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YIELDING OF *Sparaxis tricolor* Ker-Gawl. ACCORDING TO TERM AND DEPTH OF PLANTING IN LUBELSZCZYZNA REGION

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Abstract. Corms of *Sparaxis tricolor* were planted in the second 10 days period: from 20th April to 20th May, on three depths: 4 cm, 6 cm and 8 cm. The largest number of descendant corms and fresh matter of total and commercial yield was obtained from corms planted in the field on 20th April. Retarding of planting date influenced dispersion of the total yield of offspring corms. The largest number of corms produced in corners of leaves was obtained in the second 10 days' period of April. Depth of planting did not influence the total yield of corms. Plants from earlier terms produced, more descendant corms at the depth of 4 cm, while these from May dates more descendant corms produced at growing depth 8 cm.

Key words: *Sparaxis tricolor*, planting date, planting depth, yield of descendant corms

INTRODUCTION

Sparaxis tricolor Ker-Gawl. is a representative of the family of *Iridaceae*. It is a plant of the Mediterranean climate and its region of occurrence is restricted to a small area of southwestern Africa. In our climate the plants do not survive the winter in the field, that is why *Spraxis* corms should be planted in spring and dug out at the end of summer. Defining the optimum date of planting for the species from different climatic zone is the condition of their proper growth and development and also crop. The choice of the date of planting must be correlated with the temperature demands of the plants and their preferences as to the length of the day of the intensity of light and amount of water. That is why the aim of examinations carried out in the Decorative Plants Department of the Agricultural Academy in Lublin was to determine the influence of the date of planting upon the crop of S*paraxis tricolor*.

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MATERIAL AND METHODS

An experiment of two elements was carried out during the years 2000–2003 in the Experimental Farm of Agricultural Academy in Felin in the fallow soils containing about 1.6% of organic matter. The material for the examination were the plants of *Sparaxis tricolor*. The experiment was prepared as a set of chance blocks in five repetitions. A repetition was a plot of a surface of 1 m^2.

The first element was constituted by 4 dates of planting: April 20th, April 29th, May 10th and May 20th, while the second element referred to 3 depths of planting: 4 cm, 6 cm and 8 cm. The corms with a circumference: >4 cm (+4) were planted in 2000. In 2001 and 2003 larger corms were used >5 cm (+5) and they were planted of 30 corms on a plot. The corms were soaked in a suspension of Kaptan for 15 minutes before planting. The plots were fertilized with Azofoska, 25 g · m^{-2} in spring, before planting the corms. During the vegetation period the plants were fertilized ammonium saltpeter 10 g · m^{-2} and Azofoska, 25 g · m^{-2} (single does were used). During the whole vegetation period the plots were weeded manually. The plants were sprinkled against plant louse and *Fusarium* wilt. In 2001 and 2003 the plants were watered since May until the middle of June in cases when the soil was too dry. After the end of the vegetation period the plants of *Sparaxis* which were planted at the April dates were dug out at the beginning of the third decade of August, and the ones planted in May – in the first decade of September. After digging, drying and cleaning the corms, their number and mass of the general and commercial crop were stated – commercial corms are those with a circumference > 4 cm. The results obtained were then statistically compiled by means of variance analysis for the double cross classification, using Tukey's multiple trust sections (the level of relevance 0.05).

RESULTS

Statistic analysis has proved a relevant influence of the dates of planting upon the number of corms in the general crop (tab. 1). The biggest number of corms was formed by the plants which were planted on 20th April and 10th May (101.3 and 101.2 pieces · m^{-2}), the smallest number of corms in the general crop from those planted on 29th April (89.4 pieces · m^{-2}). Planting the corms at the depth of 4 cm had positive influence upon the number of obtained offspring corms (101.2 pieces · m^{-2}) compared with deeper planting at 8 cm (89.4 pieces · m^{-2}).

