

## Method Of Improving The Quality Of Coated Sugar Beet Seed

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### **Abstract:**

Implementation of intensive technologies for growing sugar beets, which are intended for sowing to the final density, is possible only in the presence of high quality seed. The quality of sugar beet seed is determined by a complex of genetic factors, ecological and agro-technological conditions of its growing and methods of pre-sowing seed preparation using modern technologies [1]. The final stage of pre-sowing preparation of sugar beet seed includes its incrusting, coating and packaging.

Coating is a complex technique that involves applying inert organic and mineral substances on the seed in order to create an even ball-like shape for each seed, which provides the most accurate placement of seed in a row and allows reducing the sowing rate by 2 - 3 times [2]. Coated seed - seed that is in a coat close to a spherical shape and contains, as a rule, a separate seed, the shape and size of which is no longer visible. Such seed is intended for accurate sowing. Coating mixtures may contain insecticides, fungicides, dyes and other substances [3].

### **INTRODUCTION.**

Implementation of intensive technologies for growing sugar beets, which are intended for sowing to the final density, is possible only in the presence of high quality seed. The quality of sugar beet seed is determined by a complex of genetic factors, ecological and agro-technological conditions of its growing and methods of pre-sowing seed preparation using modern technologies [1]. The final stage of pre-sowing preparation of sugar beet seed includes its incrusting, coating and packaging.

*Coating* is a complex technique that involves applying inert organic and mineral substances on the seed in order to create an even ball-like shape for each seed, which provides the most accurate placement of seed in a row and allows reducing the sowing rate by 2 - 3 times [2]. *Coated seed* - seed that is in a coat close to a spherical shape and contains, as a rule, a separate seed, the shape and size of which is no longer visible. Such seed is intended for accurate sowing. Coating mixtures may contain insecticides, fungicides, dyes and other substances [3].

The quality of coated seed depends on a number of factors: the size of the seed fraction before coating [4], the condition of the seed surface before coating [5], the weight of the coated covering [6], its density and composition [7]. Salt of di- and trivalent metals in order to improve the water inflow to the seed is added [8]. Artificial coating "Germins RVS" in conditions of excessive moisture and cold spring under the preparation of coated seed during coating is used [9].

150-180% of water from the seed weight for seed germination and receiving the seedlings is needed. The weight of the coated seed is twice as large as the non-coated (incrusted or treated). According to the Institute of Bioenergy Crops and Sugar Beets of NAAS, the weight of incrusted or treated seed is 13.5-16.0 g, and coated seed - 22.5-28 g. Therefore, more water for the germination of coated seed is needed, and the faster the dragee absorbs the appropriate amount of water, the faster the seedlings will be obtained. Taking into account the great advantages of coated seed, all the world's leading companies on selection and seed production of sugar beets constantly conduct intensive scientific-and-research work to find new components for seed coating; components and their ratios change almost every 2-3 years. Improving the mixture for seed coating and the coating process has always been and remains relevant.

**The purpose of the research** was to improve the coating mixture to create covering of sugar beet seed which would provide intensive germination of the coated seed.

**Materials and research methods.** The research program provides for the inclusion of an absorbing agent in the coating mixture that would accumulate moisture near the seed and glue to keep it in the mixture of dragee. The research was conducted at Uman National University of Horticulture and in the experimental shop of Kyiv Seed Plant in 2020. Sugar beet seed of Bulava hybrid was used for the experiments. The scheme of the experiment provides for the inclusion of 30 and 61 ml of glue, 10 g of absorbing agent per sowing unit and talc for the flowability of coated seed in the dragee mixture; control variant was coated seed with a mixture used in manufacturing, but without the application of insecticides and fungicides (grey dragee). Coated seed is sensitive to both water deficiency and overwetting, and in both cases germination energy and germinating capacity is reduced. The optimum humidity for germination of coated seed is 12.5-15% [10].

According to the method of germination of coated seed, it is recommended to give 30 ml of water per germination dish [11], and since it was provided by the experimental scheme to add an absorbing agent to the mixture of dragee, it was advisable to determine the optimal humidity of the bed for germination. Therefore, coated seed were germinated at the humidity of the bed, which was formed by the amount of water of 10, 20 and 30 (control) ml for each germination dish. Calculation of the number of germinated seed in order to study the effect of the mixture of dragee on the germination intensity of coated seed was conducted on the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> (germination energy) and 10<sup>th</sup> (germination) day.

