ACTA AGROBOTANICA
Vol. 66 (3), 2013: 41–48
Original Research Paper
DOI: 10.5586/aa.2013.036

THE EFFECT OF STORAGE TEMPERATURE OF STECKLING BULBS ON SEED STALK DEVELOPMENT AND SEED YIELD OF SHALLOT (*Allium cepa* L. var. *ascalonicum* Backer)

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Received: 11.05.2013

A b s t r a c t

The aim of this study, conducted in the years 2010–2012, was to evaluate bolting and seed production of shallot depending on storage temperature of steckling bulbs with different diameters. The present study included 4 cultivars ('Toto', 'Ambition F_1', 'Bonilla F_1', and 'Matador F_1') and one local population ('U'). Bulbs with the following diameters: 20–30 mm, 31–40 mm, 41–50 mm, and 51–60 mm, were stored from the first 10-day period of November (2010 and 2011) until the end of March (2011 and 2012) at a temperature of 0–1 °C, 4–6 °C, and 8–10 °C. After they were planted in the field (the second 10-day period of April), observations of bolting were carried out, while the weight of seed umbels and seed yield were determined only for the cultivar 'Toto' and the population 'U'. The storage temperature of steckling bulbs in the range of 4–6 °C and 8–10 °C was most conducive to bolting, in particular in plants grown from large bulbs with a diameter above 40 mm. In the cultivar 'Toto', plants from bulbs with a diameter above 40 mm and stored at a temperature of 4–6 °C were characterized by the highest weight of seed umbels. This had an effect on obtaining the highest seed yield (on average 1604.16-2300.7 g per 100 m^2 of area). Shallot plants from the population 'U' grown from bulbs with a diameter of 20–30 mm were characterized by a distinctly lower percentage of bolting plants compared to the cultivars studied. For this reason, this population does not promise positive effects in shallot production for seed.

Key words: *Allium cepa* L. var *ascalonicum*, bulb size, cultivar, generative shoots, seed yield

INTRODUCTION

The increasing interest in the cultivation of shallot from seed results from the possibility of obtaining larger bulbs in the yield compared to vegetative propagation – by planting bulbs. Moreover, both shallots and common onions grown from seeds sown directly into the ground produce more healthy bulbs with good storage life [1,2]. Growing shallots from seed is possible, since shallot seeds are traded on the market. In Poland shallots are grown most frequently from seeds supplied to the market by a Dutch company Bejo Zaden and these are hybrid cultivars (F_1). In recent years, shallots have been grown more and more often from seeds of the cultivar 'Toto' supplied to the market by a seed breeding company PlantiCo Zielonki. Nevertheless, these seeds are in short supply on the Polish market, since the production of this onion for seed is still highly unreliable, similarly to other countries. Difficulties with production of shallot seeds also exist in the countries where this onion belongs to major crops and is a basic vegetable for daily consumption [3–8].

The production of good quality mother bulbs and the possibility of using the seed-to-seed method has been an important issue in growing shallots and common onions for seed. The quality of mother bulbs includes, among others, traits such as proper physiological maturity, health, and size [8–10]. The shallot produces smaller bulbs than the common onion, which may have an effect on poorer bolting and lower seed yield.

The aim of the present study was to evaluate the effect of storage temperature of steckling bulbs with different diameters on bolting and seed yield of shallot.

MATERIALS AND METHODS

This study involved an evaluation of bolting in shallot (*Allium cepa* L. var. *ascalonicum* Backer) in 4 cultivars and 1 local population depending on storage

temperature of mother bulbs with different diameters. These were 3 cultivars from a seed breeding company Bejo Zaden ('Ambition F_1', 'Bonilla F_1', and 'Matador F_1') and one true-breeding cultivar 'Toto' supplied by the company PlantiCo Zielonki. The local population 'U' included in this study is the shallot that is grown in eastern Poland and in the area of Lviv.

