

## Results from preliminary studies on the effect of the pre-sowing electromagnetic treatment on Hungarian sunflower seeds

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**Results from preliminary studies on the effect of the pre-sowing electromagnetic treatment on sunflower seeds of Hungarian origin:** Both positive and negative effects have been observed after pre-sowing electromagnetic treatment of seeds of Hungarian sunflower, depending on the type of hybrid and the variety.

The values of the controllable factors of impact have been identified, that have resulted in overall positive effects on the sowing qualities of the seeds, for the hybrid Nyh-1 these being: voltage with initial value  $U_1=4kV$ , and duration of treatment with initial value  $\tau_1 = 5s$ , while for the variety KV:  $U_1=5kV$  and  $\tau_1 = 4s$ .

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

**Key words:** pre-sowing electromagnetic treatment, seeds of sunflower hybrids and varieties, size of the stem and of the seeds.

### FOREWORD

Studies to date show that for result-effective impact on oil-rich seeds, the method [3] of a multistep pre-sowing electromagnetic treatment with decreasing values of the intensity of the electric field (voltage between electrodes) and increasing duration of treatment is to be employed.

By using method [3], successful electric-physical effect has been achieved on seeds of cotton [4], sunflower [1,2], etc.

In [2], the data from the pre-sowing electromagnetic treatment of sunflower seeds of the varieties Papagalski and Perodovik are analyzed. In [1], the studies have been continued using sunflower seeds of the Bulgarian variety Vega and hybrid Albena. With [1,2,], a possibility has been established to increase the yields of sunflower seeds by subjecting them to a multistep pre-sowing electromagnetic treatment. The same source makes the assertion that electromagnetic treatment is more effective on the said varieties than on seeds of the hybrid Albena.

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The purpose of the studies is to determine the effect of the pre-sowing electromagnetic treatment on Hungarian sunflower seeds of various hybrids and varieties.

### Material and method

The studies have been carried out on sunflower seeds produced in Hungary. The seeds are of the variety KV and the hybrids AnitaF1 and Nyh-1. The variety KV is an open pollinated variety, the hybrid Anita F1 is used for oil production, while the hybrid Nyh-1 is used in the confectionery industry.

The method [3] for pre-sowing electromagnetic treatment of the oil-rich sunflower seeds consists in the following. The seeds are placed in a chamber equipped with plate electrodes. Increased voltage is supplied to the electrodes for a specified time – first processing step. At the second step, the voltage between the electrodes is decreased

while the duration of processing is increased. At the third processing step, the voltage is further decreased while the duration of processing is increased again.

Taking into consideration the results from other studies [2,4], the seeds are left to rest (14...30) days and are then sown.

In the specialized literature, no statements of results were found with respect to pre-sowing electromagnetic treatment of seeds of Hungarian origin. Hence, the choice of values of the controllable factors of impact has been made based on such values that have produced the best results in treatment of cotton seeds [4] and in other studies on sunflower seeds [1,2]. The experiments in 2011 were carried out according to the plan of the experiment shown in Table 1 below. It presents the following pre-sowing treatment options: №1 – with values of the controllable factors same as those having produced the best results after treatment of cotton seeds, option № 2 – values used for the variety Papagalski, and № 3 – values same as they were for variety Peredovik.

Table 1.

Plan of the experiment in 2011, for electromagnetic treatment of Hungarian sunflower seeds: variety KV, hybrids Anita F1 and Nyh-1

Treatment Option	Processing Steps					
	I		II		III	
	Controllable Factors		Controllable Factors		Controllable Factors	
	U <sub>1</sub> , kV	τ <sub>1</sub> , s	U <sub>2</sub> , kV	τ <sub>2</sub> , s	U <sub>3</sub> , kV	τ <sub>3</sub> , s
1	4	5	2,5	15	2	25
2	5	4	4	4	1,5	35
3	8	5	6,5	15	5	25
4	Reference specimen (untreated seeds)					

The seeds treated in 2011 were sent for further studies in the experimental field of the College of Nyíregyháza – Hungary. There, the field germination capacity of the seeds was determined, as well as the characteristics of the plants, including height of the plant, diameter of the sunflower head, diameter of the stem (measured at its mid-height), and the characteristics of the resulting crop, consisting of the mass of 1000 seeds and the linear dimensions of the seeds: length, width and thickness.

### Results from the studies

The results from the field studies of the characteristics of the sunflower plant stems are given in Table 2.

From Table 2 it can be concluded that, with equal other factors of impact, for the hybrid Anita F1 the increase of the treatment voltage (options No.1 ... No. 3 in Table 1) helps increase field germination capacity. It grows by 30.4% in option 1, 47.8% in option No. 2, and 52,2% - in option No. 3.

Considerable increase in field germination capacity is also observed in the seeds of the variety KV, ranging from 26,9% in option No. 1 to 19,2% in No. 3.

With the same impact of the controllable factors, lesser increase in the field germination capacity of hybrid Nyh-1 has been achieved (within the range of just 5,9% in No.1 to 2,9% in No. 3). This result can be explained with the generic characteristics of the two hybrids.

The pre-sowing electromagnetic treatment of seeds of the variety KV has helped increase the height of the plants H<sub>p</sub>. It can be concluded that the treatment with factor values same "as for the sunflower variety Papagalski" has resulted in growing the highest plants in comparison with the reference seeds - by 8.4% higher than the reference. Again, after the same treatment, the diameter of the sunflower head has grown by 14.8% (option № 2).

