed weight umbel^{-1} was recorded from December 10 planting that in line with early planting at November 20 whereas the lowest weight of seed per umbel was recorded from December 30th. Early planting is important for the conductive temperature for the development and growth of flowering and seed set. This result is agreeing with Teshome et al. (2014), El-Helaly and Karam (2012), who reported that maximum weight of seeds recorded from early planting. Teshome et al. (2014) reported that, variation in number of seeds umbel^{-1} might be due to flower abortion caused by high temperature, lack of efficient pollinators of all the flowers in the umbel, shortage of nutrition which caused high competition and death of the weak florets in the umbel.

There was gradual increase in the seed yield per plant from second week of October planted onion bulbs upto second week of November planted onion bulbs. Then, after there were gradual decrease in seed yield per plant, per plot, per ha with later dates of planting. This might be due to the fact that, onion seed crop raised from second week of October upto second week of November got desired minimum temperature in range of 10.3 °C to 11.8 °C, which favours conditioning process in onion and thus produces more number of flowers per umbel. These results are in line with findings of Krishnaveni et al. (1990) [10], Helay and Karam (2012) [2] under climatic conditions of Giza (Egypt) and Jagtap et al. (2014) [3] under Pune (M.S.) conditions in onion. The results were corroborated with Mollah *et al.,*1987; *Nehra et al.,* 1988 ; Gill *et al.,* 1989 Bhardwaj 1991; Ali *et al.,* 1998; Dadhnia and Gajipara,1998 ; Abedin *et al.,* 1999; Singh and Sachan 1999 ; Muktadir 2000 and Muktadir *et al.,*2001 ,reported seed yields vary with the cultivars.

The maximum thousand seed weight was recorded from mid planting time such as December 10 that was at par with early planting on November 20. On the other hand, the minimum thousand seed weight was recorded from onion seedlings transplanted on December 20th and it was statistically on par with those planted on December 10. This might be attributed to climatic condition prevailing during the seed filling stage. Therefore, early planting result in well filled seeds compared to late plantings. In addition, the seed filling period of late planting time was significantly shorter than early planting time. However, in Bangladesh, Mollah *et al.* (2015) recorded heavy 1000-seed weights from plants planted in November compared to those planted in October. Similar results were found by Helay and Karam (2012) under Giza (Egypt) condition and Jagtap et al. (2014) under Pune (M.S.) conditions in onion.

The higher seed germination in early planting might be due to the highest seed size and seed weight and availability of favorable temperature and other climatic conditions for setting seeds and their development process forming well defined structure of seed, which might be resulted in better germination percentage. Similarly, Teshome et al. (2014) recommended early planting date to produce high quality seed. These results are similar to the findings of Helay and Karam (2012), Jagtap et al. (2014) and Mollah (2015).

Maximum vigour index was obtained from seeds harvested from onion seedlings transplanted during December 20th that was statistically similar with vigour index at November 20 which might be due to the fact that, longer time was available for the development of seeds in 20 November to December 10 planted crop as compared to December 30 planted crop, for development of seed, in the present investigation which might be resulted in the formation of bolder seeds. This indicates quality difference of seed lots caused by planting time. Early planting gave high seed vigor index. This finding agrees with that of Malik et al. (1999), who reported highest seed vigor index with early planting.

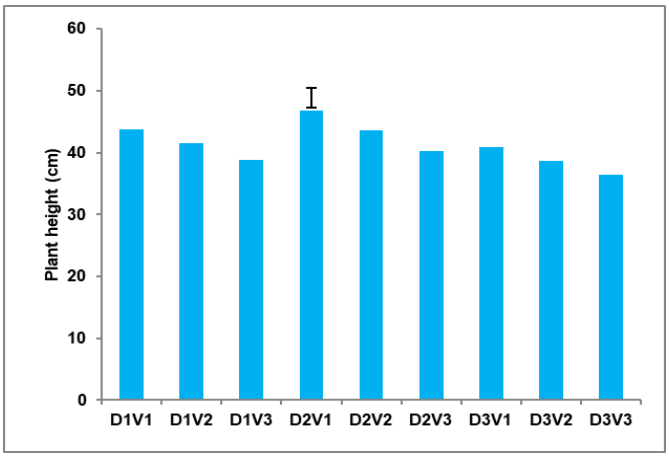

Figure 3a. Combined effect of seedling transplanting time and variety on plant height