Steckling bulbs were produced in 2010 and 2011 by planting seedlings, while in the case of the population 'U' they were produced by planting bulbs, since this population is propagated only vegetatively. Shallot bulbs of the studied cultivars with a diameter of 20–30 mm, 31–40 mm, 41–50 mm, and 51–60 mm, 500 pieces from each fraction, were stored in a cold storage room from the first 10-day period of November (2010 and 2011) until the end of March (2011 and 2012) at a temperature of 0–1 °C, 4–6 °C, and 8–10 °C. These were 3 cooling chambers with a set temperature range. In the case of the population 'U', this was one fraction of bulbs with a diameter of 20–30 mm.

The field experiment was carried out at the Felin Experimental Farm of the University of Life Sciences in Lublin (51°18'N, 22°45'E), on fallow soil with the mechanical composition of light soil comprising 1.5% of organic matter. Pre-plant fertilization (Azofoska at a rate of 10 kg × 100 m^{-2}) was introduced one week before planting bulbs. Top dressing at a rate of 5 kg N × 100 m^{-2} (in the form of ammonium nitrogen) was applied four weeks after the planting date.

The experiment was established in the second 10-day period of April (13 April 2011 and 18 April 2012) in a randomized block design in three replicates. 100 bulbs were planted per 3 m^2 plot (1.5 × 2 m). The population 'U' was treated as a separate experiment, because this shallot produces small bulbs in the cluster, with a predominance of bulbs that are 20–30 mm in diameter. This shallot was compared with the cultivars only taking into account bulbs 20–30 mm in diameter. The experiment with the population 'U' was located about 500 m away from the main experiment, since it was necessary to maintain isolation from plants of the cultivar 'Toto' in the case of which seed yield was to be determined.

Weather conditions for shallot growth were rather favourable during the study period. The mean air temperature in the growing period of shallot (April – September) ranged from 15.8 °C in 2011 to 16.2 °C in 2012 and was higher than the long-term mean (1951–2005). During the shallot growing season, excessive rainfall was observed in 2011 (+ 32.3 mm) and a shortage of rainfall in 2012 (-88.8 mm) compared to the long-term mean. Heavy rainfall in July 2011 (189.0 mm) caused high losses in seed umbels. This resulted in lower seed yield per unit area compared to the yield obtained in 2012.

Observations of plant growth and development were carried out during the growing season. As regards the hybrid cultivars (F_1), such observations were carried out until the complete formation of inflorescence umbels, and then they were cut off to prevent their flowering, because their flowering could result in uncontrolled pollination of flowers of the cultivar 'Toto'. Only the cultivar 'Toto' was allowed to finish the generative growth and to produce seeds. The same procedure was followed in the case of plants of the population 'U' which grew at a distance of 500 m from the main experiment.

After seed umbels of cv. 'Toto' and the population 'U' were collected and dried, their weight and seed yield were evaluated. The results were analysed statistically, while the significance of difference was calculated using Tukey's intervals at the α=0.05 confidence level.

RESULTS

Storage temperature of mother bulbs and their size were shown to have a very large effect on the percentage of bolting plants in the individual cultivars. Large differences were also found in this respect between the cultivars studied.

Regardless of cultivar, the bulb storage temperature of 0–1 °C was least conducive to bolting. The average percentage of bolting plants in this treatment was 25.3% in the cultivars, while no bolting plants were found in the population 'U'. On the other hand, as far as plants grown from bulbs stored at 4–6 °C are concerned, the average percentage of bolting plants was 36.5%, whereas in the case of plants from bulbs stored at 8–10 °C – it was 30.5% on average. In each cultivar, irrespective of storage temperature of mother bulbs, the larger was the diameter, the more plants bolted (Table 1).