Collection of average seed samples to determine its sowing qualities was carried out in accordance with the current standard of DSTU 4328-2004 [12], germination was determined in accordance with the current standard of DSTU 2292-93 (GOST 22617.2-94) [11] except for those elements that were object of study. Statistical processing of experimental data was performed using dispersion and correlation analysis by Fisher's method [13] using the computer program Statistica 6.0 by StatSoft company.

**Research results.** Preparation technology of coated seed includes several stages, namely: preparation of seed for coating (cleaning, calibration, grinding), formation of a draping covering close to a ball by shape and incrustation of coated seed [14]. When coating seed, its shape improves, sowing accuracy increases, and rates of seed sowing decrease [15]. Coated seed has good flowability and does not wear off [16].

Different stimulating substances, microelements and preparations to protect seedlings and young plants from diseases and pests can be added to the coating covering [17; 18].

It has been experimentally proven that the intensity of seed germination significantly depended on the humidity of the bed (substrate) for germination. The amount of germinated seed on the second day of registration, both in the control and in the variants where the seed was coated with an improved mixture was significantly higher under the humidity of the bed which was created by the amount of water of 30 ml per one germination dish compared to the humidity of the bed where 20 and 10 ml of water per germination dish were added (Table 1).

**Table 1. Intensity of seed germination in the initial stages of its germination depending on the humidity of the bed and a mixture of dragee (average of 3 experiments, 2020)**

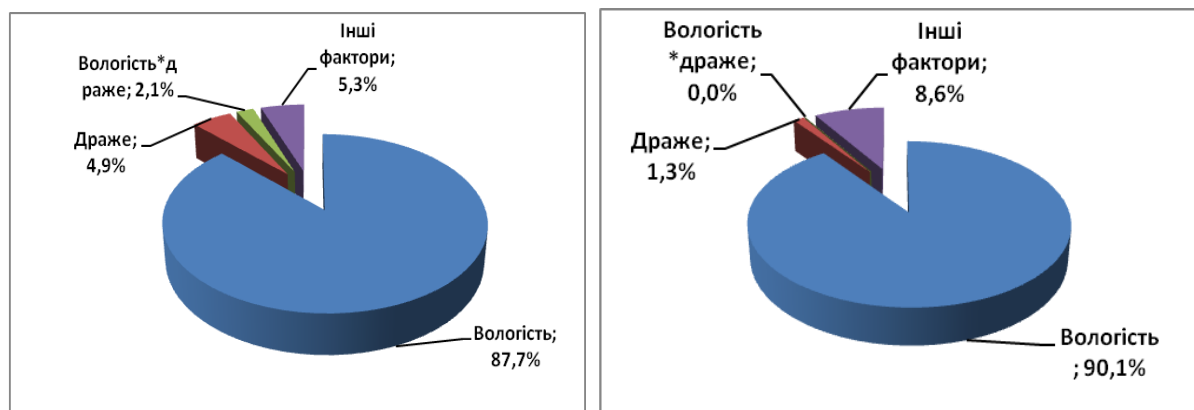
Variant		Amount of germinated seed, %, by day	
humidity of the bed, water ml per one germination dish	composition of draping mixture	2 <sup>nd</sup>	3 <sup>rd</sup>
30 (control)	Grey dragee – control	49	94
	Grey dragee + 61 ml/seed unit of glue + 10 g/seed unit of absorbing agent	55	96
	Grey dragee + 30 ml/seed unit of glue + 10 g/seed unit of absorbing agent	56	97
20	Grey dragee – control	44	95
	Grey dragee + 61 ml/seed unit of glue + 10 g/seed unit of absorbing agent	48	97
	Grey dragee + 30 ml/seed unit of glue + 10 g/seed unit of absorbing agent	57	98
10	Grey dragee – control	23	72
	Grey dragee + 61 ml/seed unit of glue + 10 g/seed unit of absorbing agent	25	74
	Grey dragee + 30 ml/seed unit of glue + 10 g/seed unit of absorbing agent	26	75
Least significant difference(LSD) <sub>0.05 gen.</sub>		5.5	5.5
LSD <sub>0.05</sub> humidity		3.0	3.2
LSD <sub>0.05</sub> mixture of dragee		3.0	3.2

Significant difference in the intensity of germination on the third day of germination on the bed which was created by the amount of water of 20 and 30 ml/germination dish wasn't found. The germination intensity under seed germination on the bed which is created by 10 ml of water per germination dish both in the control and in the variants, where coated seed was sown, was significantly lower compared to the humidity of the bed with the amount of water of 20 and 30 ml/germination dish.

