

CARROT SEED PREPARATION IN A CORONA DISCHARGE FIELD

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Abstract

The influence of a corona discharge field to the quality of carrot seed (its germinating power and the separation of biologically viable seed) is discussed. The seeds were processed with a cylindrical electric separator. Several methods of the intensification of the germinating power were compared when discussing the influence of a corona discharge field to the germinating power: control seed unaffected by soaking or discharge; seed soaked in ordinary water for 24 h; seed soaked in ordinary water for 24 h and germinated by constantly wetting it; seed soaked in alkaline activated water with 11.65 pH for 24 h and seed stimulated by a corona discharge field. Two methods were chosen for the comparison of the results of the seed separation: corona discharge field in the cylindrical separator separated the seeds into 4 fractions; seeds were sorted in the 5% solution of NaCl into 2 fractions.

The tests showed that stimulating carrot seed with corona discharge fields increases germination from 7% to 19%; grading of seed material by a corona discharge field in cylinder separator enables to distinguish 60% of seed whose quality indicators are better than those of the control.

Keywords: carrot seeds, germinating power, mass, output, corona discharge field, separation.

Introduction

The development of the vegetable seed growing in Lithuania has increased the importance of the improvement of the seed quality. The vegetable seeds are grown for two years, they are expensive, and the growers have losses due to bad seed quality.

Well known methods to increase the germinating power of the seeds include the use of magnetic [1, 3, 4] and electric [2, 5, 9] fields, as well as traditional methods of soaking and germinating with the use of the stimulators, ordinary or activated water [7, 8]. The analysis of the sources of literature shows that the germinating power of seeds heated by magnetic or electric fields is greater than using soaking and germinating. The germinating power of the effected seeds depends on their initial germinating power and is often greater than the initial germinating power from 3% to 15%.

The variety of the size, mass and form of the vegetable seeds is serious hindrance to prepare seed of good quality. In order to prepare the seed of good condition, it should be sorted. When carrot seed was sorted by pneumatic sorter [6], the fraction of the standard mass equal to 30%

is separated. The germinating power of this fraction is 5% greater than the control one. The seeds of various vegetables can be sorted in the salt solutions also [8]. Then the light, floating seed fraction is not used for the sowing and the settled down seed fraction should be washed with water and dried.

Object and Methods

The object of our investigation was to determine the impact of a corona discharge field on carrot seed quality. Several methods of the intensification of the germinating power were compared: control seed unaffected by soaking or discharge; seed soaked in ordinary water for 24 h; seed soaked in ordinary water for 24 h and germinated by constantly wetting it; seed soaked in alkaline activated water with 11.65 pH for 24 h and seed stimulated by a corona discharge field in the electric separator (Fig.1). For each method were obtained for 100 g carrot seeds.

