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THE SOWING VALUE OF TANSY PHACELIA (*PHACELIA TANACETIFOLIA* BENTH.) SEEDS IN THE LONG-TERM STORAGE

Piotr Ponichtera*

Department of Agribusiness, The Academy of Agrobusiness in Łomza

* *Corresponding author: e-mail: piotr.ponichtera@wsa.edu.pl*

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ABSTRACT

In 2010 the experiment, which aim was to examine the sowing value of tansy phacelia seeds after eight and nine years of storage, was conducted in the laboratory of the Academy of Agrobusiness in Łomża. The experiment clearly demonstrates that the period of storage of tansy phacelia seeds has an essential impact on the changes of basic parameters of the sowing value. Vetrovska variety had the highest seed germinability among the other varieties of tansy phacelia which were stored for 8 years. At the same time this variety had the highest decrease in seed germinability after 9 years of storage. During the 9-year storage Natra variety showed the highest decrease in thousand seeds weight despite the highest value of this parameter among all the tested varieties immediately after yielding. The results of the experiment allowed for the conclusion that the economic life cycle of tansy phacelia seeds is 8 years.

Introduction

Excess production of basic agricultural plants determines growers to cultivate alternative crops, which become a next source of income and may enrich soil with organic matter as a green fertilizer or to feed animals in the form of mixtures with fodder plants with simultaneous low work expenditure (Brzezowska and Dreszczyk 2009). Tansy phacelia is one of them. It has not been popular up until recently. However, in the recent years slowly but successively it has gained numerous followers. Due to possibility of using it as an intercrop in the agri-environmental program, farmers obtain additional aid from the The Agency for Restructuring and Modernisation of Agriculture. The crop itself is great for non-plough cultivation which on account of economics gives a great advantage over other post-crop plants (Leszczyńska, 2012).

Tansy phacelia is presently very intensively used in organic agriculture and for sowing of arable land temporarily excluded from production (Ramenda, 2003).

Tansy phacelia is used in our country as a post-crop and honey plant. Limited popularity of this plant depends on a low availability of its seeds on the market which results from difficulty in cultivation and price of seeds. Despite the fact that the plant has low soil, fertilization and climatic requirements, high yield may be obtained only with optimal moisture and thermal conditions. Plants which were negatively affected by weather may characterize

with low yield and extension of flowering and seeds maturation. One of the grower's task should consist in maintaining high quality of seeds through their appropriate storage. Unfortunately, storing also causes some problems. Plants lose their vitality and sowing value with each year. Storage without loses of sowing value of seeds has been interesting for researchers for many years. The research by Gabińska et al., (1991), Górecki et al. (1998), Górskiego (1999; 1995) proved varied impact of the storage period on particular crops.

The issue of the impact of long-term seeds storage on their sowing quality is very significant on account of economy and maintaining high germination ability of the investigated sowing material in the form of a specific species of crop. According to Sulewska et al., (2005) during the so called farm storage of seeds, conditions and storage time should be absolutely considered, which affect germination ability, particularly when we plan the use of these seeds as sowing material.

Objective, scope and methodology of research

The objective of the research was to determine fundamental parameters of the sowing value of tansy phacelia seeds after eight and nine years of storage. The parent substance consisted in tansy phacelia of four varieties: Mira, Natra, Stala and Vetrovska. Each variety came from the harvesting in 2001 and 2002. Sowing material was stored in paper bags in a storage in a dark room in temperature of 15-20ºC and relative moisture of 50%. Investigation of the sowing value included determination of germination energy after 5 days, germination ability after 14 days from placing seeds on a blotting paper in specially prepared cuvettes. Analysis of energy and germination ability was carried out under applicable International Seeds Testing Association ISTA (2009). Sowing was preceded by determination of 1000 seeds mass, which consisted in counting 500 seeds, weighting them and multiplying by 2. After germination energy and ability were determined, a determined number of seeds (100 pcs) were sowed in cuvettes with dimension of 12x21.5x3 cm in four iterations. Research was carried out in 2010, that is, respectively after eight and nine years of storage.

For statistical analysis a two factor analysis of variance was applied. In case of determination of a significant impact of investigated factors, significance of differences between averages was proved with T-Student test.

Research results

Period of storage of seeds has a crucial impact on the germination ability in all investigated varieties (tab. 1 and 2).

Average germination energy of tansy phacelia seeds harvested in 2002 was 95.02%. The highest germination energy was in case of Mira variety (95.38%) and the highest one in case of Natra variety (94.31%). After 8 years of storage a decrease of germination energy took place (at the average by 10.38%). The lowest one was reported in case of Vetrovska variety (5.87%), and the highest in case of Mira variety (15.94%), which was presented in table 1.