It was stated that there is a dependence between the date and depth of planting. The highest general crop was obtained when planting *Sparaxis* on 20th April at the depth of 4 cm, and shallow planting also influenced positively the size of the crop at the second and the third date of planting. The plants which were planted at the latest date gave higher crop of offspring corms from the ones planted at the depth of 6 and 8 cm.

Comparison of the examined dates of planting proves that the highest mass of corms of the general crop was obtained from *Sparaxis* planted early on 20th April (195.6 g · m^{-2}), (tab. 1). The lowest mass of the general crop was obtained from the bulbs planted on 20th May (126.0 g · m^{-2}). The mass of corms of the general crop obtained from the second and third date of planting was of similar value.

Table 1. Yield of descendent corms of *Sparaxis tricolor* according to term and depth of planting of corms (means of the year 2000–2003)
Tabela 1. Plon bulw potomnych sparaksisu trójbarwnego w zależności od terminów i głębokości sadzenia (średnie z lat 2000–2003)

Term and depth of planting Terminy i głębokości sadzenia		General crop Plon ogólny		Commercial crop Plon handlowy		The cormles produced in corners of leaves Plon bulw kątowych	
		szt·m^{-2} – pcs·m^{-2}	g·m^{-2}	szt·m^{-2} – pcs·m^{-2}	g·m^{-2}	szt·m^{-2} – pcs·m^{-2}	g·m^{-2}
20.04	4 cm	114.7a*	209.2a	62.3a	191.1a	48.1ab	11.4
	6 cm	97.9bc	189.8ab	59.2ab	175.2ab	54.5a	13.1
	8 cm	91.3bc	187.9ab	56.1abc	175.5ab	51.1ab	13.2
29.04	4 cm	95.0bc	152.2c	50.1cde	131.5c	39.9bcd	9.5
	6 cm	87.1c	152.3c	49.5cde	137.3c	39.6bcd	10.1
	8 cm	86.1c	161.0bc	53.4bcd	148.0bc	45.4ab	11.3
10.05	4 cm	106.5ab	143.7cd	49.8cde	122.1cd	42.8abc	10.3
	6 cm	101.8abc	141.4cde	48.9c-f	120.0cd	37.7bcd	8.8
	8 cm	95.3c	140.8cde	44.0ef	119.6cd	31.4cd	7.1
20.05	4 cm	88.6c	114.0e	43.3ef	95.5d	27.2d	8.1
	6 cm	99.9abc	119.3de	41.2f	96.3d	28.2d	8.4
	8 cm	100.9abc	144.6cd	45.9def	124.3cd	31.5cd	8.8
Mean for term of planting Średnie dla terminów	20. 04	101.3a	195.6a	59.2a	180.6a	51.2a	12.6a
	29. 04	89.4b	155.2b	51.0b	138.9b	41.6b	10.3b
	10. 05	101.2a	142.0b	47.6b	120.6c	37.3b	8.7bc
	20. 05	96.5ab	126.0c	43.5c	105.4d	29.0c	8.4c
Mean for depth of planting Średnie dla głębokości sadzenia	4 cm	101.2a	154.8	51.4	135.1	39.5	9.8
	6 cm	96.7ab	150.7	49.7	132.2	40.0	10.1
	8 cm	93.4b	158.6	49.9	141.9	39.8	10.1

* Means followed by the same letter do not differ significantly – Średnie oznaczone tą sama literą nie różnią się istotnie

A kind of dependence was found between the date and depth of planting. The highest mass of offspring corms was obtained from *Sparaxis* planted on 20th April at the depth of 4 cm (209.2 g · m^{-2}), and the lowest on 20th May at the depth of 4 cm (fig. 1).

