

## FIELD EMERGENCE OF DIFFERENTLY STORED SUNFLOWER SEED

Jelena MRĐA<sup>1</sup>, J. CRNOBARAC<sup>2</sup>, B. DEDIĆ<sup>1</sup>, V. MIKLIČ<sup>1</sup>

<sup>1</sup>*Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia*

<sup>2</sup>*Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia*

*E-mail: jelena.mrdja@ifvcns.ns.ac.rs*

**Abstract:** Sunflower seed treatment with fungicides has become regular measure in sunflower seed production. In recent years, along with fungicides seed is treated with appropriate insecticides in order to increase seed quality. This practice in seed production has brought out a problem of treated seed storage. Aim of this research was to determine the effect of different means of storage on field emergence of two sunflower hybrids. The trial was set during 2007 and 2008. Research was done using seed of two sunflower hybrids, developed in Institute of Field and Vegetable Crops from Novi Sad. Effect of storage conditions was carried out partly on seed kept in storage facility and partly on seed kept in chamber with control of temperature. Field emergence was evaluated immediately after pesticide treatment and one year after storage by counting number of emerged plants in the first pair of leaves. Treatments selected for the research were: control (untreated seed), benomyl + metalaxyl, fludioxonil + metalaxyl, fludioxonil + metalaxyl + thiamethoxam and fludioxonil + metalaxyl + imidacloprid. Research data were calculated using analysis of variance of two-factorial split-plot experimental design. Seed of hybrid Baća had the lowest value of field emergence when it was kept on low temperatures regime (73.75%). This value was significantly lower than values for seed sown in short period after treatment (decrease of 8.54%) and seed kept in storage (decrease for 10.95%). Furthermore,

field emergence of seed treated with insecticides compared with field emergence of untreated seed (76.59%) was highly significantly lower and compared to treatment 2 (78.67%) significantly lower. Comparison of field emergence of seed submitted to same pesticide treatment and different storage conditions revealed highly significantly lower field emergence, for control and treatment 1, of seed kept in cold chamber. On the contrary, there was no significant difference of the same trait for treatment 2. Evaluated parameter for seed treated with insecticides and kept in cold chamber and storage facility compared to germination of seed sown shortly after treatment was significantly and highly significantly lower, respectively. Seed of hybrid Rimi kept in storage had highest value of field emergence (80.98%) and was highly significantly different compared to other treatments. Field emergence of treatment 4 (77.48%) was highly significant compared to control, treatment 1 and treatment 2 by 6.0, 5.51 and 5.16%, respectively. Under same storage conditions and different chemical treatment control and treatment 2 had highly significantly highest field emergence. Field emergence for seed kept in storage and for treatments 1 and 4 was significantly higher compared to field emergence of non-storage seed, and highly significantly higher than field emergence of seed kept in cold chamber. For treatment 3 there was no significant difference between treatments.

**Key words:** field emergence, sunflower seed, storage conditions, chemical treatment

### INTRODUCTION

Protection of seed using fungicides in order to prevent damage of diseases in early stages of sunflower development has become a regular measure in sunflower seed production. In recent years, along with fungicides, seed is treated with appropriate insecticides in order to increase seed quality. For that reason, seed treatment is from economical and ecological standpoint acceptable way of seed protection. Treating seed with pesticides one is applying considerably less amount of pesticide compared to soil and foliar treatments (MARJANOVIĆ-JEROMELA et al., 2008). This practice in seed production has brought out a problem of treated

seed storage because seed which is not used in first year remains for the next one.

Conditions in storage facility as well as length of storage have great influence on seed quality. Humidity and temperature are environmental factors with the greatest influence on seed ageing which leads to gradual decline of quality. Control of these two factors provides successful and safe storage of seed. Seed stored in conditions of high temperature and humidity may cause decrease in seed quality (ŠIMIĆ et al., 2006). Decrease of sunflower seed vigor after 4 years of storage could be over 50%, and is positively correlated with temperature (ŠIMIĆ et al., 2005). On the other hand, GHASEMNEZHAD and HONERMEIER (2009) failed to prove dependence of temperature and length of storage on sunflower seed germination.