In the case of plants grown from mother bulbs with the smallest diameter, the percentage of bolting plants was 3.6 times lower compared to plants from the largest bulbs. Among the cultivars investigated, 'Toto' was characterized by the highest proportion of bolting plants, in particular in the case of plants from bulbs stored at a temperature 4–6b °C. The cultivar 'Matador F_1' was also shown to have a similar percentage of such plants.

The study demonstrated that in the population 'U' plants from small bulbs (20–30 mm in diameter) did not bolt at all or their percentage was very low (temperature of 4–6 °C and 8–10 °C). Compared to the cultivars, this percentage was on average 6–8 times lower

The number of generative shoots per bolting shallot plant was on average 2.4 in the cultivars, while

in the case of the local population it was 1–3. Cultivar and size of bulbs used for planting had a significant effect on the number of these shoots, whereas storage temperature was found to be insignificant. Plants of cv. 'Bonilla F_1' produced the lowest number of generative shoots – on average 1.8 (Table 2). It was found that the larger were bulbs used for planting, the more seed stalks were produced by plants. However, the present study showed a significant interaction between the experimental factors: storage temperature and bulb diameter. Plants from bulbs with a diameter of 41–50 mm and 50–60 mm stored at a temperature 0–1 °C and 8–10 °C produced significantly the highest number of generative shoots.

Table 1
Percentage of bolting shallot plants depending on the size of steckling bulbs and storage temperature

Cultivar	Size of steckling bulbs (mm in diam.)	Storage temperature									Mean
		0–1 °C			4–6 °C			8–10 °C			
		2011	2012	mean	2011	2012	mean	2011	2012	mean	
'Toto'	20–30	7.0	1.1	4.0	21.4	21.8	21.6	18.6	20.0	19.3	14.9
	31–40	14.0	19.3	16.6	51.3	46.1	48.7	32.9	35.5	34.2	33.1
	41–50	22.1	30.7	26.4	52.5	35.0	43.7	80.6	25.0	52.8	40.9
	51–60	24.0	32.5	28.2	60.3	62.5	61.4	77.8	41.4	59.6	49.7
	mean	16.7	20.9	18.8	46.3	41.3	43.8	52.5	30.4	41.4	34.6
'Ambition F_1'	20–30	7.5	2.6	5.0	2.1	3.1	2.6	12.8	14.0	13.4	7.0
	31–40	19.2	7.4	13.3	11.8	4.0	7.9	24.4	11.5	17.9	13.0
	41–50	9.0	11.1	10.0	76.6	46.6	61.6	21.2	46.6	33.9	35.1
	51–60	25.0	46.4	35.7	75.0	46.8	60.5	25.0	70.2	47.6	47.9
	mean	15.1	16.8	16.0	41.3	25.1	33.1	20.8	35.5	28.8	25.7
'Bonilla F_1'	20–30	8.0	1.0	4.5	29.6	7.0	18.3	11.8	9.0	10.4	11.0
	31–40	8.2	1.1	4.6	36.4	5.0	20.7	17.6	11.0	14.3	13.2
	41–50	10.8	10.0	10.4	38.5	15.0	26.7	12.0	20.0	16.0	17.7
	51–60	1.9	8.6	5.2	40.6	47.0	43.8	39.0	40.0	39.5	29.5
	mean	7.2	5.1	6.1	36.2	18.5	27.3	20.1	20.0	20.0	17.8
'Matador F_1'	20–30	14.0	11.1	12.5	45.3	2.8	24.0	28.0	2.8	15.4	17.3
	31–40	24.0	10.8	17.4	40.0	8.6	24.3	18.7	14.2	16.4	19.3
	41–50	30.0	26.6	28.3	55.5	48.0	51.7	29.7	52.0	40.8	40.2
	51–60	36.2	50.0	43.1	66.7	67.0	66.8	70.0	46.9	58.4	56.1
	mean	26.0	24.6	25.3	51.8	31.6	41.7	36.6	28.9	32.7	33.2
Mean	20–30	9.1	3.9	6.5	24.6	8.6	16.6	17.8	11.4	14.6	12.5
	31–40	16.3	9.6	12.9	34.8	15.9	25.4	23.4	18.0	20.7	19.6
	41–50	17.9	19.6	18.7	55.7	36.1	45.9	35.8	35.9	35.8	33.4
	51–60	21.7	34.3	28.0	60.6	55.8	58.1	52.9	49.6	51.2	45.8
	mean	16.2	16.8	16.5	43.9	29.1	36.5	32.4	28.7	30.5	27.8
Population 'U'	20–30	0.0	0.0	0.0	1.2	3.0	2.1	1.0	8.0	4.5	2.2

