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Onion bulb and seed yield as influenced by transplanting time and transplant age

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Abstract

Registration of a new variety needs information to be generated regarding its production technology. Therefore, an experiment was conducted at the experimental field of Vegetable Programme, Horticultural Research Institute, National Agricultural Research Center (NARC) Islamabad during 2017-19 to observe the effect of transplanting time and transplant age on onion bulb and seed yield for two new strains (NARC Onion-1 & NARC Onion-2) along with the cultivated variety (Phulkhara) as check. Highest bulb and seed yield was achieved from December transplanting and 12 weeks old transplant except in 'Phulkara' where seed yield per plant was best in February 15 transplanting and 08 & 10 weeks of transplant age treatments. Maximum bulb weight (96 grams) and yield per hectare (33.6 t/ha) was recorded in one of the onion strain tested (NARC Onion-2) when 12 weeks old seedling transplanted on December 15, 2017. However, seed yield per plant (15.1 gram) was highest in NARC Onion-1 among two strain tested. No one onion strains tested could gave higher seed yield/plant compared to 'Phulkhara'. It could be concluded from the results that transplanting time and transplant age for first year bulb crop had a great impact on the preceding seed crop during second year.

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Introduction

The cultivated onion (*Allium cepa* L.) is one of the important condiments widely used in all households and it is a major bulb crop of Pakistan. In Pakistan onion is cultivated under an area of 145.4 thousand hectares with production of 1982 thousands tones during 2016-17.

Limited number of varieties; Phulkhara, Swat-1, Suriab surkh, Nasarpuri etc are mostly cultivated on major part under onion cultivation in Pakistan. To increase gene pool selection process is always carried on from new germplasm on regular basis. Two new onion strains (NARC Onion-1 & NARC Onion-2) were selected on yield parameters basis. However, one of the important issues of research towards this improvement is to study the effect of transplanting time & transplant age on the bulb yield & indirectly on seed yield. Kandil *et al.,* 2013 reported that transplanting onion seedlings on 15th December recorded highest total yield and average bulb weight. Faruq *et al.,* 2003 also showed that November 22 planting produced the highest yield. Due to biennial nature of the crop, bulbs produced during 1st year through different transplanting time or under different environmental conditions will be used as a mother bulb and could play a vital role in effecting seed yield per plant. That is why we can say that transplanting time and transplant age which can affect bulb yield directly during 1st year, it could also affect seed yield too indirectly during 2nd year by affecting mother bulb characteristics. Ali *et al.,* 2015 reported that large bulbs gave more number of umbels per plant and ultimately increased seed yield per plant. Ashagrie *et al.,* 2014 results showed significant interaction between mother bulb size and planting time on seed yield per plant. Manna *et al* (2016) mentioned that planting of large size bulbs produced quality onion seed compared to medium and small size bulbs.

Considering the above mentioned previous work the present study was performed to observe the effect of transplanting time & transplant age directly on the bulb yield & indirectly on seed yield of these two selected onion strains (NARC Onion-1 & NARC Onion-2) along with 'plulkara' variety as check under agro climatic condition of Islamabad.

Materials and methods

An experiment was conducted to optimize transplanting time and transplant age for two new onion strains (NARC Onion-1 & NARC Onion-2) along with the cultivated variety (Phulkara) as check. The experiment was carried out at the experimental field of Vegetable Programme, HRI, and National Agricultural Research Center (NARC) Islamabad during 2017-19.

Onion seed sowing was done from September 15 to December 15, 2017 with the interval of 15 days to raise three different age of seedlings (8, 10 & 12 weeks) for each of the three transplanting times (December 15, 2017; January 15, 2018 & February 15, 2018). Bulbs harvested during May, 2018 from these different treatments were randomly selected as a representative sample and replanted during October, 2018 to observe the effect of different treatments on seed production. Seed was harvested during May, 2019. Experiment was laid out under RCBD with three replications. Similar cultural practices; weeding, manuring, fertilizer application, irrigation were done with all treatments and replications. Data regarding bulb yield and bulb weight was recorded during 1st year of crop i.e. May, 2018 while data regarding seed yield was recorded during 2nd year of crop i.e. October 2018 to June, 2019. Data collected were analyzed statistically by Statistix 8.1 using analysis of variance technique (Steel and Torrie, 1980).

