

EFFECT OF DIFFERENT SUBSTRATUM ON TREATED SUNFLOWER SEED GERMINATION

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Abstract: Results of the examination of Rimi hybrid seed showed the existence of a highly significant effect of different substratum on germination energy and germination. Also, a highly significant influence was detected between treatments, while the substratum x treatments interaction was significant. On average, germination energy was the highest on filter paper and it was 90.10%. Also, the germination was the best on filter paper (92.05%). This value was statistically significantly higher (by 13.60%) with respect to germination determined in sand and by 4.00% concerning germination determined in compost.

Key words: sunflower seed, germination, sand, compost, filter paper, seed treatments.

Introduction

Sunflower is one of the four most important oil crops and it is cultivated at 23 million hectare (<http://faostat.fao.org>, 2009) in more than 70 countries all over the world (de Rodrigez et al., 2002; Šimić et al., 2008). Sunflower is the most important oil crop in Serbia and it is cultivated at 146,000 to 201,000 ha (<http://webrzs.stat.gov.rs/axd/poljoprivreda>, 2009). Sunflowers sown areas depend on year conditions, yield and economic position of this important crop (Miklič et al., 2004).

High yield requires good hybrid, optimal technical measures, irrigation and seed of high quality (Milošević et al., 1996). Indicators of seed vitality, germination energy and sprouting in field conditions are determinate number of plant per acres – one of three basic yield components. Seed quality affects speed and equable sprouting as well as the initial plant growth (Crnobarac, 1992).

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The two most important seed characteristics are germination energy and germination. That implies substratum, conditions during the germination, length of germination as well as different methods which are used for interruption of seed resting (Milošević and Malešević, 2004). For sunflower seed three substrata are used: sand, compost and filter paper. Sand is most frequently used. Sand is the substratum which provides a good contact with seed and it decreases the contagion possibility. Sand can be used several times because it can be treated in sterilisation process in relation to compost and filter paper which are suitable for one time usage. Compost and filter paper are often used only for comparative examination or for research proposes.

Investigation of seed germination is performed in optimal and control laboratory conditions (substratum, moisture and temperature, light). The results gained in those conditions can be the good indicator for seed sprout in field conditions. The main aim of this paper work was to examine the effect of substratum on seed germination and energy of germination.

Materials and Methods

The investigations are conducted on Rimi hybrid in Research Institute of Field and Vegetable Crops in Novi Sad. Seed germination was tested in laboratory conditions.

Standard laboratory examinations imply 4 x 100 seeds, at 25°C temperature and 95% air moisture with 4 days of incubation period for germination energy and 10 days for seed germination (ISTA, 2007). Seed was germinated in sand, compost and filter paper.

Seed used for research was treated in the previous year with chemical preparations with active matters: benomil, metalaxil, fludioxonil, insecticide 1 and insecticide 2 in the next combinations:

1. control - untreated variant,
2. benomil + metalaxil,
3. fludioxonil + metalaxil,
4. fludioxonil + metalaxil + insecticide 1 and
5. fludioxonil + metalaxil + insecticide 2.

Dosage of applied preparations was standard. The gained results are statistically processed with variance analyses of the two-factor trial (A factor-substratum for germination, B factor-chemical treatment) with statistic package STATISTIKA 8, and the importance of the accomplished results was defined by the Least Significant Difference (LSD). Values of significance were 1 and 5%.

Results and Discussion

The results are shown in Tables 1 and 2. Variance analyses of investigated parameters show the existence of highly significant substratum and chemical treatments (F-test possibility: $F_{pr} = <.001$) which influence germination energy and seed germination. At interaction substratum x chemical treatment, statistically significant difference was shown in germination energy (F-test possibility: $F_{pr} = 0.030$), while the accomplished difference in seed germination was not statistically important.

Table 1. Influence of substratum and chemical treatment on germination energy (%).

Treatment (B)	Seedling substratum (A)			Average (B)
	Sand	Compost	Filter paper	
Control	79.25	92.25	94.50	88.67
Benomil Metalaxil	79.00	87.75	89.75	85.50
Fludioxonil Metalaxil	74.50	86.00	91.00	83.83
Fludioxonil Metalaxil Insecticide 2	81.00	89.25	94.00	88.08
Fludioxonil Metalaxil Insecticide 2	64.00	84.25	81.25	76.50
Average (A)	75.55	87.90	90.10	-

	A	B	AΔB	BΔA
LSD _{0.05}	3.20	2.74	4.75	5.01
LSD _{0.01}	4.84	3.68	6.37	6.71

In average, germination energy was highest in seed which was germinated on filter paper (90.10%), (Table 1). This value was statistically significant in relation to germination energy of seed which was germinated in sand (the difference was 14.55%). Also, statistically significant difference was shown between results gained with germination in compost and in sand, where the germination energy in compost was 12.35% higher in relation to sand. These results are in accordance with the results gained by Mrda et al. (2009).

If we compare results of chemical treatments, the highest value, in average, was found in control variant (88.67%) and it was highly significant in relation to treatment fludioxonil + metalaxil + insecticide 2 (by 12.17%) and in relation to fludioxonil + metalaxil treatment by 4.84% but in relation to benomil + metalaxil treatment was significant. Similar results were gained by Mrda et al. (2008).

Within all investigated variants there were highly significant differences between germination energy on filter paper and in compost in relation to sand. The highest difference was at variant 5 where values of germination energy in sand decreased in relation to values in compost. The difference was statistically significant (20.25%).