Table 2
Number of generative shoots per shallot plant depending on the size of steckling bulbs and storage temperature

Cultivar	Size of steckling bulbs (mm in diam.)	Storage temperaure									Mean
		0–1 °C			4–6 °C			8–10 °C			
		2011	2012	mean	2011	2012	mean	2011	2012	mean	
'Toto'	20–30	1.7	1.0	1.3	1.2	1.2	1.2	1.8	1.9	1.8	1.4
	31–40	2.2	1.5	1.8	2.3	2.5	2.4	2.3	2.7	2.5	2.2
	41–50	3.7	3.1	3.4	3.1	2.8	2.9	2.8	4.8	3.8	3.3
	51–60	4.6	4.0	4.3	3.7	3.7	3.7	3.5	4.8	4.1	4.0
	mean	3.0	2.4	2.7	2.6	2.5	2.5	2.6	3.5	3.0	2.7
'Ambition F_1'	20–30	2.2	1.1	1.6	2.3	1.0	1.6	1.6	1.0	1.3	1.5
	31–40	2.4	1.3	1.8	2.8	1.6	2.2	2.2	1.0	1.6	1.8
	41–50	2.3	3.2	2.6	1.8	2.2	2.0	2.5	3.4	2.9	2.5
	51–60	4.0	4.8	4.4	3.6	5.3	4.4	3.6	4.1	3.8	4.2
	mean	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.3	2.4	2.5
'Bonilla F_1'	20–30	1.7	1.0	1.3	1.1	1.0	1.0	1.5	1.2	1.3	1.2
	31–40	1.5	1.3	1.4	1.8	1.4	1.6	1.3	1.7	1.5	1.5
	41–50	3.3	2.0	2.6	2.2	1.1	1.6	2.0	1.8	1.9	2.0
	51–60	3.0	2.0	2.6	2.7	2.7	2.7	2.6	2.8	2.7	2.6
	mean	2.4	1.6	2.0	1.9	1.5	1.7	1.8	1.8	1.8	1.8
'Matador F_1'	20–30	1.8	1.6	1.7	2.3	1.0	1.6	1.6	1.1	1.3	1.5
	31–40	2.3	1.5	1.9	2.6	3.0	2.8	2.1	3.2	2.6	2.4
	41–50	3.6	4.5	4.0	3.2	4.4	3.8	2.2	3.0	2.6	3.4
	51–60	4.4	4.6	4.5	4.5	4.6	4.5	2.8	6.0	4.4	4.5
	mean	3.0	3.0	3.0	3.1	3.2	3.1	2.2	3.3	2.7	2.9
Mean	20–30	1.8	1.1	1.4	1.7	1.0	1.3	1.6	1.3	1.4	1.3
	31–40	2.1	1.4	1.7	2.4	2.1	2.2	1.9	2.1	2.0	1.8
	41–50	3.2	3.2	3.2	2.6	2.6	2.6	2.4	3.2	2.8	2.8
	51–60	4.0	3.9	3.9	3.6	4.0	3.8	3.1	4.4	3.7	3.8
	mean	2.8	2.4	2.6	2.5	2.4	2.4	2.2	2.7	2.4	2.4
$LSD_{0.05}$											
Cultivar (A)											0.48
Bulb size (B)											0.48
Storage temperature (C)											n.s.
Interaction (B×C)											1.10
Population 'U'	20–30	0.0	0.0	0.0	3.0	2.0	2.5	0.0	1.6	0.8	