Field emergence, as a measure of seed viability, directly determines number of plants per hectare. This value is one of three basic yield components in crop production. Apart from that, speed and uniformity as well as rate of plant growth in early developing stages are influenced by seed quality (CRNOBARAC, 1992).

Aim of this research was to determine the effect of different means of storage on field emergence of two sunflower hybrids.

#### **MATERIAL AND METHODS**

The trial was set during 2007 and 2008. Research was done using seed of sunflower hybrids Baća and Rimi, developed in Institute of Field and Vegetable Crops from Novi Sad. For determination of effect of storage on seed germination part of seed was kept in storage and the other part in cold chamber. In cold chamber temperature was maintained on 5°C. relative humidity (RH) inside chamber was not regulated and measured values were around 80%. In storage facility, which is used for storage of commercial seed, conditions were in dependence of outside temperature and humidity. In both cases, seed was kept in paper bags. Field emergence of seed was evaluated shortly after chemical treatment and one year after keeping in storage and cold chamber. For seed treatment fungicides (benomyl, metalaxyl, fludioxonil) and insecticides (thiamethoxam, imidacloprid) were used. Experimental treatments were: control (untreated seed), treatment 1 (benomyl + metalaxyl), treatment 2 (fludioxonil + metalaxyl), treatment 3 (fludioxonil + metalaxyl + thiamethoxam) and treatment 4 (fludioxonil + metalaxyl + imidacloprid). The amount of commercial product applied was according to manufacturer recommendation.

The trial was set as split-split-plot experimental design, in four replications, on Rimski Šančevi experimental field. Soil type was calcareous chernozem and field was irrigated. The experimental unit was contained of 4 rows 4.2 m in length and 70 cm inter-row spacing. Sowing was done manually putting 3 seeds per spot. Field emergence was evaluated by counting sunflower plants when they developed first pair of leaves.

Results were compared using analysis of variance for two-factorial split-plot experimental design (factor A – storage conditions, factor B - chemical treatment) using statistical software. Ranking of differences was done using LSD-test on 1% and 5% level of significance (MEAD et al., 1996).

#### **RESULTS AND DISCUSSIONS**

F-test showed that conditions of storage had highly significant influence on field emergence of hybrid Baća (Table 1). Moreover, F- test was significant for chemical treatments whereas interaction between storage conditions and chemical treatment was not significant.

According to results presented in table 2, the lowest value of field emergence had seed kept in cold chamber (73.75%). This value was highly significantly lower compared to values for non-storage seed (decrease of 8.54%) and seed kept in storage (decrease of 10.95%). There was no significant difference in field emergence for non-storage and seed kept in storage.

Similar results were gained in research of MRDA et al. (2010), studding effect of genotype, storage conditions and chemical treatment on field emergence. However, ŠIMIĆ et al. (2006) came to conclusion that storage conditions for maize, soybean and sunflower seed of 12°C and RH of 60% was more beneficial on seed quality than keeping seed on 25°C temperature and RH of 75%.

Table 1

Source of variation	df	ss	ms	F	p
A	2	1324.84	662.42	22.90	0.002**
Error A	6	173.55	28.93	1.22	-
B	4	355.04	88.76	3.75	0.012*
A x B	8	178.19	22.27	0.94	0.496ns
Error B	36	851.83	23.66	-	-
Total	59	2949.61	-	-	-

