

Results from laboratory studies after pre-sowing electromagnetic treatment of seeds of Hungarian sunflower plants

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Results from laboratory studies after pre-sowing electromagnetic treatment of seeds of Hungarian sunflower plants: *The pre-sowing electromagnetic treatment was carried out in Bulgaria, at the University of Rousse "Angel Kanchev".*

It has been observed that the three-step pre-sowing electromagnetic treatment of Hungarian sunflower seeds of the variety KV and hybrids Nyh-1F1K, Nyh-1F1K produces a specific effect on the monitored laboratory parameters. The observed differences on the resulting effect can be attributed to the specific characteristics of the said variety and hybrids.

With the following initial values of the controllable factors: voltage $U_1=4kV$, and duration of treatment $\tau_1=10s$, the effect of the pre-sowing electromagnetic treatment of seeds of the sunflower hybrids Nyh-1F1F and Nyh-1F1K is such that it stimulates their growth and helps improve the germination capacity, the mass of the green plants, and the length of the roots and shoots.

The selected initial values, $U_1=5kV$ and $\tau_1=4s$, of the controllable factors for pre-sowing electromagnetic treatment of the seeds of the variety KV, suppress their development in laboratory conditions.

Key words: *three-step pre-sowing electromagnetic treatment, seeds of sunflower hybrids and varieties, length of shoots and roots, seed mass.*

The studies in this research have been carried out together with representatives of the College of Nyíregyháza–Hungary under the agreement reached in the course of collaboration on the international project implemented within Framework Program 7: Bio Mob FP7 – REGIONS – 2009 -1 № 245449.

Introduction

The studies in this research have been carried out together with representatives of the College of Nyíregyháza–Hungary and of the Research Institute of Nyíregyháza at the University of Debrecen – Hungary, under the agreement reached in the course of collaboration on the international project implemented within Framework Program 7: **Bio Mob** FP7 – REGIONS – 2009 -1 № 245449. These studies come as a continuation of the joint research activities initiated in 2011 [3].

The purpose of conducting pre-sowing electromagnetic treatment is to identify opportunities to stimulate the growth of the seeds through an unconventional method.

The aim of the studies is to determine the effect of pre-sowing electromagnetic treatment of seeds from Hungarian sunflower hybrids and variety.

Material and method

The seeds are produced in Hungary and are of the variety KV and hybrids Nyh-1F1F and Nyh-1F1K. The hybrids Nyh-1F1F and Nyh-1F1K are sister lines to Nyh-1 [3].

Since sunflower seeds are rich in oil, the pre-sowing electromagnetic treatment has been carried out according to method [2]. The seeds were treated in an electromagnetic field on 23.03.2012.

After taking the results described in [3], the plan for the experiment, presented in Table 1, was prepared.

After the pre-sowing treatment to which they were subjected in 2012, the seeds were sent to Hungary. In Bulgaria, the studies carried out in 2012 – in laboratory conditions and in the open field, comprised: option № 22 for the hybrids Nyh-1F1F and Nyh-1F1K, and option № 32 for the variety KV. In the studies, a reference specimen of untreated seeds was also used.

The seeds – both the treated ones and the reference specimen – were placed for germination in laboratory conditions on 09.04.2012 i.e. after a 17-day rest. The laboratory examinations were carried out in compliance with the requirements of the Bulgarian State

Standard (BDS) 601 – 85 [1]. The following parameters were measured: laboratory germination capacity, length of roots and shoots, mass of the sprouting (green) plants and their mass after natural drying (in laboratory conditions) for a time period of 4 months.

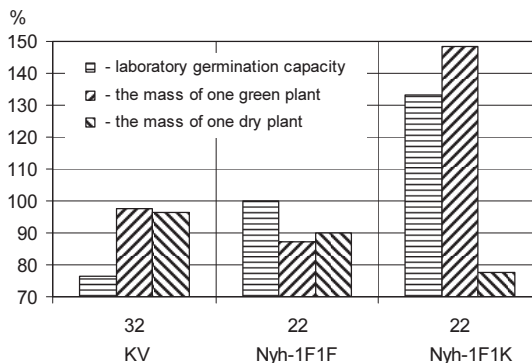
Table 1.

Plan of the experiment in 2012 for pre-sowing electromagnetic treatment of the hybrids Nyh-1F1F and Nyh-1F1K, and the variety KV

Treatment Option	Factor level		Processing Steps					
	σ_{x_1}	σ_{x_2}	I		II		III	
			$U_1, \text{ kV}$	$\tau_1, \text{ s}$	$U_2, \text{ kV}$	$\tau_2, \text{ s}$	$U_3, \text{ kV}$	$\tau_3, \text{ s}$
For seeds of the hybrids Ny1F1F and Ny1FK								
21	+1	+1	8	10	6,5	20	5	50
22	-1	+1	4	10	2,5	20	2	50
23	+1	-1	8	5	6,5	15	5	25
24	-1	-1	4	5	2,5	15	2	25
25	Reference specimen (untreated seeds)							
For seeds of the variety KV								
31	+1	+1	8	5	6,5	15	5	25
32	-1	+1	5	5	4	15	1,5	25
33	+1	-1	8	4	6,5	4	5	35
34	-1	-1	5	4	4	4	1,5	35
35	Reference specimen (untreated seeds)							

Results from laboratory studies (in Bulgaria)

In Fig.1 are presented the results from an examination of the laboratory germination capacity and the mass, reduced to one green plant (from the Petri dish), as well as the reduced mass of the dry plants, expressed as a percentage of the respective reference specimen - %K.