The height of generative shoots was significantly dependent only on cultivar and diameter of bulbs used for planting. Generative shoots of cv. 'Toto' had the highest height (on average 76.2 cm), while generative shoots of cv. 'Ambition F_1' had the lowest height (on average 60.2 cm). No significant differences were found in the height of generative shoots in all the hybrid cultivars. Their height was at a level of 60.2–64.7 cm. In each cultivar, shallot plants from larger bulbs produced higher generative shoots. Nevertheless, no significant differences were found in the height of shoots in plants from bulbs with a diameter of 31–40 mm and 41–50 mm (Fig. 1 and 2).

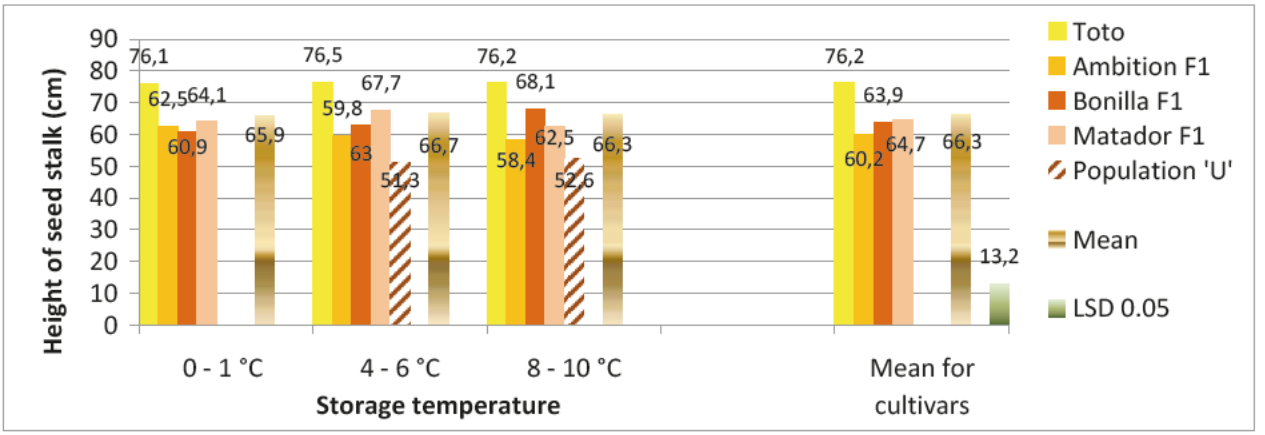

Fig. 1. The height of generative shoots (seed stalk) depending on the cultivars and storage temperature of steckling bulbs