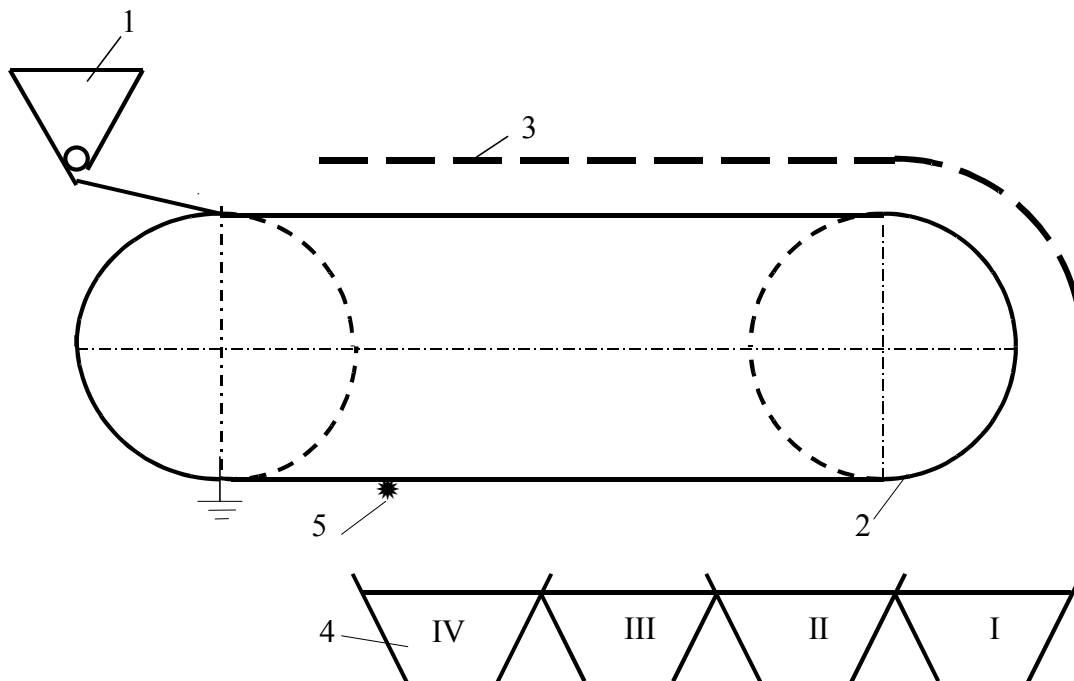


Figure 1. Electric separator: 1 - the hopper-type weight; 2 - cylinder (earth electrode); 3 - the potential electrode of corona discharge; 4 - the classifier; 5 - the cleaner of the stucked seeds

All the seeds were germinated in Petri saucers and left in the temperature of 20°C. The number of the germinated seeds was determined every day for ten days. The activated water was prepared with apparatus of PTV-1 type. Corona discharge field in the electric separator stimulated the seeds.

Two methods were chosen for the comparison of the results of the seed separation: corona discharge field in the cylindrical separator separated the seeds into 4 fractions; the seeds were sorted in the 5% solution of NaCl into 2 fractions. The output, germinating power and the mass of 1000 seeds were determined in the each fraction for two variants.

Results and Discussion

The results of seed germination tests are presented in Fig. 2.

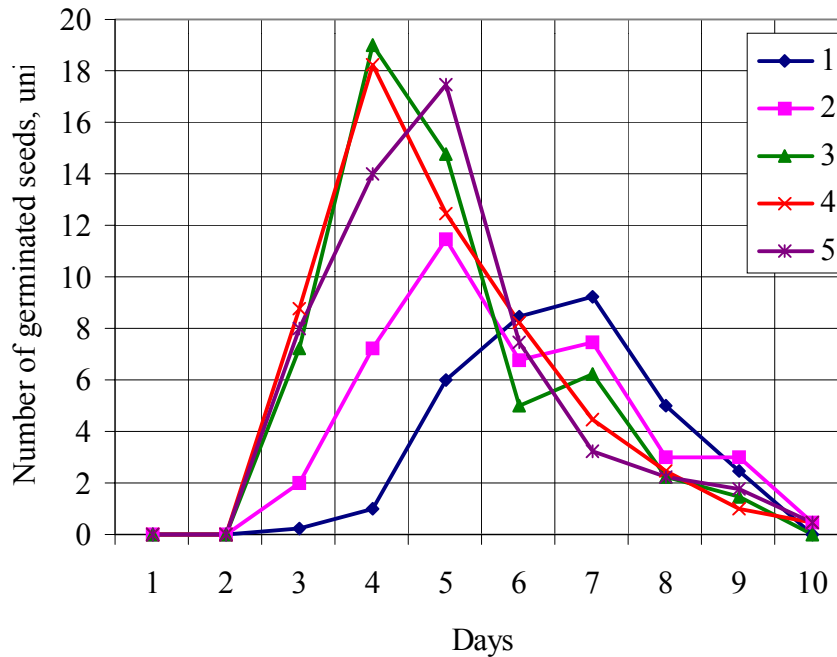


Figure 2. Dynamics of carrot seed germination: 1–check treatment (total germination 33%); 2–soaked seeds (33%); 3–sprouted (32%); 4–soaked in activated water (33%); 5–exposed to corona discharge field (52%)

The results show that soaking and sprouting accelerates seed shooting but it does not improve its germination. The effect of corona discharge field promotes not only seed shooting but also its germination. The average germination of the four graded fractions is 52%, i.e. 19% higher than in the control treatment. Dynamics of the seed germination graded into separate fractions by the electrical separator is presented in Fig. 3.