Table 2

Chemical treatment (B)	Storage conditions (A)			Mean (B)
	a	b	c	
Control	80.65	80.51	68.80	76.59
1	82.14	86.76	71.88	80.26
2	80.21	79.76	76.04	78.67
3	84.37	88.39	75.45	82.74
4	84.08	88.10	76.79	82.99
Mean (A)	82.29	84.70	73.75	-
	A	B	AxB	BxA
LSD <sub>0.05</sub>	4.16	4.03	6.98	7.11
LSD <sub>0.01</sub>	6.31	5.40	9.35	9.52

a = non-storage seed

b = seed kept in storage

c = seed kept in cold chamber

Control – Untreated seed

1 = Benomyl + Metalaxyl

2 = Fludioxonil + Metalaxyl

3 = Fludioxonil + Metalaxyl + Thiamethoxam

4 = Fludioxonil + Metalaxyl + Imidacloprid

Comparison of values between different chemical treatments, reveals that field emergence of non-treated seed (76.59%) was highly significantly lower, and same value in treatment 2 (78.67%) was significantly lower compared to treatments that include insecticides, what was expected.

Under same storage conditions and different chemical treatment interaction between treatments was not significant for non-storage seed while field emergence for seed kept in storage was significantly higher for treatment with insecticides compared to control and treatment 2. Field emergence for seed kept in cold chamber was significantly higher compared to control.

Under same chemical treatment and different storage conditions field emergence of seed of control and treatment 1 was highly significantly lowest and for treatment 2 differences were not significant. Seed treated with insecticides had significantly lower field emergence

when kept in cold chamber compared to non-storage seed, and highly significantly lower than field emergence of seed kept in storage.

Table 3

Analysis of variance for hybrid Rimi

Source of variation	df	ss	ms	F	p
A	2	1747.89	873.94	20.34	0.002**
Error A	6	257.78	42.96	1.43	-
B	4	300.61	75.15	2.50	0.060ns
A x B	8	507.11	63.39	2.11	0.060ns
Error B	36	1081.74	30.05	-	-
Total	59	3949.10	-	-	-

Table 4

Field emergence of hybrid Rimi seed (%)

Chemical treatment (B)	Storage conditions (A)			Mean (B)
	a	b	c	
Control	70.09	81.25	63.10	71.48
1	71.13	81.99	62.80	71.97
2	68.60	80.36	68.01	72.32
3	72.77	75.60	75.74	74.70
4	75.15	85.71	71.58	77.48
Mean (A)	71.55	80.98	68.24	-
	A	B	AxB	BxA
LSD <sub>0.05</sub>	5.07	4.54	7.86	8.18
LSD <sub>0.01</sub>	7.68	6.09	10.54	10.96

a = non-storage seed

b = seed kept in storage

c = seed kept in cold chamber

Control – Untreated seed

1 = Benomyl + Metalaxyl

2 = Fludioxonil + Metalaxyl

3 = Fludioxonil + Metalaxyl + Thiamethoxam

4 = Fludioxonil + Metalaxyl + Imidacloprid

Effect of storage conditions on field emergence of hybrid Rimi was highly significant (Tab.3). On the other hand, effect of chemical treatment and interaction (storage conditions x chemical treatment) was not significant.

Field emergence of seed kept in storage was the highest (80.98%) and highly significantly different than the other way of storage. Difference of 3.31% between field emergence of seed kept in cold chamber and non-storage seed was not significant. Similar results were obtained by RAJIĆ et al. (2005). According to their research seed of sugar beet kept in storage without control of temperature and RH had better quality compared to the seed kept in laboratory on temperature of 20°C and RH of 65-75%. Comparison of different chemical treatments lead to result that there was no significant difference between treatments although field emergence compared to control was higher for treatment 4, treatment 1 and treatment 2 by 6.0, 5.51 and 5.16%, respectively.

Under the same storage conditions and different chemical treatments there was no significant differences in field emergence for non-storage seed. On the contrary, field emergence for treatment 4 was significantly higher compared to treatment 3, for seed kept in storage. Results from our research are not in concordance with results of BAČA et al. (2008),

who concluded, after four-year trial using insecticides thiamethoxam and imidacloprid, that there was no negative influence of chemical treatment on field emergence of maize seed. For treatment 3 field emergence was highly significantly higher and for treatment 4 significantly higher compared to control and treatment 1.