Table 1.
Germination energy of tansy phacelia after harvesting and after 8 years of storage (%)

Variety	Harvesting date		Level p
	After harvesting (2002)	After 8 years (2010)	
Stala	95.06	85.00	<0.01
Vetrovska	95.31	89.44	<0.01
Natra	94.31	84.69	<0.01
Mira	95.38	79.44	<0.01
Average	95.02	84.64	

– probability proved with T-student test

Average germination energy of tansy phacelia collected in 2001 was 94.86% and it only insignificantly differed between the varieties. After 9 years of storage a decrease of germination energy took place (at the average by 34.19%). The lowest decrease of germination energy of 28.81% was reported in case of Vetrovska variety. Mira variety, despite high germination energy in the harvesting years, also after 9 years of storage reported the highest germination energy decrease which was 36.62% and it was presented in table 2.

Table 2.
Germination energy of tansy phacelia after harvesting and after 9 years of storage (%)

Variety	Harvesting date		Level p
	After harvesting (2001)	After 9 years (2010)	
Stala	94.69	59.69	<0.01
Vetrovska	95.00	58.69	<0.01
Natra	94.94	66.13	<0.01
Mira	94.81	58.19	<0.01
Average	94.86	60.67	

– probability proved with T-student test

The average germination ability of tansy phacelia collected in 2002 was 95.24% and it only insignificantly differed between the varieties. After 8 years of storage germination ability decreased (at the average by 8.43%). The highest decrease was reported in Mira variety and it was 13.81% despite the highest germination ability from among all investigated varieties shortly after harvesting in 2002. The lowest decrease was reported in case of Vetrovska variety which was 3.32% which proves the fact that the storage period did not significantly influence the germination ability. The remaining varieties had the storage time that affected significantly germination ability (tab. 3).

Table 3.
Germination ability of tansy phacelia after harvesting and after 8 years of storage (%)

Variety	Harvesting date		Level p
	After harvesting (2002)	After 8 years (2010)	
Stala	95.19	87.06	<0.01
Vetrovska	95.38	92.06	0.05
Natra	94.81	86.38	<0.01
Mira	95.56	81.75	<0.01
Average	95.24	86.81	

- probability proved with T-student test

Storage duration significantly affected the germination ability in all investigated phacelia varieties stored for 9 years (tab. 6). Average germination ability of tansy phacelia seeds harvested in 2001 was 95.16%. The highest germination ability was in case of Natra variety (95.38%). After 9 years of storage an average decrease of 26.97% was reported. The lowest decrease was reported in case of Natra variety 22.44% and the highest decrease of germination ability was reported in Vetrocska variety 36.37% (tab. 4).

Table 4.
Germination ability of tansy phacelia after harvesting and after 9 years of storage (%)

Variety	Harvesting date		Level p
	After harvesting (2001)	After 9 years (2010)	
Stala	95.00	69.44	<0.01
Vetrovska	95.06	58.69	<0.01
Natra	95.38	72.94	<0.01
Mira	95.19	71.69	<0.01
Average	95.16	68.19	

– probability proved with T-student test

The average thousand seeds weight of tansy phacelia harvested in 2002 was 1.97 g. Vetrovska variety (2.06 g) had the highest thousand seeds weight and Stala variety had the lowest one (1.93 g). After 8 years of storage, the average decrease of thousand seeds weight was (0.02 g). Stala and Natra variety reported the increase of thousand seeds weight and it was respectively 0.02 g and 0.03 g. Storage time did not significantly influenced the thousand seeds weight of the above mentioned varieties. In case of other varieties: Vetrovska and Mira decrease of thousand seeds weight was reported and it was respectively 0.11 g and 0.03 g. The period of storage had a significant impact on the thousand seeds mass of the stored tansy phacelia varieties (tab. 5).

Table 5.
Germination ability of tansy phacelia after harvesting and after 8 years of storage (g)

Variety	Harvesting date		Level p
	After harvesting (2002)	After 8 years (2010)	
Stala	1.93	1.95	0.50
Vetrovska	2.06	1.95	0.01
Natra	1.95	1.98	0.50
Mira	1.94	1.91	0.44
Average	1.97	1.95	

– probability proved with T-student test

The average germination energy of tansy phacelia collected in 2001 was 2.01 g and it only insignificantly differed between the varieties. After 9 years of storage the thousand seeds weight was at the average 1.86g. The lowest reduction was reported in case of Mira and it was 0.10g. The highest reduction was reported in case of Natra variety 0.23 g. For Stala, Vetrovska and Natra varieties, the storage period had a significant impact on the thousand seeds weight. Also for Mira variety the impact of the storage period was significant (tab. 6).