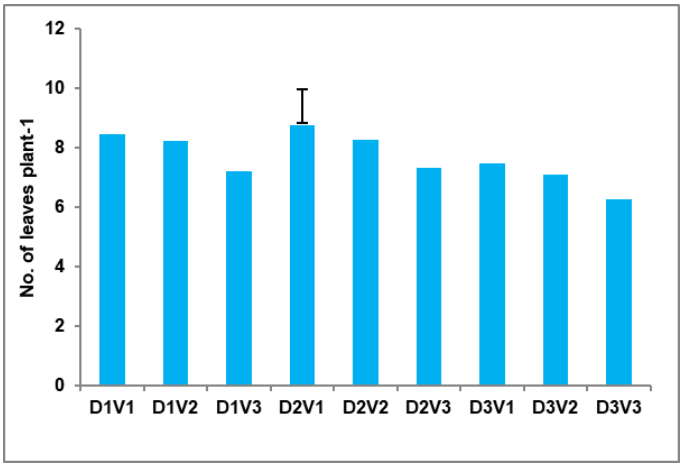

Figure 3b. Combined effect of seedling transplanting time and variety on no. of leaves plant^{-1}

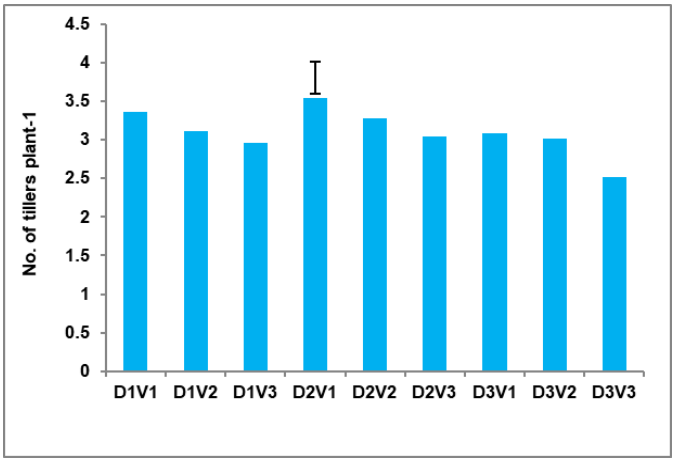

Figure 3a. Combined effect of seedling transplanting time and variety on no. of tillers plant^{-1}

Conclusions

The highest quality summer onion seed yield (802.83 kg ha^{-1}) was obtained from seedlings transplanted at December 10 (D_2) that was at par with seedlings planted at November 20 but the lowest seed yield (728.57 kg ha^{-1}) was found in late transplanting time at December 30(D_3). On the other hand, the variety BINA PIAZ-1 (V_1) produced the highest amount (816.82 kg ha^{-1}) quality seed and the lowest seed yield was obtained from BARI PIAZ-3 (V_3). The combined effect of BINA PIAZ-1 with seedlings transplanted at December 10 (D_1V_1) give the highest yield (892.25 kg ha^{-1}) summer onion seed and the lowest (616.03 kg ha^{-1}) one was exerted from the combination of D_3V_3. From the study, it can be concluded that onion seedlings transplanted at early to middle of the growing season produced superior quality seeds of summer onion while the late transplanting give the inferior quality and minimum seed yield of summer onion.

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References

Anisuzzaman, M., Ashrafuzzaman, M., Mohd, R. I., Uddin, M. K., and Rahim, M. A. (2009). Planting time and mulching effect on onion development and seed production. African Journal of Biotechnology, 8 (3), 412–6.

Anonymous. (2003). The wealth of India, A Dictionary of Indian Raw Materials & Industrial Products, Council of Science & Information Research, New Delhi, Vol.: I:A, pp. 167-181.

BBS (Bangladesh Bureau of Statistics), 2004. Year book of Agricultural statistics of Bangladesh, 1999. Bangladesh Bureau of Statistics. Statistics Division, Ministry of planning, Govt. of the Peoples Republic of Bangladesh. Dhaka. pp. 143.

BBS (Bangladesh Bureau of Statistics). 2022. Yearbook of Agricultural Statistics of Bangladesh-2021. 33rd Series, May 2022. Bangladesh Bureau of Statistics, Statistics & Informatics Division, Ministry of planning, Government of the People's Republic of Bangladesh, p. 138.

BINA (Bangladesh Institute of Nuclear Agriculture). 2018. Leaflet, pp.1-4.

Coolong, T.W. and Randle, W.M. (2003). Temperature influences flavor intensity and quality in 'Granex 33' onion. Journal of the American Society for Horticultural Science, 128(2), 176-181.

Demisie, R. and Tolessa, K. (2017). Growth and bulb yield of onion (Allium cepa L.) in response to plant density and variety in Jimma, South Western Ethiopia. Advances in Crop Science and Technology, 6(2), 357.

Deshi, K. Obasi, M. Nanbol, K. Sirajo, S. and Okechalu, B. (2018). The effect of growth environments on the growth and yield of onion (Allium cepa L.) in Jos, Plateau State, Nigeria. Journal of natural Sciences Research, 8(6), 67-74.