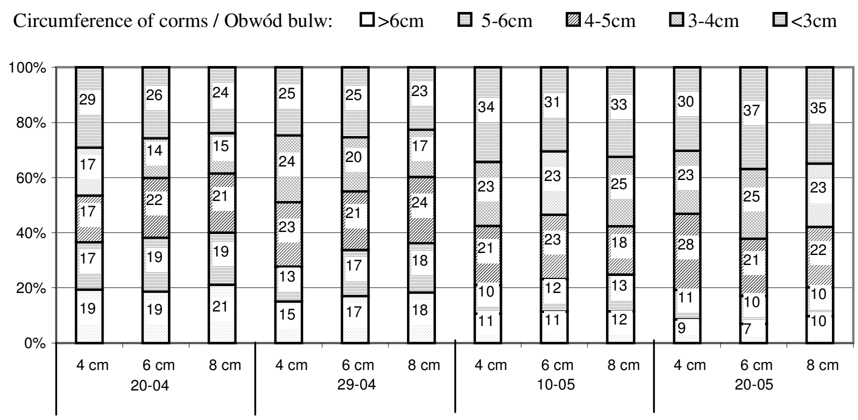

Fig. 1. Percentage of corms of each sort in the *Sparaxis tricolor* offspring corms general crop according to term and depth of planting (means of the year 2000–2003)

Rys. 1. Procentowy udział bulw poszczególnych wyborów w plonie ogólnym bulw potomnych *Sparaxis tricolor* w zależności od terminów i głębokości sadzenia (średnie z lat 2000–2003)

Planting the corms on 20th April had the most positive influence upon the number of commercial corms 59.2 pieces · m^{-2}. The smallest number of commercial corms was obtained from planting maternal corms on 20th May (43.5 pieces · m^{-2}). The influence of the depth of planting was dependent upon the date of planting Sparaxis. The largest number of commercial corms was obtained from planting *Sparaxis* on 20th April at the depth of 4 cm and the smallest number from planting it on 20th May at the depth of 6cm. Early planting of maternal bulbs enlarged also the mass of corms of the commercial crop. The largest commercial crop as far as weight is concerned was obtained from *Sparaxis* planted at the first date (195.6 g· m^{-2}) while the lowest mass of commercial corms was obtained from the plants of *Sparaxis* planted at the latest date (20th May) (126.0 g · m^{-2}). It was proved that there is a dependence between the date and the depth of planting the corms. The date of 20th April at the depth of 4 cm was the most advantageous for the mass of the commercial crop, while the corms planted on 20th May at the depth of 4 cm gave the smallest commercial crop as far as weight is concerned.

The dates of planting *Sparaxis* corms examined in the experiment influenced the number of corms formed in the leaf angles at the underground part of the stems. The largest number and mass of angle corms were obtained from the earliest date of planting (20th April). Retardation of planting caused a successive decrease of the number of angle corms. The smallest number of angle corms was obtained from the plants which were planted on 20th May (tab. 1). On the basis of the interaction between the date and depth of planting it was stated that the largest number of corms can be obtained when the maternal corms are planted on 20th April at the depth of 6 cm (54.5 pieces · m^{-2}),and the smallest number of angle corms was obtained from *Sparaxis* planted on 20th April at the depth of 6cm (54.5 pieces · m^{-2}), and the smallest number of angle corms was obtained from *Sparaxis* planted on 20th May at the depth of 4 cm.

On the basis of comparison of the structure of crop of offspring corms from 3 years of examination it can be stated that the largest proportional share of commercial corms in the general crop (61%) was obtained when corms were planted on 20th April at the depth of 8 cm (fig. 1), and also the proportional share of corms of particular sizes had the most advantageous arrangement in this combination (corms > 6 cm 21%, corms 5–6 cm 19%, corms 4–5 cm 21%). Retardation of the of planting diminished the share of the corms with the circumference > 6 cm (from 20 to 9%) and 5–6 cm (from 18 to 10%) in the structure of general crop. The share of corms with a circumference of 3–4 cm in the structure of the crop increased in the plants which were planted in May (from 15% on 20th April to 24% on 20th May) and the smallest corms < 3 cm (from 26 to 34%). The smallest share of commercial corms in the structure of commercial crop was noted in plants which were planted on 20th May at the depth of 6 cm (38%).