Under the same chemical treatment but different storage conditions field emergence for seed of control and treatment 2 had the highest mean values and it was highly significantly different compared to other treatments. Field emergence, in treatments 1 and 4, for seed kept in storage was significantly higher compared to results of non-stored seed and highly significantly higher compared to seed kept in the cold chamber, while for treatment 3 there was no significant differences in field emergence.

### CONCLUSIONS

Results of research clearly have shown that storage conditions had highly significant effect on field emergence of hybrid Baća. Moreover, chemical treatments had also significant effect, although interaction between this factor and storage conditions was not significant. The lowest value of field emergence had seed kept in cold chamber (73.75%). Compared to treatments with insecticides field emergence in control (76.59%) was highly significantly lower and for treatment 2 (78.67%) was significantly lower.

Influence of storage conditions on field emergence of hybrid Rimi was highly significant. On the other hand, effect of chemical treatment and interaction between two factors was not significant.

Seed of hybrid Rimi kept in storage had highest value of field emergence (80.98%) and difference compared to other treatments was highly significant. Field emergence of treatment 4 (77.48%) was highly significant compared to control, treatment 1 and treatment 2 by 6.0, 5.51 and 5.16%, respectively.

In conclusion, keeping seed in cold chamber had negative effect on field emergence of tested genotypes. Reason for that is most probably high relative humidity in chamber. Further research effort will be in direction of solving this problem.

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### BIBLIOGRAFY

1. BAĆA, F., GOŠIĆ-DONDO, S., VIDANOVIĆ, Ž. ERSKI, P. (2008): Efekat tretiranja semena kukuruza imidaklopridom i tiametoksamom na sklop biljaka i prinos zrna. Zbornik naučnih radova, 12. savetovanje agronoma, veterinarara i tehnologa, Beograd, 61-69
2. CRNOBARAC, J. (1992): Uticaj ekoloških faktora na biološka i agronomska svojstva semena i F1 generaciju nekih genotipova suncokreta. Doktorska disertacija, Poljoprivredni fakultet, Novi Sad
3. GHASEMNEZHAD, A., HONERMEIER, B. (2009): Influence of storage conditions on quality and viability of high and low oleic sunflower seeds. International Journal of Plant Production 3: 39-48
4. MARJANOVIĆ-JEROMELA, A., MARINKOVIĆ, R., MILOVAC, Ž., MILADINOVIĆ, D., SEKULIĆ, R., JASNIĆ, S. (2008): Ispitivanje sjemenskih kvaliteta sjemena uljane repice (*Brassica napus* L.) tretiranog insekticidima i fungicidima. Glasnik zaštite bilja 4: 13-21
5. MEAD, R., CURNOW, R.N., HASTED, A.M. (1996): Statistical methods in agriculture and experimental biology. Chapman & Hall, London, UK
6. MRDA, J., OSTOJIĆ, B., PROLE, S., JOKIĆ, G., BUTAŠ, D., ĐILVESI, K., MIKLIĆ, V. (2010): Uticaj hibrida, načina čuvanja i zaštite semena na nicanje suncokreta. Ratarstvo i povrtarstvo 47(2):

517-522

7. RAJIĆ, M., VUJAKOVIĆ, M., LONČAREVIĆ, V. (2005): Čuvanje semena šećerne repe. PTEP 9: 25-271
8. ŠIMIĆ, B., VRATARIĆ, M., SUDARIĆ, A., KRIZMANIĆ, M., ANDRIĆ, L. (2005): Effect of storage longevity under different storage conditions on seed vigor and oil content in maize, soybean and sunflower. Poljoprivreda 11 (2): 12-17
9. ŠIMIĆ, B., SUDARIĆ, A., LIOVIĆ, I., KALINOVIĆ, I., ROZMAN, V., ĆOSIĆ, J. (2006): Influence of storage condition on seed quality of maize, soybean and sunflower. Proceedings, 9th International Working Conference on Stored Product Protection, Campinas, Sao Paulo, Brasil, 59-63