El-Helaly, M.A. and S.S. Karam, 2012. Influence of planting date on the production and quality of onion seeds. J. Hortic. Sci. Ornamental Plants, 4(3),275-279.

FAO (Food and Agricultural Organization), 2003. FAO Production Yearbook. Food and Agricultural Organization of the United Nations, Rome, Italy, 55: 153.

FAOSTAT (2024). Crops and Livestock Products. Available at: https://www.fao.org/faostat/en/ - data/QCL (Accessed: 03 March 2024).

Ibrahim M Y, Mostafa A K, HegazyA M and El-Kafoury A K. 1996. Flowering behavior of Egyptian onion cv. Giza 20 affected by planting date. Proceedings of 7th Conference on Agronomy, 9-19 Sept, pp. 635–42.

Jagtap KB, Patil SD, Patil MR, Kamble DM. Studies on flowering, yield and quality of onion seed cv. Phule Suvarna as influenced by bulb size and planting dates. Int. Sci. J. 2014;1(3), 2348-6058.

Jones H A and Mann L K. 1963.Onions and Their Allies. Leonard Hill, London, p 169.

Khan, M. A., M. M. Rahman., S. N. Mozumdar and M. I. Haque. 2020. Strategies for increasing storability of onion (in Bengali). A Folder, Spices Research Sub-Centre, Bangladesh Agricultural Research Institute, Faridpur. Publication No. SRSC/BARI/Farid.01/2020, p.3-8.

Krishnaveni S, Balasubramanian T, Sadasivam S. Potentiality of sweet sorghum (Sorghum bicolor, Poaceae) for syrup preparation and alcohol production in India. Economic Botany. 1990 Sep; 44,355-9.

Malik, Y.S., B.K. Nehra and N. Singh, 1999. Effect of planting time, bulb cut and pinching of bolt treatments on yield and quality of onion seed. Veg. Sci., 26, 143-145.

Manna D, Santra P, Maity TK, Basu AK. Quality seed production of onion (Allium cepa) cv Sukhsagar as influenced by bulb size and date of planting. Agri. Res. & tech. open access J. 2016, 2(3).

Maria T, Derbew B, Yigzaw D, Getachew S. (2018). Effects of planting time on growth, yield components, seed yield and quality of onion (Allium cepa L.) at Tehuledere district, Northeastern Ethiopia Agriculture & Food Security. 7:28.

Mathanakar VB, Sdavarte KT, Kale PB, Kulwal LV. Effect of date of planting of seed production of some varieties of onion under Akola conditions. PKV Res. J. 1990;14(1),27-30.

Mollah MRA, Ali MA, Ahmad M, Hasan MK, Alam MJ. (2015). Effect of planting dates on the yield and quality of true seeds of onion. Int. J of Applied Sciences and Biotech. 3(1), 67-72.

Mosleh M D. 2008. Effect of mother bulb size and planting time on growth, bulb and seed yield of onion. Bangladesh Journal of Agricultural Research. 33(3), 531–7.

NHB (National Horticulture Board). 2019. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, New Delhi.

Ojha, M.D., Kumar, V., Pal, M., Tiwari, D., Kumar, N. and Singh, P.K. (2019). Effect of date of planting and varieties on growth, yield and storability of rabi onion (Allium cepa L.). Journal of Phrmacognosy and Phytochemistry, 8(4),1908-1911.

Pareek S, NA Sagar, S Sharma, V Kumar (2017). Onion (Allium cepa L.). Fruit and Vegetable Phytochemicals: Chemistry and Human Health, 2nd edn., pp:1145–1162.

Peters R J. 1990. Seed production in onion and other Allium species. (In) Onion and Allied Crops, Volume 1: Botany, Physiology and Genetics, pp.103–24.

Rabinowitch, H.D. (1985). Onions and Other Edible Alliums. In: CRC Handbook of Flowering (Ed. Haley, H. C.). Boca Raton, CRC Press, Vol. 1, pp. 398-409.

Simon, T.A. Tora, S.M. and Urkato, S. (2014). The effect of variety, nitrogen and phosphorous fertilization on growth and bulb yield of onion (Allium cepa L.) at Wolaita, Southern Ethiopia. Journal of Biology, Agriculture and Healthcare, 4 (11), 89-97.

Singh, A. and Korla, B.N. (1991). Effect of transplanting dates and varieties on number of leaves and yield in onion (Allium cepa L.). Vegetable Science, 18(1),24-28.

Teshome A, Derbew B, Sentayehu A and Yehenew G. 2014. Effect of planting time and mother bulb size on onion (Allium cepa L.) seed yield and quality at Kobo Woreda, Northern Ethopia. International Journal of Agricultural Research 9(5), 231–41.

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