Comparison of the Quality of Seeding the Virginia Fanpetals Seeds by S071 Kruk Seeder in Laboratory and Field Conditions

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Summary. The paper presents the results of the research on the quality of seeding the Virginia fanpetals seeds (*Sida hermaphrodita rusby*) by means of S071 Kruk precision seeder in laboratory and field conditions. It was observed that best quality sowing for the examined classes of distances in a row was obtained at the sowing disk's peripheral speed of 0.23 $m \cdot s^{-1}$ and the working speed of 0.8 $m \cdot s^{-1}$, both in the laboratory and in the field conditions. In subsequent tests a significant impact of the disk's peripheral speed on percentages of single, duplicate and skipped plants was observed. Thus, it can be concluded that the peripheral speed of the sowing disk of the examined seeder impacts the precision of seed distribution in a row.
Key words: Virginia fanpetals seeds (*Sida hermaphrodita rusby*), precision seeding, seeding quality.

INTRODUCTION

Properly performed act of seeding is one of the major factors determining the volume and quality of the yield. Economic justification behind the application of this seeding method is based on the fact that it allows to reduce to a minimum the amount of the sown seeds and thus lower the seeding costs [5, 9, 11].

Sida hermaphrodita rusby, in America commonly known as Virginia fanpetals, was brought to Poland in the fifties of the previous century and since then has been used as a raw material providing energy. This plant belongs to the family of *Malvaceae*. Virginia fanpetals can be reproduced generatively through sowing seeds, but also vegetatively. The growth and development of this plant is basically undisturbed in our climate. Prior to establishing a plantation of this plant, the most advantageous reproduction method should be chosen. It was observed that 1 or 2 year old seeds germinate easily in humid and not crusty soil but the initial growth of seedlings is very slow and the plantation requires intensive weed control [2, 6, 8, 10].

The most frequently applied method of Virginia fanpetals reproduction is sowing seeds, at which it is crucial to properly and carefully arrange individual seeds on a specified unit of surface and keep the same sowing depth for all of them [1, 3, 7, 12, 13].

MATERIAL AND METHODS

In the laboratory conditions the Virginia fanpetals seeds were sown onto a sticky tape of the research stand.

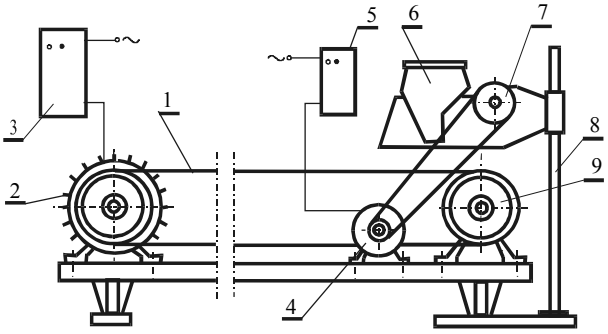

Fig. 1. Scheme of the research stand: 1 – sticky tape, 2, 4 – electric engine, 3, 5 – frequency converter, 6 – seed dispensing section, 7 – drive wheel of seed dispensing section, 8 – supporter, 9 – roller straining the sticky tape

Then distances between them were measured on 1-meter measurement sections in 5 repetitions and the percentage of single, duplicate and skipped plants was calculated. Single plants were considered those between which the distance was bigger than half of the average real distance and smaller or equal to 1.5 of the average real distance. Duplicated plants were considered those which grew at distances smaller or equal to the half of the average real distance. Skips were considered at distances bigger than 1.5 of the average real distance.

Then the following values were calculated:
- percentage of single plants expressed as a quotient of the number of single plants and overall number of plants grown on all measurement sections,
- percentage of duplicated plants expressed as a quotient of the number of such plants and overall number of plants grown on all measurement sections,
- percentage of skips expressed as a quotient of the number of skips and overall number of skips on all measurement sections. In the laboratory conditions the precision of seeds distribution in a row was determined [ISO 7256/1-1884 (E) 1984].