The smallest amount of germinated seed was at the humidity of the bed, where 10 ml of water per one germination dish was given. Amount of germinated seed at the humidity of the bed created by adding of 20 ml of water per one germination dish was significantly less than under the humidity of 30 ml of water per germination dish and more than under the humidity of 10 ml of water. Significant difference on the amount of obtained seedlings under germination of coated seed at the humidity of 30 and 20 ml of water per germination dish wasn't detected.

There was no significant difference on the number of germinated seed two days after the sowing under germination of seed in the coating mixture which was included 30 ml/seed unit (s.u.) of glue and 10 g/s.u. of absorbing agent on the bed which was created by adding of 20 ml of water.

The factor "humidity of the bed" had the greatest influence on the intensity of germination both on the second day and on the third day of germination, which was 87.7% and 90.1%, respectively (Fig. 1).



Вологість драже – humidity of dragee

Драже – dragee

Вологість - humidity

Інші фактори – other factors

a) on the 2<sup>nd</sup> day of germination

b) on the 3<sup>rd</sup> day of germination

Fig.1. Share of the factors influence on the intensity of seed germination

The influence of the "dragee" factor on the intensity of germination was insignificant.

The high intensity of seed germination indicates not only its friendly germination in both laboratory and field conditions, but also affects the germination energy and seed germination. It was found that the inclusion of 10 g/s.u. in the coating mixture provided a significant increase in germination energy and germination of coated seed compared to control - grey dragee without absorbing agent than under germination at the humidity of the bed which was formed by the amount of water of 20 and 30 ml/germination dish (Table 2). There was no significant difference between these indicators depending on the composition of the coating mixture. Germination energy and germination of coated seed were almost the same when including 10 g/s.u. of absorbing agent and 61 or 30 ml/s.u. of glue in the mixture under germination with a bed humidity of 20 and 30 ml of water per germination dish.

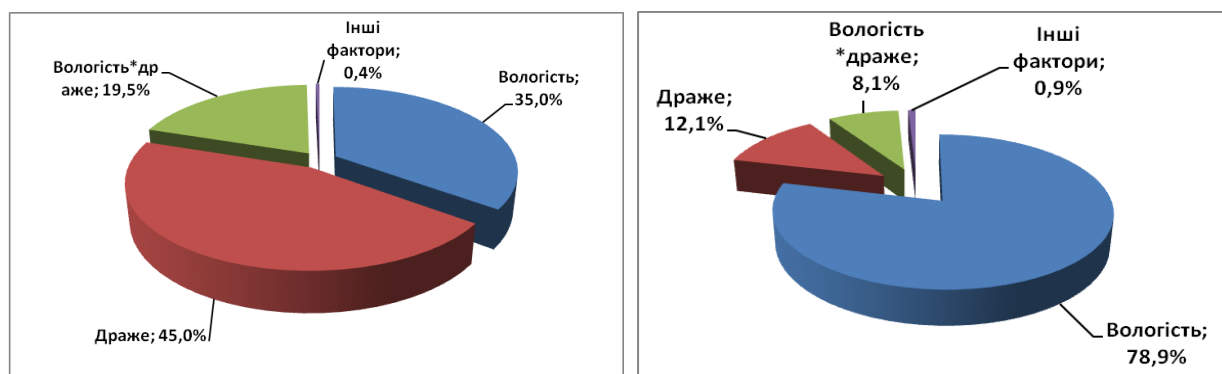
**Table 2. Seed quality depending on the humidity of the bed and the mixture of dragee (average of 3 experiments, 2020)**

Variant		Germination energy, %	Germination, %
bed humidity, water ml per one germination dish	composition of coating mixture		
30 (control)	Grey dragee – control	95	96
	Grey dragee + 61 ml/s.u. of glue + 10 g/s.u. of absorbing agent	97	98
	Grey dragee + 30 ml/s.u. of glue + 10 ml/s.u. of absorbing agent	98	98