Results and discussions

Bulb weight and yield

Transplanting time had a great impact on onion bulb weight and yield (Table -1). Maximum bulb weight and bulb yield was recorded when crop was transplanted on December 15 for all varieties tested. A huge decrease was observed when transplanted one or two months later from the earlier one. Kandil *et al.,* 2013 also reported similar results for transplanting time impact on onion bulb and yield. Considering the

seedling age impact, 12 weeks old seedling performed better followed by 10 and 08 weeks old seedling respectively. However, Latif *et al.,* 2010 reported highest bulb yield for summer onion from 50 days old seedlings in Bangladesh. Interaction between transplanting time, seedling age and varieties had a significant effect on bulb weight (gram) and yield (t/ha) of different onion varieties. Maximum bulb weight (96.0 g) and yield (33.6 t/ha) was recorded when 12 weeks old seedling of NARC onion-2 were transplanted on Dec.15 (Table-3). However, the lowest bulb weight (5.3 g) and yield (1.8 t/ha) was recorded when 08 weeks old seedling of NARC Onion-1 were transplanted on Jan 15.

Table 1. Effect of transplanting time and Seedling age on Yield and Yield Contributing Factors in Onion.

Treatments	Bulb weight (g)	Yield (t/ha)
15-Dec-2017	63.5 a	22.22 a
15-Jan-2018	26.3 b	9.17 b
15-Feb-2018	13.8 c	4.72 c
Seedling Age		
12 weeks	44.2 a	15.46 a
10 weeks	34.8 b	12.07 b
08 weeks	24.6 c	8.85 c
Varieties		
NARC Onion-1	29.8 b	10.42 b
NARC Onion-2	41.8 a	14.44 a
Phulkara	32.2 b	11.26 b
LSD (0.05)	2.7892	0.9701

Days to Sprouting

Bulb harvested/ produced from different treatments i.e. three different transplanting times and from saplings of three different age, sprouted in the range of 98-99 days and showed not any significant difference when planted during next coming season of October for seed production. However, among varieties/strains Phulkara bulb sprouted earlier as compared to both onion strains either produced from Dec-15, Jan-15 or Feb-15 transplanting treatments and either from 12, 10 or 08 weeks old seedling treatments. Bulb sprouting was late in NARC Onion-2 compared to NARC onion-1 & Phulkara (Table-2). Jilani, 2003 also mentioned in their results that onion varieties differ significantly from each other for number of days taken for sprouting.

Table 2. Effect of Transplanting time and seedling age on reproductive development of onion.

Treatments	Days to Emergence	Scape per plant at 135 DAP	Scape per plant at 165 DAP	Umbel per plant	Seed yield per plant	1000 seed weight
Transplanting Time						
15-Dec-2017	98.48	3.61 a	7.41 a	8.26 a	14.02 a	3.51 a
15-Jan-2018	99	2.64 c	5.90 b	7.03 b	7.36 b	2.30 b
15-Feb-2018	98.44	3.03 b	6.24 b	7.80 a	14.24 a	3.55 a
Seedling Age						
12 weeks	97.56	3.10 b	6.87 a	7.96 a	11.51 b	3.53
10 weeks	99	2.60 c	5.96 b	7.20 b	11.64 b	3.36
08 weeks	99.37	3.57 a	6.72 a	7.92 a	12.47 a	3.49
Varieties						
NARC Onion-1	112.2 b	1.31 b	4.63 b	5.88 b	9.92 b	3.38 b
NARC Onion-2	122.7 a	0.52 c	3.90 c	5.27 c	5.94 b	3.15 c
Phulkara	61 c	7.44 a	11.0 a	11.93 a	19.76 a	3.84 a
LSD (0.05)	5.58	0.1632	0.4474	0.5258	0.5976	0.1922