In the field conditions the precision of the Virginia fanpetals seeds distribution in a row was determined after the germination process was completed. In order to do that distances between plants were measured on 5-meter measurement sections in 5 repetitions for each peripheral speed of the seeder sowing disk. Classification of the obtained results was carried out following the methodology applied in laboratory research.

Table 1. Characteristics of the sown Virginia fanpetals seeds

Characteristics	Measurement unit	Measurement result
Length	mm	2.6
Width	mm	2.3
Thickness	mm	1.7
Mass of 1000 seeds	g	3.4
Germination ability	%	33.0

Geometrical dimensions and weight of 1,000 seeds were determined on the basis of 100 seeds selected at random, measured and weighed. Germination ability was determined on the basis of tests conducted just before proper seeding in laboratory conditions.

The obtained research results were made subject to further statistical analysis based upon a variance analysis and multiple confidence intervals of T-Tukey at an assumed significance level of $\alpha = 0.05$.

RESEARCH RESULTS

The research results have been presented in the form of charts contained in Figures 2-5 and Tables 2-3.

Table 2. Results of testing the quality of sowing Virginia fanpetals seeds with S071 Kruk seeder

No plot	Peripheral speed of dial (m·s^{-1})	Seeder working speed (m·s^{-1})	The ratio of the average sowing depth to set	Cover seeds with soil (%)
1	0.42	0.8	0.98	100
2	0.36	0.8	0.98	100
3	0.23	0.8	0.98	100

Table 3. Results of testing the quality of sowing Virginia fanpetals seeds with S071

Seeder working speed (m·s^{-1})	Peripheral speed of dial (m·s^{-1})	Single plants (%)	Duplicated plants (%)	Skips (%)
	Laboratory tests			
0.8	0.42	59.9^{a}	26.5^{a}	13.6^{a}
0.8	0.36	67.4^{b}	27.0^{a}	5.6^{b}
0,8	0.23	79.5^{c}	12.7^{b}	7.8^{b}
	Field tests			
0.8	0.42	35.6^{a}	42.4^{a}	22.0^{a}
0.8	0.36	39.0^{b}	42.6^{a}	18.4^{b}
0.8	0.23	41.6^{c}	36.8^{b}	21.6^{a}

Different letters provided in the indexes mean that at the examined operating speeds of the seeder, significant differences occurred between single and double plants sown and skips at the level of $\alpha = 0.05$

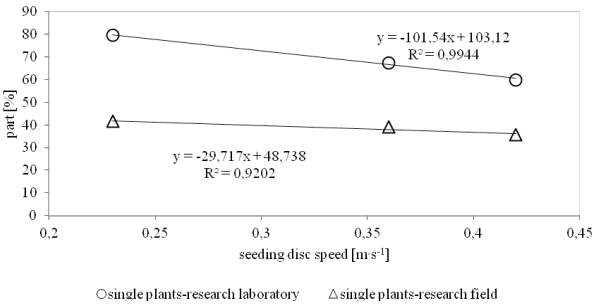

Fig. 2. Percentage shares of single plants sown as the function of the Kruk seeding disk speed obtained while sowing the Virginia fanpetals in the laboratory and field conditions

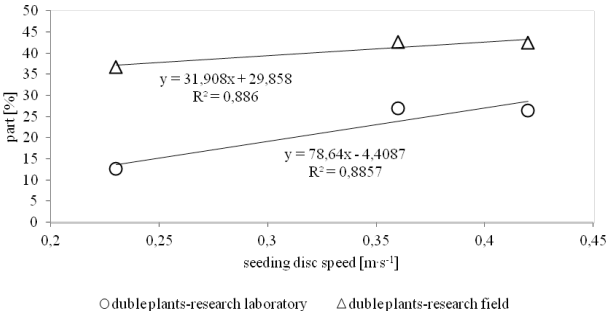

Fig. 3. Percentage shares of duplicated plants sown as the function of the S071 Kruk seeding disk speed obtained while sowing the Virginia fanpetals in the laboratory and field conditions