DISCUSSION

Sparaxis planted in 10 day intervals since 20th April until 20th May gave a similar number of offspring corms but the overall mass of the general crop decreased along with the retardation of planting which shows the worsening of its quality. The number and mass of corms counted in the commercial crop also decreased gradually along with the retardation of planting. Kapczyńska et al. [2003] also state that the date of planting does not influence the overall crop of *Sparaxis* corms and the largest number of large corms is obtained when *Sparaxis* is planted at the on turn of April and May. Our own examinations, however, prove that in Lublin region better quality and quantity crops of corms are obtained when *Sparaxis* is planted on 20th April, although a high commercial crop was also obtained from corms planted on the last days of April. The plants which were planted on that date gave little small corms in a clone of offspring corms, but the corms with the largest circumference were obtained from the ones planted on the earliest date. Our own examinations have proved that the mass of the overall crop of the plants which were planted on the first date was higher by 55%, and the mass of the commercial crop higher by 71% as compared to the crop obtained from plants which were planted on the last date. It is confirmed by Grabowska's examinations [1978] concerning the influence of the date of planting upon the growth of the storage tissue of *Gladiolus*, in which planting in the second decade of March caused an increase of the overall crop of corms from 26 to 92% and of the commercial crop from 54 to 122% as compared to plants which were planted 4 weeks later. Tonecki [1980] has also found a negative influence of late planting upon the crop of *Gladiolus* corms. A profitable influence of early dates of planting *Gladiolus* in India upon the mass and diameter of new corms, and also the number of small corms formed by the plant has also been stated by Kalasareddi et al. [1998], Arora and Sandhu [1987], Hong et al. [1989] and also Maitra and Roychowdhury [1999]. *Acidantera bicolor* gave the highest crop of offspring scale corms when it was planted between 8th March and 9th April as compared with later planting [Piskornik and Koziara 1994]. Laskowska and Kocira [2003] also stated that the retardation of planting *Acidantera* until the second decade of May can cause the decrease of offspring corms crop by 45%, and of the commercial crop even by 130–211% as compared with earlier planting on the turn of April and May. *Allium sativum* planted on autumn and spring dates reacted to the retardation of planting with the decrease of bulb crop even by 63% and the share of bulbs of the first size decreased from 89.1 to 71.8% in the plants which were planted on the latest date [Orłowski 1993]. In our own examinations a similar dependence was proved between the date of planting and the structure of crop of offspring corms. Retardation of planting causes an increase of division of the crop structure, the commercial corms of plants which were planted on 20th April constituted 61% of the overall crop, and their share in the crop decreased to 38% in the plants which were planted a month later (fig. 1).

A separate component of the crop of *Sparaxis tricolor* corms are the ones formed in leaf angels at the underground part of the stem. In favorable conditions they usually may even reach 3 cm of circumference, and after year of cultivation they usually reach the commercial size. The largest number and mass of the corms was always obtained from the plants which were planted on the earliest date, on 20th April. *Sparaxis* plants cultivated in Cracow region formed more angle corms when it was planted at the end of April and beginning of May as compared with the corms planted in the first and second decade of April [Kapczyńska 2001]. Our own examinations prove that the number of angle corms obtained from particular dates of planting may be similar in the years witch favorable meteorological conditions, and as they are formed after the end of flowering they do not profit by fast dormancy of the plants, which was observed in the last year of the examination, when extremely high temperatures caused faster drying of the plants and they were already dug in the middle of August. The Angle corms crop was lowest that year and the differences between the dates of planting were very large, which was not observed in the first and second year of examinations. It can also be noticed that the plants which were planted at the end of the end of the second decade of May gave the smallest number and mass of the angle corms; it may be connected with a shorter vegetation period.