Фиг.1. Results from an examination of the laboratory germination capacity and the reduced mass to one plant (green, dry) – as a percentage of the respective reference specimen

Table 2 shows results from the laboratory examinations on the lengths of roots l_{root} and length of shoots l_{shoot} of sunflower seeds, after pre-sowing electromagnetic treatment of the seeds.

Table 2.

Results from the examinations of the lengths of roots and shoots of sunflower seeds after performed pre-sowing electromagnetic treatment in 2012

Type of seeds	Treatment Option	Length of roots, l_{root}		Length of shoots, l_{shoot}		Variation factor, \hat{V}^*	Variance, s^{2*}
		mm	%/K	mm	%/K	%	
KV	32	42,5	88,0	50,6	88,5	59,5/47,5	1394/894
Nyh-1F1F	22	89,3	104,2	101,4	167,9	57,8/54,6	1927/1915
Nyh-1F1K	22	41,7	182,9	58,5	168,1	91,9/64,6	2033/778

- * as footnotes are presented the values of the variation factor and the variance of the studied parameters of the reference plants

- %/K – data, given as a percentage of the reference specimen

From Fig.1 and Tabl. 2 it can be concluded, that the treatment of the seeds of sunflower variety KV according to option № 32 has had a suppressive effect on the monitored laboratory parameters – they all have smaller values compared to those of the reference specimen (untreated seeds). For example, according to Fig.1, the laboratory germination capacity is only 76,5% of that of the reference specimen, and the mass of the green, and of the dry, plants – 97,55% and 96,45% respectively.

For the hybrid Nyh-1F1K, an increase in the laboratory germination capacity (by 33,3% - Fig.1), and of the mass of the green plants – by up to 48,6%, has been observed. The mass of the naturally dried (after laboratory examinations) plants, however, is only 77,7% of that of the reference specimen.

The analysis of the data obtained for the sunflower hybrid Nyh-1F1K shows that, during their growth in the Petri dishes, these plants absorbed much larger amounts of moisture. Over the short period of 7 days, during which the laboratory examinations were carried out, however, the seeds did not succeed to transform the absorbed moisture in dry matter. The increased laboratory germination capacity and the enlarged mass of the green plants gives reason to assume that a further advanced growth will take place with the plants developed from seeds of the hybrid Nyh-1F1K that have been subjected to pre-sowing electromagnetic treatment with values of the controllable factors specified for treatment option № 32.

The studies of the lengths of roots l_{root} and shoots l_{shoot} – Table 2, show a powerful effect of the pre-sowing electromagnetic treatment on the seeds of the hybrid Nyh-1F1K. The values of these monitored parameters are by 82,9%, respectively 68,1%, higher than those of the reference specimen. Despite the lesser mass of the dry plants it can be assumed that over a longer time period of growth they will catch up with the reference specimen in accumulation of more dry mass.

The pre-sowing electromagnetic treatment of the seeds of the hybrid Nyh-1F1F has also affected positively the controlled parameters. It has been observed, however, that the effect on the development of roots and shoots is different. The length of roots l_{root} has increased by 4.2%, while that of shoots l_{shoot} - by 67.9%.

Under equal other conditions (values of the controllable factors for pre-sowing electromagnetic treatment, same time period of rest before sowing, same conditions of sprouting), the different impact of the pre-sowing electromagnetic treatment on the hybrids Nyh-1F1F and Nyh-1F1K can be attributed to their somewhat different generic features.

It is worth noting that the monitored parameters (l_{root} and l_{shoot}) of the treated plants are dispersed around their mean values rather than the values of the reference specimen. This can be observed from the estimated coefficients of variation \hat{V} and variances s^2 , reduced values for the plants sprouting from the treated, resp. untreated seeds (specified as footnotes in Table 1).

Conclusions:

1. It has been concluded that the three-step pre-sowing electromagnetic treatment of Hungarian sunflower seeds of the variety KV and hybrids Nyh-1F1F, Nyh-1F1K produces a specific effect on the monitored laboratory parameters.

2. With the following initial values of the controllable factors: voltage $U_1=4\text{kV}$, and duration of treatment $\tau_1=10\text{s}$, the effect of the pre-sowing electromagnetic treatment on seeds of the sunflower hybrids Nyh-1F1F and Nyh-1F1K is such that it stimulates their growth and helps improve the laboratory germination capacity, the mass of the green plants, and the length of the roots and shoots.

3. The selected initial values of the controllable factors, $U_1=5\text{kV}$ and $\tau_1=4\text{s}$, for pre-sowing electromagnetic treatment of the seeds of the variety KV, suppress their development in laboratory conditions.

References:

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Докладът е рецензиран.