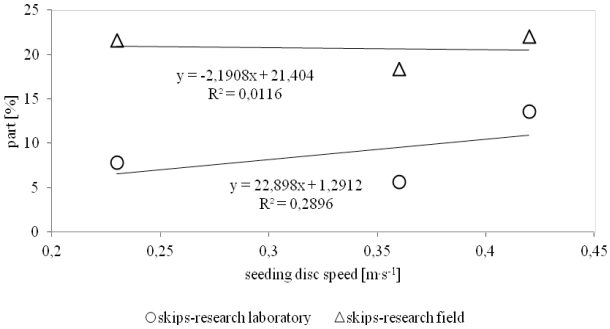

Fig. 4. Percentage shares of skipped plants as the function of the S071 Kruk seeding disk speed obtained while sowing the Virginia fanpetals in the laboratory and field conditions

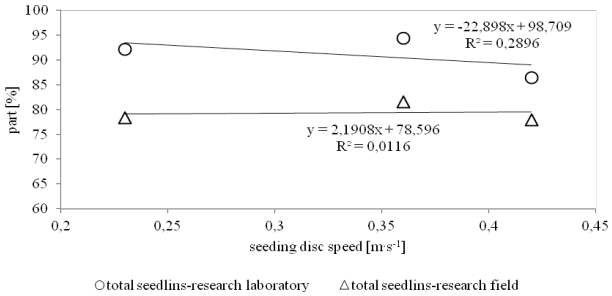

Fig. 5. Percentage shares of total seedlings as the function of the S071 Kruk seeding disk speed obtained while sowing the Virginia fanpetals in the laboratory and field conditions

Statistical analysis of the results showed significant differences between the shares of single plants, duplicated plants and skips obtained at the examined seeding disc speed speeds in the laboratory and field conditions.

The trend lines for the shares of single, duplicated and total seedlings, presented in Figures 2, 3, 4 and 5, along with their regression equations, confirm the correlation, which proves that the shares decreased as the peripheral speed of the seeder sowing disk increased.

CONCLUSIONS

1. Significant influence of peripheral speed of the seeder's sowing disk on percentages of single, duplicate and skipped plants was observed.
2. Negative correlation of simple regression of shares of single, duplicated and skipped seedlings shows that the shares decreased as the peripheral speed of the S071 Kruk seeder sowing disk increased.
3. Most advantageous ratios related to the distribution of the seeds in a row were obtained at the peripheral speed of the sowing disk of 0.23 $m \cdot s^{-1}$.
4. At the examined peripheral speeds of the seeder sowing disk, the ratios indicating the distribution of the seeds in a row obtained in laboratory conditions were better than the ones obtained in the field conditions.

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PORÓWNANIE JAKOŚCI SIEWU NASION ŚLAZOWCA PENSYLWAŃSKIEGO SIEWNIKIEM S071 KRUK W WARUNKACH LABORATORYJNYCH I POLOWYCH

Streszczenie. Przedstawiono wyniki badań dotyczące jakości siewu nasion ślazowca pensylwańskiego siewnikiem S071 Kruk z łyżeczkowym zespołem wysiewającym uzyskane w warunkach laboratoryjnych i polowych. Stwierdzono, że najkorzystniejszy udział nasion i roślin ślazowca pensylwańskiego w badanych klasach odległości w rzędzie wystąpił przy prędkości obwodowej jego tarczy wysiewającej 0,23 $m \cdot s^{-1}$ zarówno w badaniach laboratoryjnych jak i polowych. W próbach stwierdzono istotny wpływ prędkości obwodowej tarczy wysiewającej z łyżeczkami na wielkość procentowych udziałów wysiewów pojedynczych, podwójnych, przepustów i obsiewu całkowitego (suma udziałów nasion wysianych pojedynczo i podwójnie). Zatem można stwierdzić, że prędkość obwodowa tarczy wysiewającej badanego siewnika wpływa na precyzję rozmieszczenia nasion ślazowca pensylwańskiego w rzędzie.

Słowa kluczowe: ślazowiec pensylwański, siew precyzyjny, jakość siewu.