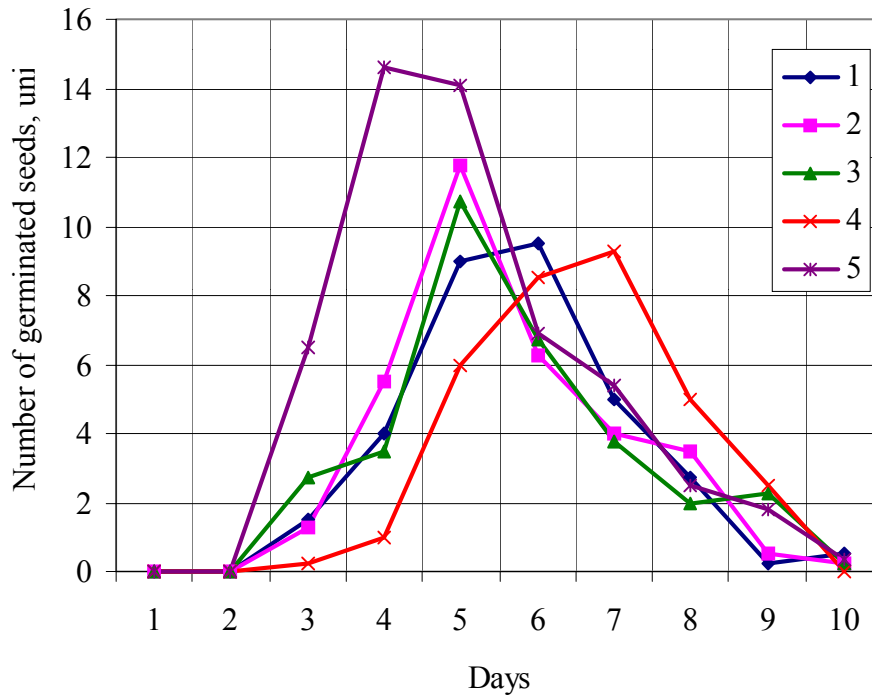


Figure 3. Germination dynamics of the graded seed: 1 - control (total germination 33%); 2 – fraction I (42%); 3 – fraction II (56%); 4 – fraction III (56%); 5 – fraction IV (55%)

The obtained results enable to conclude that the germination of the seed graded in the electrical field was higher in all the fractions than in the control treatment.

The electric field is the only tested method which increased germination. The use of the electrical field is also more practical to implement because no soaking or drying of seed is necessary.

Carrot seed was graded in 5% solution of NaCl and in the electrical field. When grading in the salt solution two fractions were obtained: light, which came to the surface and heavy, which precipitated in the bottom. The grading in the electrical field gave four fractions differing in seed weight and germination.

The results of carrot seed grading are presented in Figure 4 and Figure 5.

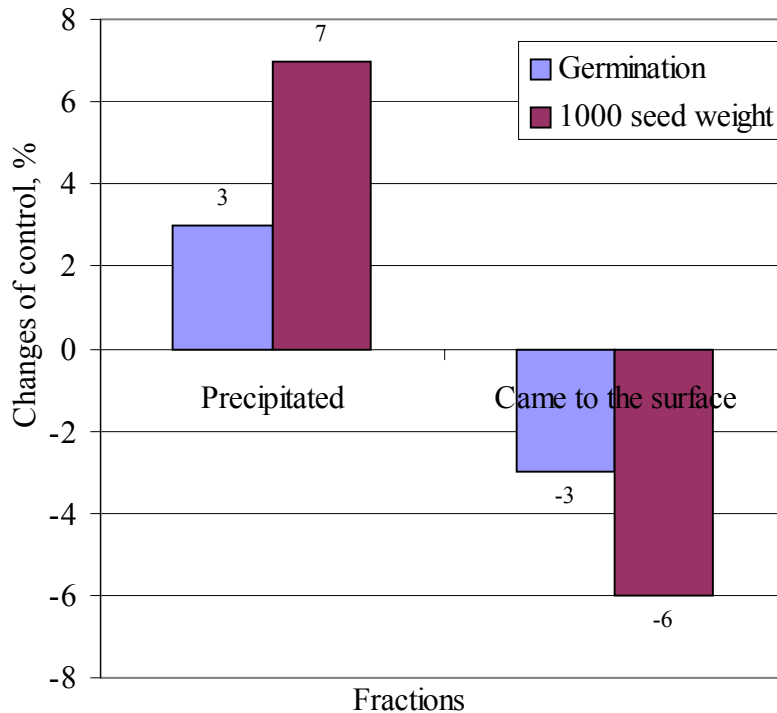


Figure 4. Carrot seed grading according to density: control germination 32 %; 1000 seed weight 1,45 g; precipitated – 44%, came to the surface – 56%

Analysis of the results shows that when an electrical field is used for grading 60% of seed falls within fractions I and II whose 1000 seed weight is 8% and germination 12% higher than in the control. When grading the seed in the salt solution 44% of seed precipitates whose 1000 seed weight is 7% and germination 3% higher than in the control.