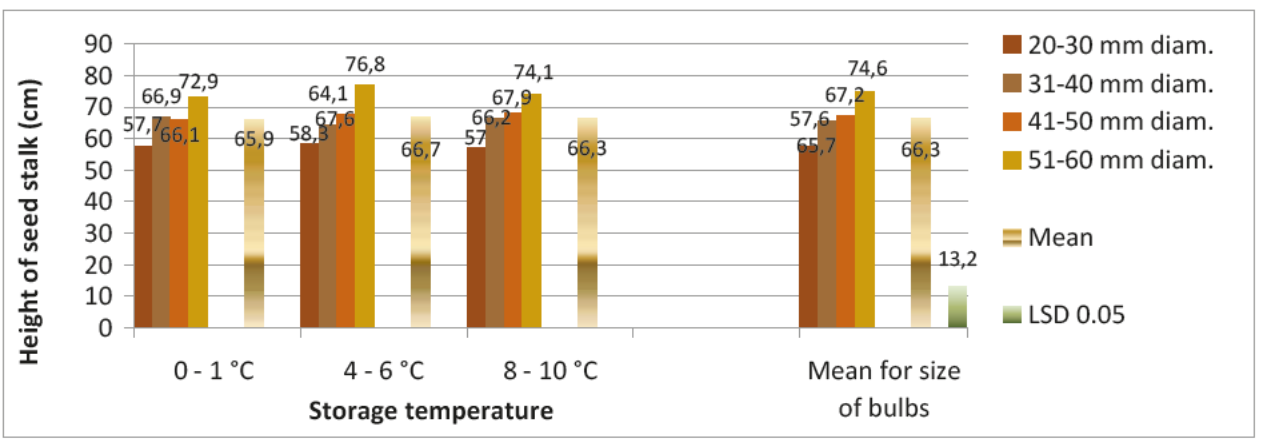

Fig. 2. The height of generative shoots (seed stalk) depending on storage temperature of steckling bulbs with different diameters

Plants of the population 'U' produced lower shoots compared to the cultivars grown from the same fraction of bulbs. They did not exceed a height of 55 cm. When grown from bulbs 20–30 mm in diameter, only plants of cv. 'Matador F_1' produced generative shoots with a similar height as in the population 'U'.

The weight of seed heads and seed yield was determined only for the cultivar 'Toto' and the population 'U'. Plants of cv. 'Toto' grown from bulbs with the smallest diameter of 20–30 mm stored at 0 ºC, similarly to the other cultivars, produced very few generative shoots and no set seeds were found in their umbels. In 2011 seed umbels in plants of cv. 'Toto' grown from bulbs 20–30 mm in diameter stored at 8–10ºC did not produce seeds, either. Seed umbels of cv. 'Toto' which were harvested from plants grown from bulbs stored at 4–6 ºC were characterized by significantly the highest weight. This had an effect on seed weight per umbel and seed yield from all umbels harvested in this treatment.

The highest seed yield was obtained from plants grown from bulbs with a diameter of 41–50 mm and 51–60 mm. Regardless of bulb diameter, the storage of bulbs at a temperature 0–1 ºC did not promote the production of seed in umbels and thus obtaining seed yield.

The local population 'U' was characterized by a very poor ability to produce seeds. The yield obtained from plants grown from bulbs 20–30 mm in diameter can be considered to be insignificant. Compared to the cultivar 'Toto', seed umbels of plants of the population 'U' from bulbs stored at 4–6 ºC had lower weight more than 7 times, while seed yield per umbel was 15 times lower (Table 3). In this population, regardless of storage temperature of steckling bulbs, plants showed the bolting ability at a very marginal level.

Table 3
Weight of seed umbels and seed yield of the cultivar 'Toto' depending on storage temperature of steckling bulbs