The overall crop of offspring corms was the highest when the planting was shallow, at the depth of 4 cm. The deeper the planting, the smaller the number of corms formed by the plants. The fact is confirmed by the examinations led by Kapczyńska [2001], who also managed to obtain a higher crop of offspring corms planting *Sparaxis* at the depth 4 cm. The profitable influence of shallow planting upon the number and mass of corms and also the coefficient of propagation is confirmed by the examination concerning *Gladiolus* [Grabowska 1978, Incalcaterra 1992], *Tuberose* [Sing and Kumar 1999, Mahros 1999, Rao et al. 1991] and *Freesia* [Lee et al. 1997]. On the other hand, cultivation of *Acidanthera bicolor* gave a higher crop of scale-corms when planted deeper (8–12 cm) as compared to shallow planting (4 cm) [Laskowska and Kocira 2003]. Maitra and Roychowdhury [1999] also state that in case of *Gladiolus* very shallow planting (2–

4 cm) causes an increase of the crop of small offspring corms but the plants which were planted more deeply had a bigger mass and diameter of the supplementary corms. *Allium moly* also gave larger bulbs when they were planted at a greater depth [Sadkowska 2002].

The influence of the depth of planting upon the crop of the storage tissue of *Sparaxis* was dependent upon the date of planting the corms in the field. As far as the earliest date of planting in concerned (20th April) the largest number of corms of general and commercial crop was obtained from the corms planted at the depth of 4 cm, while the later dates of planting gave a higher general and commercial crop when planted at the depth of 8 cm. The plants which were planted in the first and second decade of May at a small depth were often put into rather warm ground, which was drying very fast on hot days, and it could cause worsening of the growing conditions and the crop of the offspring corms. Ruiters et al. [1992] examined plants of *Sparaxis grandiflora* subsp. *fimbriata* in their natural environment and found corms of the largest circumference at the depth of 4 cm. Our own examinations prove that *Sparaxis tricolor* planted early at the depth of 4 cm gives most corms of largest circumference > 6 (2000) and 9 cm (2001, 2003). Kapczyńska's [2001] examinations also prove that more shallow planting influences formation of *Sparaxis* corms with the largest circumference.

CONCLUSION

1. The date of planting *Sparaxis tricolor* in the field influences meaningfully the differences of mass of the crop of offspring corms. The highest general crop as far as weight is concerned can be obtained when *Sparaxis* is planted at the beginning of the second decade of April. Retardation of planting causes the decrease of the mass of corms, but it doesn't influence the general number of offspring corms.

2. The largest commercial crop both concerning number and weight, and also the most profitable structure of the crop, with the biggest share of commercial corms and first size corms in the general crop can be obtained when *Sparaxis* is planted.

3. Shallow planting of *Sparaxis* at the depth of 4 cm on the earliest date causes the increase of the number of corms of the largest circumference, but a higher share of the commercial crop in the general crop can be obtained planting the corms at the depth of 6–8 cm.

4. Retardation of planting causes an increase of small corms with the circumference of 3–4 cm and < 3 cm in the structure of crop, but the share of corms of the first and second size decreases. Likewise the number of angle corms decreases along with the retardation of planting maternal corms in the field.

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PLONOWANIE SPARAKSISU TRÓJBARWNEGO (*Sparaxis tricolor* Ker-Gawl.) W ZALEŻNOŚCI OD TERMINU I GŁĘBOKOŚCI SADZENIA BULW W WARUNKACH LUBELSZCZYZNY

Streszczenie. Bulwy sparaksisu trójbarwnego sadzono w odstępach 10-dniowych od 20 kwietnia do 20 maja na 3 głębokościach: 4, 6 i 8 cm. Najwyższy liczbowo i wagowo plon ogólny i handlowy bulw potomnych, a także bulw wytwarzanych w katach liści uzyskano z najwcześniejszego terminu sadzenia bulw matecznych. Wpływ głębokości sadzenia zależał od terminu sadzenia bulw. Przy wczesnym sadzeniu wyższe plony uzyskiwano, sadząc bulwy mateczne na głębokości 4 cm. Sparaksis sadzony w drugiej dekadzie maja wytwarzał wyższy plon bulw potomnych, gdy bulwy mateczne posadzono na głębokości 8 cm.

Słowa kluczowe: *Sparaxis tricolor*, termin sadzenia, głębokość sadzenia, plon bulw

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