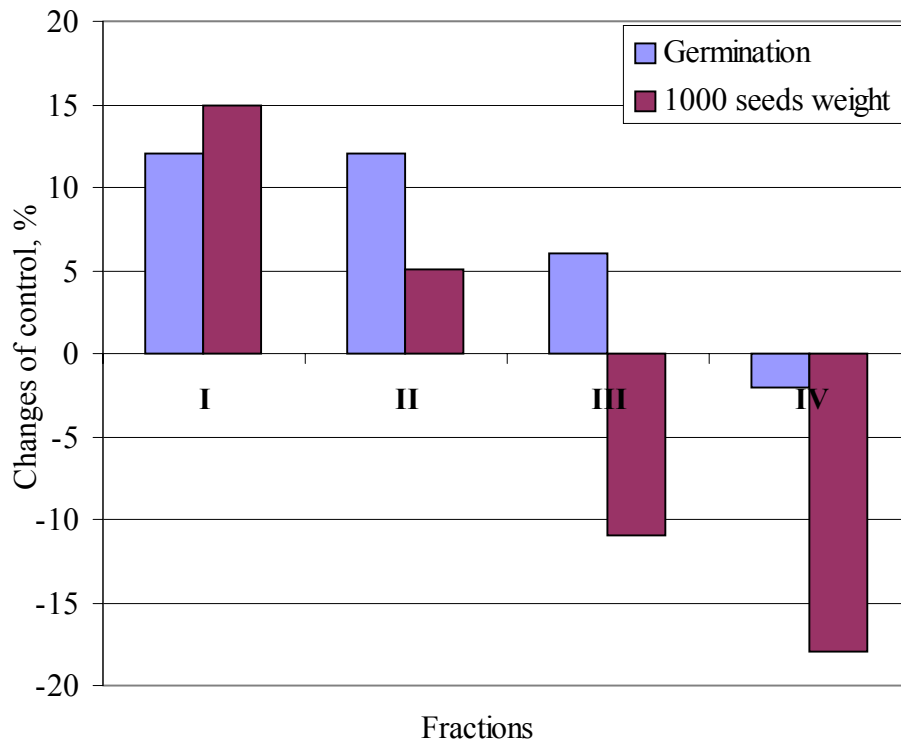


Figure 5. Carrot seed grading in the electrical field: control germination 32 %; 1000 seed weight 1,45 g; output into fractions: I – 20%, II – 40%, III – 30%, IV – 10%

Irrespective of the fact that the germination of the last IV-th fraction is negligibly lower than in the control, the average germination increase through the stimulating field effect makes up 7%.

Seed graded in salt solution was also graded in the electrical field. The obtained results (Table 1) show that the germination of precipitated seed of all fractions is higher than that of precipitated control seed.

Table 1. Carrot seed grading results

Treatment	Indicator	Control		Fractions of electric separator							
				I		II		III		IV	
Graded in the electrical field	Output, %	100		20		40		30		10	
	1000 seed weight, g	1.45		1.67		1.52		1.29		1.19	
	Germination, %	32		44		44		38		30	
Graded in 5% NaCl solution	Output, % 1000 seed weight, g Germination, % Amount of seed which came to	came to the surface	precipitated	came to the surface	precipitated	came to the surface	precipitated	came to the surface	precipitated	came to the surface	precipitated
		56	4	10.5	9.5	20.6	9.4	16.7	13.3	8.2	1.8
		1.37	1.55	1.62	1.72	1.40	1.65	1.27	1.31	1.18	1.26
		29	35	42	47	37	42	34	42	28	40

the surface and sank in separate fractions, %	56	44	52	48	52	48	56	44	82	18
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Analysing the amount of seed, which came to the surface and precipitated in each individual fraction it is seen that the percentage distribution in the fractions from the electric field is similar to the control. In three fractions from 52% to 56% of seed came to the surface and from 44% to 48% precipitated. In fraction IV, 80% came to the surface. This shows that light and empty seed get into the last fraction when electric field graded.

Conclusions

1. Corona discharge fields stimulation increased carrot seed germination from 7% to 19%.
2. Grading of seeds by a corona discharge field in a cylinder separator enabled the collection of seed fractions whose quality indicators are better than those of the control.

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