Storage temperature	Size of steckling bulbs (mm in diam.)	Weight of umbel (g)			Weight of seed yield per umbel (g)			Seed yield (g × 100 m^{-2})		
		2011	2012	mean	2011	2012	mean	2011	2012	mean
0–1 °C	20–30	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0
	31–40	1.26	1.53	1.39	0.01	0.01	0.01	10.26	3.89	7.07
	41–50	1.66	2.40	2.03	0.02	0.02	0.02	54.46	25.00	39.73
	51–60	3.12	5.20	4.16	0.06	0.25	0.15	220.77	427.08	323.92
	mean	1.51	2.28	1.89	0.02	0.07	0.04	71.37	113.99	92.69
4–6 °C	20–30	1.02	1.96	1.49	0.02	0.29	0.15	8.56	222.33	115.44
	31–40	1.15	3.23	2.19	0.11	0.45	0.27	432.25	523.12	477.68
	41–50	1.76	3.30	2.53	0.12	0.39	0.25	648.33	2560.00	1604.16
	51–60	3.40	4.83	4.11	0.16	0.89	0.52	1189.4	3411.66	2300.70
	mean	1.83	3.33	2.58	0.10	0.50	0.29	569.72	1679.27	1124.49
8–10 °C	20–30	0.00	2.52	1.26	0.00	0.42	0.21	0.00	434.00	217.00
	31–40	0.00	3.10	1.55	0.00	0.15	0.07	0.00	375.00	187.50
	41–50	1.86	3.03	2.44	0.09	0.26	0.17	674.93	1040.00	857.00
	51–60	2.12	3.10	2.61	0.09	0.43	0.26	1680.3	949.58	1314.85
	mean	0.99	2.93	1.96	0.04	0.31	0.17	588.76	699.64	644.20
Mean	20–30	0.34	1.49	0.91	0.01	0.23	0.12	2.85	218.77	110.81
	31–40	0.80	2.62	1.71	0.04	0.20	0.12	147.50	300.67	224.08
	41–50	1.76	2.91	2.33	0.07	0.22	0.14	459.24	1208.33	833.63
	51–60	2.88	4.37	3.62	0.10	0.52	0.31	1030.1	1596.10	1313.16
	mean	1.44	2.84	2.14	0.05	0.29	0.17	409.95	830.96	620.42
$LSD_{0.05}$:										
Stor. temp				n.s.			n.s.			846.71
Bulb size				2.00			n.s.			1089.20
Interaction				n.s.			n.s.			n.s.
Popul. °U'										
0–1 °C	20–30	-	-	-	-	-	-	-	-	-
4–6 °C	20–30	0.18	0.22	0.2	0.02	-	0.01	2.08	0.00	-
8–10 °C	20–30	-	0.18	-	-	-0.11		-	-	-

DISCUSSION

The results of the present study showed that bolting in shallots, similarly to common onions, depends not only on the size of mother bulbs but also on the temperature of their storage. The shallot belongs to the Aggregatum group, since it can produce several or over a dozen not very large bulbs in the cluster of a plant [1,11,12]. This trait is quite important in the production of shallot and common onion for seed. As shown by this research and studies of other authors [13–15], only large mother bulbs and an appropriately long period of treatment of these bulbs with a temperature of 4–10 °C promote bolting and seed production. Plants of the studied cultivars grown from small mother bulbs with a diameter of 20–30 mm and 30–40 mm produced very few generative shoots and a small quantity of seeds. In many shallot plants from bulbs with the same diameter stored at 0–1 °C, no seed heads formed even though the plants had bolted. For this reason, this fraction of bulbs proved to be useless as mother bulbs in shallot production for seed. T a b o r [16] and T a b o r *et al.* [17] attempted to explain the response of shallot plants to the effect of vernalization temperature in combination with the juvenile phase. In young plants in which the

accumulation of carbohydrates, as a source of energy, is lower than in older plants (with larger dimensions), the chance of bolting is definitely lower. Energy stored in the form of carbohydrates promotes cell differentiation in inflorescence stems, a consequence of which is their full growth, including the production of seeds.

Storage temperature of shallot bulbs had a significant effect on bolting and seed yield. According to numerous studies on this issue, in shallots and common onions the most beneficial effect of vernalization and, as a consequence of that, bolting can be achieved when plants are grown from large bulbs stored at a temperature of 4–10 °C [13, 14,18,19,20,21].

Seed yield of the shallot cultivar 'Toto' was significantly dependent on the size of mother bulbs and storage temperature. Such a relationship has also been found in onions grown in the Polish conditions [15,21,22].

The research of Khokhar et al. [20] and Khokhar [14] found that in the onion cultivars 'Hygro' and 'Delta' the highest seed yield was obtained from large bulbs (22.5 mm in diameter) stored at a temperature 5 °C for 90 days and 120 days. This yield was 2.96–3.31 g per head. In the shallot cultivar 'Toto', seed yield per head in plants from bulbs with a similar diameter (20–30 mm) was however much lower, since shallots produce slightly smaller seeds than common onions, which was shown at a further stage of the present study.