Table 2.

Characteristics of sunflower plants,  
taken after pre-sowing electromagnetic treatment of the seeds in 2011

Type of seeds	Treatment Option	Germination capacity	Height of the plant		Diameter of the sunflower head, Dh		Diameter of the stem, Ds	
		%/K	cm	%/K	cm	%/K	mm	%/K
Hybrid Anita F1	1	130,4	181	101,7	23	95,8	40,4	102,9
	2	147,8	181	10,7	22	91,7	37,7	95,9
	3	152,2	179	100,6	23	95,8	35,7	90,8
	K	100,0	178	100,0	24	100,0	39,3	100,0
Hybrid Nyh-1	1	105,9	218	105,3	22	95,7	33,2	96,5
	2	102,9	214	104,9	22	95,7	32,9	95,6
	3	102,9	209	101,0	22	95,7	33,1	96,2
	K	100,0	207	100,0	23	100,0	34,4	100,0
Variety KV	1	126,9	385	107,2	24	88,9	36,9	97,4
	2	126,9	389	108,4	31	114,8	38,0	100,3
	3	119,2	380	105,8	25	92,6	36,5	96,3
	K	100,0	359	100,0	27	100,0	37,9	100,0

With the exception of the treatment option mentioned (№ 2) for the variety KV, in all other treatment options for this variety as well as for the hybrids Anita F1 and Nyh-1, the pre-sowing electromagnetic treatment has had a mildly suppressive role for the formation of the sunflower head diameter and of the stem.

The results from the studies of the mass of 1000 seeds and the linear parameters of the seed - length, width and thickness - for the hybrid Nyh-1 and the variety KV - are shown in Fig. 1.

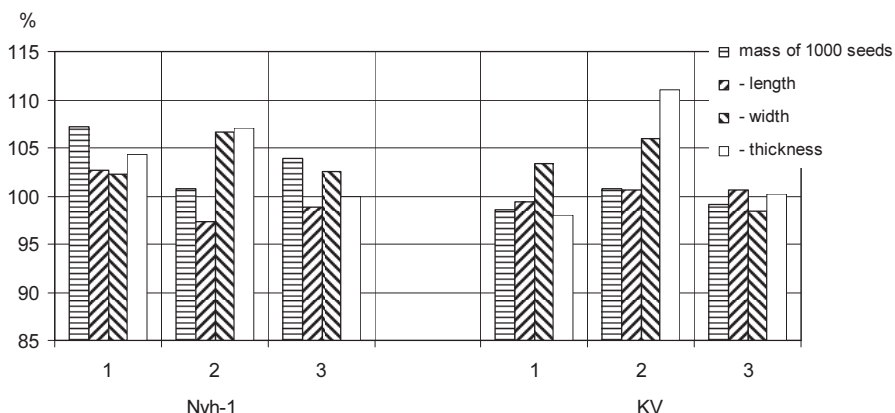


Fig.1. Research results for the mass and linear dimensions of sunflower seeds of the hybrid Nyh-1 and the variety KV, expressed as a percentage of the reference specimen

From Fig.1 it can be concluded that the best results have been obtained by treating the seeds of hybrid Nyh-1 with impact parameters “same as for cotton” (treatment option No.1). The mass of the resulting seeds surpasses the reference specimen by 7,2%. Their linear dimensions exceed those of the reference seeds by (2,2...4,3)%. Therefore, further studies of hybrid Nyh-1 should be based on the results in Table 2, for treatment option № 1 – same as “for cotton”.

The results from the studies of the pre-sowing electromagnetic treatment of seeds of the variety KV (Table 2 and Fig. 1) show that positive effect can be reached with treatment such as with "sunflower of the variety Papagalski" (treatment option № 2 from Table 1).

### Conclusions

1. Both positive and negative effects of the pre-sowing electromagnetic treatment of Hungarian sunflower seeds have been observed, depending on the type of the hybrid and the variety;

2. The values of the controllable factors of impact have been identified, with which complex positive effect on the sowing qualities of the seeds has been achieved: for hybrid Nyh-1 – voltage with initial value  $U_1=4\text{kV}$  and duration of treatment with initial value  $\tau_1 = 5\text{s}$ , while for the variety KV these values are:  $U_1=5\text{kV}$  and  $\tau_1= 4\text{s}$

### REFERENCES

[1]. Georgiev Dr., P. Yankov P., Iv. Palov, G. Demirev, Some studies on sunflower seeds sown after electromagnetic treatment, Jubilee Scientific Session "50th anniversary of the DZI Insurance Company", G. Toshevo, 2001, p. 626 to 630. (in Bulgarian language)

[2]. Palov Iv., St. Stefanov, N. Armyanov, K. Sirakov, A research on the effect of the pre-sowing electromagnetic treatment of sunflower seeds, Agricultural Engineering, Sofia, 1998, No.6, p.8-11. (in Bulgarian language, with an abstract in English)

[3]. Patent for invention No. 4268, A method for pre-sowing electromagnetic treatment of peanut seeds, A 01C 1/00, A 01 G 7/04 (in Bulgarian language)

[4]. Radevska M., A. Stoilova, Iv. Palov, K. Sirakov, Effect of the electromagnetic treatment and storage time on the sowing qualities of cotton seeds, Plant Science. I. Laboratory germination capacity, Sofia, 2012, №49, p. 19-27 (in Bulgarian language, with an abstract in English).

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**Докладът е рецензиран.**