20	Grey dragee – control	88	95
	Grey dragee + 61 ml/s.u. of glue + 10 g/s.u. of absorbing agent	97	98
	Grey dragee + 30 ml/s.u. of glue + 10 ml/s.u. of absorbing agent	99	99
10	Grey dragee – control	73	74
	Grey dragee + 61 ml/s.u. of glue + 10 g/s.u. of absorbing agent	77	85
	Grey dragee + 30 ml/s.u. of glue + 10 ml/s.u. of absorbing agent	78	87
LSD <sub>0.05</sub> gen.		2.7	1.3
LSD <sub>0.05</sub> humidity		1.6	0.8
LSD <sub>0.05</sub> mixture of dragee		1.6	0.8

That is, inclusion of 10 g/s.u. of absorbing agent and 30 ml/s.u. of glue in the coating mixture provides a significant increase in the germination intensity of coated seed on the 2<sup>nd</sup> and 3<sup>rd</sup> days of accounting, as well as germination energy and germination both under the humidity for germination of 30 ml of water per one germination dish, and under less humidity supply - 20 ml of water per one germination dish. This conclusion is of great practical importance because the sowing period is in the spring and seedlings obtaining is characterized by a lack of moisture, and in such conditions seedlings are not friendly and uneven when sowing coated seed which affects the productivity of sugar beets.

Analysis of the factors that influenced the germination energy and germination showed that the germination energy was significantly influenced by both the "humidity" factor - 35% and the "dragee" factor - 45%. The interaction of these factors was also not small - 19.5% (Fig. 2).



Вологість драже – humidity of dragee

Драже – dragee

Вологість - humidity

Інші фактори – other factors

a) for germination energy

б) for germination

Fig.2. Share of factors influencing seed quality

Seed germination was significantly influenced by the "humidity" factor which was 78.9%, and influence of the "dragee" factor was much smaller.

## CONCLUSIONS.

It is advisable to include 10 g/s.u. of absorbing agent and 30 ml/s.u. of glue in the coating mixture which provides a significant increase in these indicators both under the humidity for germination of 30 ml of water per one germination dish and under less moisture supply - 20 ml of water per one germination dish in order to increase the germination intensity of coated seed, its germination energy and germination.

This conclusion is of great practical importance because the sowing period is in the spring and seedlings obtaining is characterized by a lack of moisture, and in such conditions seedlings are not friendly and uneven when sowing coated seed, which leads to the reduction in productivity of sugar beets.

**Abstract.** *Improving the coating mixture to create a covering of coated sugar beet seed which would ensure its intensive germination was under analysis. The study was conducted by laboratory, measuring-and-weighing and mathematical-and-statistical methods. As a result of the conducted researches it was established that coating is the final stage of preparation of sugar beets seed for sowing at seed plants, which provides sowing to the final density. It was experimentally proven that the intensity of seed germination significantly depended on the humidity of the bed (substrate) for germination. On the second day of registration, the number of germinated seed was significantly higher under the humidity of the bed, which was created by the amount of water 30 ml per germination dish compared to both the control and the variants, where the seed was coated with an improved mixture.*

*Significant difference in the intensity of germination on the third day of germination on the bed which was created by the amount of water 20 and 30 ml/germination dish was not found. Germination intensity was much lower under the germination of seed on a bed which was created by 10 ml of water per germination dish both in the control and in the variants where the coated seed was sown compared to the humidity of the bed with the amount of water of 20 and 30 ml/germination dish. Significant difference in the number of seed that germinated two days after sowing under the germination of seed when including 30 ml/seed unit (s.u.) of glue and 10 g/s.u. of absorbing agent in the coating mixture on the bed which was created by adding of 20 ml of water was not detected. The factor "humidity of the bed" showed the greatest influence on the intensity of germination both on the second and on the third day of germination, which was 87.7% and 90.1%, respectively.*

*The high intensity of seed germination indicates not only its germination friendliness in both laboratory and field conditions, but also affects the germination energy and seed germination. It was found that the inclusion of 10 g/s.u. of absorbing agent in the coating mixture provided a significant increase in germination energy and germination of coated seed compared to the control - grey dragee without absorbing agent than under germination at the humidity of the bed which was formed by the amount of water of 20 and 30 ml/germination dish.*

*Inclusion of 10 g/s.u. of absorbing agent and 30 ml/s.u. of glue in the coating mixture provides a significant increase in the germination intensity of the coated seed, its germination energy and germination both at the humidity for germination of 30 ml of water per one germination dish, and under less moisture supply - 20 ml of water per one absorbing agent, which is of practical importance.*

**Keywords:** *coated seed, germination intensity, germination energy, germination, bed for germination.*

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