Number of scape/plant at 135 & 165 dap and umbel per plant

A significant difference was observed for all three factors i.e; transplanting time, seedling age and varieties (Table 2). Highest number was recorded from Dec. 15 treatment followed by Feb. 15 and Jan. 15 respectively at 135 DAP. However, there is a variation recorded in number of scape/plant observed at 165 DAP as compared to data recorded one month earlier i.e. 135 DAP. For transplanting time treatments highest figure was from Dec.15 while remaining two i.e. Jan 15 and Feb.15 showed at par results among each other. Results showed a rapid increase in number of scape/plant in Jan 15 treatment as compared to other two. Total number of umbel per plant recorded just before harvesting showed its highest level and at par results for Dec. 15 & Feb. 15 transplanting treatments. On comparison among seedling age treatment levels, highest number of scape per plant was recorded from 08 weeks old seedling treatment at 135 DAP while one month later i.e. at 165 DAP & before harvest the highest number of scape/plant and number of umbel/plant were observed from 12 and 08 weeks old seedling treatments. However, a rapid increase was recorded from 10 weeks old seedling treatments. The highest number of scape per plant was may be due to higher bulb size achieved during 1st year of crop from Dec. 15 & 12 weeks old seedling treatments. Ashagrie *et al.,* 2014 also mentioned that by using large mother bulbs increases number of scapes by 77 % as compared to small mother bulbs. Among varieties highest number was recorded from Phulkara followed by NARC Onion-1 & NARC Onion-2.

Table 3. Combined Effect of Transplanting time, Seedling age and comparison among onion varieties for Yield and Yield Contributing Factors.

Transpl. Time	Bulb weight (g)								
	NARC Onion-1			NARC Onion-2			Phulkara		
	Seedling age (weeks)								
	12	10	8	12	10	8	12	10	8
15-Dec-2017	69.5 b	56.5 cd	48.7 de	96.0 a	76.6 b	72.5 b	59.3 c	47.9 e	44.3 ef
15-Jan-2018	44.1 ef	17.1 ij	5.3 m	47.1 e	31.6 gh	15.9 jk	37.1 fg	28.8 gh	9.5 jklm
15-Feb-2018	7.8 klm	14.1 jkl	5.5 m	11.9 jklm	15.0 jkl	7.5 lm	25.0 hi	25.7 h	11.9 jklm
LSD Value	8.3677								
Transpl. Time	Yield (t/ha)								
	NARC Onion-1			NARC Onion-2			Phulkara		
	Seedling age (weeks)								
	12	10	8	12	10	8	12	10	8
15-Dec-2017	24.3 b	19.8 cd	17.0 de	33.6 a	26.8 b	25.4 b	20.8 c	16.8 e	15.5 ef
15-Jan-2018	15.3 ef	6.0 ij	1.8 m	16.5 e	11.0 gh	5.6 jk	13.0 fg	10.1 gh	3.3 jklm
15-Feb-2018	2.7 klm	4.9 jkl	1.9 m	4.2 jklm	4.2 jklm	2.6 lm	8.8 hi	9.0 h	4.2 jklm
LSD Value	2.9103								

Seed yield/plant and seed weight

Comparison between transplanting time, seedling age and varieties had a great impact on reproductive development of onion (Table 2). Maximum seed yield/plant and 1000 seed weight was recorded from Dec 15 & Feb 15 transplanting treatments and lowest in Jan 15. Results shows that seed per umbel and its quality is relatively better in Feb. 15 treatment. On comparing the seedling age treatment maximum seed yield and 1000 seed weight was recorded from 08 weeks old seedling treatments. It means that small size bulbs produced from Feb. 15 & 08 weeks old seedling treatments as evident from our results proved better for seed yield per plant & 1000 seed weight. This might be due to number of scape per plant, number of umbel per plant and seed per umbel.

Our results are contradictory from the findings of Ashagrie *et al.,* 2014 mentioning that highest seed yield per plant and 1000 seed weight was due to the larger bulbs. Among varieties Phulkara out yielded other two strains tested.

Conclusion

Both new onion strains; NARC Onion-1 & NARC Onion-2 gave highest bulb and seed yield from December 15 transplanting and 12 weeks old transplant compared to other treatments. However, overall seed yield/plant was less in the tested strains compared to 'Phulkara' used as check due to less number of umbels per plant. It could be concluded from the results that transplanting time and transplant age for first year bulb crop had a great impact on the preceding seed crop during second year.

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