Table 6.
Germination ability of tansy phacelia after harvesting and after 9 years of storage (g)

Variety	Harvesting date		Level p
	After harvesting (2001)	After 9 years (2010)	
Stala	1.98	1.86	<0.01
Vetrovska	2.00	1.85	<0.01
Natra	2.04	1.81	<0.01
Mira	2.03	1.93	0.01
Average	2.01	1.86	

– probability proved with T-student test

According to Gabińska et al., (1991) storage of triticale in controlled conditions in the temperature of approx. 0ºC and air moisture within 40-50% allows maintaining high sowing value even for 6 years. Similar results were obtained by Skiba (2005) in the experiment with winter rapeseed where it proved the impact of temperature on the increase of damage and reduction of the sowing value of investigated seeds.

Panasiewicz et al., (2012) in the experiment with winter triticale proved the impact of half-year storage on the reduction of germination ability with simultaneous increase of the number of dead caryopses and deterioration of parameters of vigour of the investigated seeds.

Sulewska et al., (2005) in the experiment with corn seeds stored for 6 years also obtained the reduction of the sowing value of the investigated seedlings. A part of the investigated varieties of corn after 6 years of storing seeds completely lost the germination ability, and the remaining one maintained its germination ability at the level of 30-70%.

Sowiński's study (1999) is the only Polish publication which concerns the period of storage on the sowing value of tansy phacelia sowing value. In his research he proved a considerable decrease of the sowing value after 7, 8 and 9 years of storage. His results were clearly correlated with the values obtained shortly after storage. Own research prove a similar relation. The higher output germination ability after harvesting the higher it is after the storage period.

Sowiński's research (1999) also proves that tansy phacelia seeds react to the storage duration differently. Tansy phacelia seeds get older in a non-uniform manner which is proved by the author's own research.

What is more, Jabłoński (1968) also confirms a considerable decrease of germination ability of tansy phacelia seeds. He reported it in the own research carried out on all varieties after 9 years of storage. He noticed that seeds stored for the period of 10 years completely lose the sowing value and further storage of tansy phacelia seeds is unjustified.

According to Duczmal and Tucholska (2000) economic life cycle of seeds is a period, when seeds of a given batch maintain livelihood predicted with suitable standards. Resolution of the Minister of Agriculture and Rural development as of 14th September 2010. (JoL No 183 Item 1230) determines a minimal germination ability of tansy phacelia for the basic and qualified category at the level of 80%. In the own research, average germination ability of tansy phacelia stored for 8 years was 86.81% and after 9 years it unfortunately decreased to the level of only 68.19%.

Conclusion

1. The period of storage of tansy phacelia seeds had a significant impact on the change of fundamental parameters of the sowing value.
2. The highest decrease of germination ability after 8 and 9 years of storage (respectively 15.94% and 36.62%) was in case of Natra variety despite a high value of this parameter in the cropping years.
3. The highest germination ability from among the investigated varieties of tansy phacelia stored for 8 years was in case of Vetrovska variety seeds (92.06%); at the same time this variety reacted with the highest decrease of germination ability after 9 years of storage.
4. During 9-years of storage the highest decrease of the thousand seeds weight was reported in case of Natra variety despite the highest value of this parameter from among all investigated varieties after harvesting.
5. Average germination ability of tansy phacelia seeds after 8 years of storage was 86.81% and after 9 years it dropped to 68.19% which proves that the economic life cycle of phacelia seeds is 8 years.

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WARTOŚĆ SIEWNA FACELII BŁĘKITNEJ (*PHACELIA TANACETIFOLIA* BENTH.) W DŁUGOTERMINOWYM PRZECHOWYWANIU NASION

Streszczenie. W roku 2010 w laboratorium Wyższej Szkoły Agrobiznesu w Łomży przeprowadzono doświadczenie, w którym badano wartość siewną nasion facelii błękitnej po ośmiu i dziewięciu latach przechowywania. Wykazano, że długość okresu przechowywania nasion facelii błękitnej miała istotny wpływ na zmianę podstawowych parametrów wartości siewnej. Najwyższą zdolność kiełkowania spośród badanych odmian facelii błękitnej przechowywanych 8 lat zachowała odmiana Vetrovska, jednocześnie odmiana ta zareagowała największym spadkiem zdolności kiełkowania po 9 latach przechowywania. Po 9 latach przechowywania najwyższy spadek masy tysiąca nasion zaobserwowano u odmiany Natra, pomimo najwyższej wartości tego parametru spośród wszystkich badanych odmian zaraz po zbiorze. Uzyskane wyniki pozwoliły stwierdzić, że gospodarcza długość życia nasion facelii błękitnej wynosi 8 lat.

Słowa kluczowe: facelia błękitna, długoterminowe przechowywanie, wartość siewna