The seed yield obtained from shallot plants grown from large bulbs (51–60 mm in diameter) stored at a temperature 4–6 °C was on average 160.1–2300.7 g per 100 m^2. As reported by Kowithayakom et al. [23] as well as by Sumami and Soetiarso [8], in the conditions of Thailand and Indonesia similar seed yield was obtained from shallot plants grown from bulbs with a diameter of 28 mm (in the range of 2180–2500 g × 100 m^{-2}).

CONCLUSIONS

1. The storage temperature of shallot steckling bulbs in the range of 4–6 °C and 8–10 °C proved to be more conducive to bolting compared to the temperature of 0–1 °C. Regardless of bulb size, the percentage of bolting plants from bulbs stored at a temperature of 0–1 °C was almost 2 times lower than in the case of plants from bulbs stored at a temperature of 4–6 °C and 8–10 °C.
2. The study showed that shallot plants can bolt and produce the highest number of generative shoots per plant only when they were grown from mother bulbs with a diameter over 40 mm (41–60 mm).
3. Steckling bulbs of the cultivar 'Toto' with a diameter of less than 40 mm proved to be not very useful for seed production, even if they were stored at a temperature that was the most conducive to vernalization, i.e. 4–6 °C.
4. The local population 'U', which does not have the propensity to produce large bulbs compared to the cultivars included in the present experiment, does not promise positive effects for seed production.

Acknowledgements

This work was financially supported by the Ministry of Science and Higher Education within the scientific project No. N N310 449838.

Authors' contributions

The following declaration about authors' contributions to the research have been made: study conception: MT; field researches and collecting data: MT, BM, MK; data interpretation: MT, MK; writing of the manuscript, table and figure arrangement: MT,BM.

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Wpływ temperatury przechowywania cebul wysadkowych na rozwój pędów nasiennych i plon nasion szalotki (*Allium cepa* L. var. *ascalonicum* Backer)

Streszczenie

Badania przeprowadzone w latach 20010–2012 miały na celu ocenę rozwoju generatywnego szalotki i wytwarzania nasion w zależności od temperatury przechowywania cebul wysadkowych o różnej średnicy. W badaniach występowały 4 odmiany (‘Toto’, ‘Ambition F_1’, ‘Bonilla F_1’, ‘Matador F_1’) i jedna lokalna populacja (‘U’). Cebule o średnicy: 20–30 mm, 31–40 mm, 41–50 mm i 51–60 mm przechowywano od pierwszej dekady listopada (2010 i 2011) do końca marca (2011 i 2012) w temperaturze 0–1 °C, 4–6 °C i 8–10 °C. Po ich posadzeniu w polu (druga dekada kwietnia) prowadzono obserwacje rozwoju pędów nasiennych, a tylko u odmiany ‘Toto’ i populacji ‘U’ określono masę baldachów nasiennych i plon nasion. Temperatura przechowywania cebul wysadkowych 4–6 °C i 8–10 °C najbardziej sprzyjała rozwojowi pędów generatywnych, zwłaszcza u roślin z cebul dużych o średnicy powyżej 40 mm. U odmiany ‘Toto’ największą masą charakteryzowały się baldachy nasienne roślin z sadzenia cebul powyżej 40 mm średnicy i przechowywanych w temperaturze 4–6 °C. Miało to wpływ na uzyskanie największego plonu nasion (średnio 1604.16–2300.7 g ze 100 m^2 powierzchni pola). Szalotka populacji ‘U’ z sadzenia cebul o średnicy 20–30 mm charakteryzowała się zdecydowanie mniejszym udziałem roślin wytwarzających pędy generatywne w porównaniu do odmian. Z tego powodu nie rokuje pozytywnych efektów w produkcji na nasiona.

Handling Editor: Elżbieta Weryszko-Chmielewska