Individually, the highest values (94.50%) were accomplished at control (variant without chemical treatment) where the seed was germinated on filter paper, and the smallest values were gained in sand at fludioxonil + metalaxil + insecticide 2 variant (64.00%).

The highest value of seed germination (Table 2) was accomplished on filter paper (92.05%). This value was highly significant in relation to value gained in sand (by 13.60%) and significant in relation to compost (by 4.00%).

Table 2. Influence of substratum and chemical treatment on seed germination (%).

Treatment (B)	Seedling substratum (A)			Average (B)
	Sand	Compost	Filter paper	
Control	79.50	92.50	94.75	88.92
Benomil Metalaxil	80.75	87.75	91.25	86.58
Fludioxonil Metalaxil	78.00	86.25	93.25	85.83
Fludioxonil Metalaxil Insecticide 1	84.00	89.50	95.25	89.58
Fludioxonil Metalaxil Insecticide 2	70.00	84.25	85.75	80.00
Average (A)	78.45	88.05	92.05	-

	A	B	AΔB	BΔA
LSD _{0.05}	2.95	2.41	4.17	4.47
LSD _{0.01}	4.47	3.23	5.60	5.99

Also, highly statistically significant difference was present between results in compost in relation to sand and it was 9.60%. According to the results of Caldeira and Perez (2008), during the seed storage, substratum did not have any influence on germination but affected vigour. Perez et al. (1999) during the investigation of different substratum influence on *Peltophorum dubium* germination concluded that the type of substratum did not have statistically significant influence on the result.

During the different chemical treatments, variants of the highest germination had seed which was treated with combination of fludioxonil + metalaxil + insecticide 1 and that value was statistically significant (89.58%). This value was statistically significant: it was higher than the values gained in treatment 5 by 9.58 % and higher than values in treatment 3 by 3.75%. There was a statistically significant difference in relation to benomil + metalaxil treatment (by 3.00%) while in relation to control variant there was not any significant difference. Vujaković et al. (2003) concluded that applied chemical preparations on wheat did not have any negative effects on seed germination.

If we compare results of seed germination gained using seed which was treated with the same combination of chemical preparation we can note the differences between all investigated variants. The highest statistically significant difference emerged during the fludioxonil + metalaxil + insecticide 2 treatment between seed germinated on filter paper and in sand (15.75%), and between seed germinated in compost and in sand (14.25%). The statistically significant difference between germination on filter paper and in sand was present between control variant and treatment 3 (15.25%).

The highest value (95.25%) during the seed germination examination was gained in treatment 4 (fludioxonil + metalaxil + insecticide 1) where we used filter paper as substratum and smallest value (70.00%) in treatment fludioxonil + metalaxil + insecticide 2 where we used sand as substratum. According to Bača et al. (2008) insecticides with insecticide 2 and insecticide 1 did not have any significant influence on plant number in relation to control variant.

Results of germination energy and seed germination investigations in different substratum indicate that in all variants the gained values on filter paper and in compost were higher than the values gained in sand. Also, the values accomplished on filter paper, were higher than the values gained in compost in all investigated variants except for variant number 5 where the germination energy was higher in compost by 3%.

Conclusion

Germination energy was the highest in seed germinated on filter paper (90.10%). This value was statistically significant in relation to germination energy of seed germinated in sand (by 14.55%).

There was statistically significant difference between seed germinated in compost and in sand. The value gained in compost substratum was higher by 12.35% than in sand substratum.

For all investigated variants the differences of germination energy of seed germinated on filter paper and in compost in relation to sand was present. The highest difference occurred in treatment 5 where values gained in sand were lower by 20.25% in relation to compost.

The highest value was accomplished in control variant 94.50%, when seed was germinated on filter paper and the lowest in treatment 5 when the seed was germinated in sand (64.00%).

Seed germination was the highest on filter paper (92.05%) and this value was highly statistically significant in relation to sand (by 13.60%), and significant in relation to compost 4.00%.

The statistically considerable significance was present in compost in relation to sand (9.60%).

The highest statistically significant difference was gained in treatment 5 (15.75%) between germination on filter paper and in sand and between compost and sand (14.25%). Statistically significant difference was present in control variant and treatment 3 between germination on filter paper and in sand 15.25%.

The results show that the highest value (95.25%) was gained in treatment 4 using filter paper as substratum, and the lowest in treatment 5 (70.00%) using sand as substratum.

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UTICAJ PODLOGE NA KLIJAVOST TRETIRANOG SEMENA SUNCOKRETA

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R e z i m e

Rezultati ispitivanja energije klijanja i klijavosti semena hibrida Rimi na različitim podlogama za ispitivanje klijavosti ukazali su na postojanje visoko značajnog uticaja podloge na energiju klijanja i klijavost semena. Takođe, visoko značajna razlika utvrđena je i kod primenjenih tretmana, dok se značajna razlika ispoljila kod interakcije podloga x tretmani. U proseku, energija klijanja bila je najveća kod semena koje je naklijavano na filter papiru i iznosila je 90,10%. Ispitivanje klijavosti semena pokazalo je u proseku, takođe, najveću vrednost kod naklijavanja na filter papiru (92,05%). Ova vrednost bila je statistički visoko značajna u odnosu na rezultat ispitivanja u pesku za 13,60%, a u odnosu na ispitivanje u kompostu za 4,00%.

Ključne reči: seme suncokreta, klijavost, pesak, kompost, filter papir, tretmani semena.

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