

Influence of desiccation on germination and field emergence of sunflower

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ABSTRACT

In this paper we present results on the influence of desiccation on laboratory germination and field emergence of sunflower hybrid Favorit and its parental lines. As desiccants we used Reglone forte [diquat] (3 l/ha) and Harvade 25F [dimethipin] (2 l/ha), with water usage of 500 l/ha. Desiccation was done on August 20, 2006, and, after 20 days, the genotypes were harvested. In each trial variant (combination of genotype and treatment) laboratory germination was performed on four subsequent dates with 2-month intervals. With relation to the control, the Harvade 25F variant had a statistically significant higher germination of 4.38%, while the Reglone forte variant had a statistically significant higher germination in relation to both, control and Harvade 25F, of 7.32% and 2.95%, respectively. Regarding field emergence, differences among the treatments were small, statistically non-significant. Like in the laboratory germination test, Reglone forte treatment had the highest field emergence (78.55%) which was higher than the control and Harvade 25F in 2.94% and 2.86%, respectively.

Key words: desiccation – field emergence – Harvade 25F – laboratory germination – Reglone forte – sunflower.

INTRODUCTION

Chemical desiccation before harvesting is a very useful agro-technical measure, which is applied on different crops like cotton, rice, potato, alfalfa, soybean, oil rape and sunflower. Desiccation of sunflower is performed at technological maturity of plants, when seeds contain 24-50% of moisture (Degtyarenko, 1976; Palmer and Sanderson, 1976; Kosovac and Sudimac, 1980; Tombu, 1988; Miklič et al., 2001; Johnson et al., 2004; Radić, 2006). At that time the process of seed forming and filling has been completed, the seeds begin to lose their moisture and plants are still green.

Desiccation remarkably decreases moisture of seeds, leaves, heads and stalks, accelerates maturation and enables earlier harvest. Losses of seeds in combining as well as drying expenses, bird damage and presence of weeds on fields are reduced. It is possible to prepare the field earlier for the next crop and there are no harmful consequences for oil and byproducts quality (Hill et al., 1974; Kosovac and Sudimac, 1980). Desiccation has an especially positive influence in years with heavy rainfalls during the maturation period of sunflower when attacks of fungal diseases are very intensive.

Besides its positive influence on grain yield, desiccation also improves seed quality (Dembinski et al., 1974; Palmer and Sanderson, 1976; Miklič et al., 2004; Đukić et al., 2006). The objective of this research was to test desiccation influence on germination and field emergence of the sunflower hybrid Favorit and its parental lines by treating them with the desiccants Reglone forte (total herbicide) and Harvade 25F (growth regulator).

MATERIALS AND METHODS

Research was conducted in the experimental field and laboratory of the Agricultural Institute Osijek. Field trial was sown on April 22, 2006, with inter row space of 70 cm, in-row space of 23.5 cm, giving a plant population of around 61000 plants/ha. Main plot had surface of 14 m² (4 rows by 5 m length).

Genotypes in the research were the sunflower hybrid Favorit and its parental lines, developed at the Agricultural Institute Osijek. Treatments in the research were Reglone forte [diquat] (3 l/ha) and Harvade 25F [dimethipin] (2 l/ha), with water usage of 500 l/ha, and non-desiccated control treatment. Desiccation was done on August 20, 2006, and, after 20 days, the genotypes were harvested. In each trial variant (combination of genotype and treatment) laboratory germination was performed four times (October 23, 2006; December 21, 2006; February 22, 2007 and April 23, 2007). Seed vigor was calculated as the percentage of seeds that germinated after four days. Seed germination was calculated as the percentage of

seeds that germinated after 10 days (Official Gazette, 4/2005). For field emergence determination, seeds were sown in the field on April 13, 2007, and counting of emerged seedlings was carried out on May 11, 2007. The experimental data obtained were processed by SAS for Windows (SAS, 2003) software.

RESULTS

Seed samples of sunflower hybrid and parental lines were taken at the same time, before desiccation. Seed moisture of hybrid was 24%, female line 22.8%, and pollinator line 34.4%. The latter had distinctly the highest moisture. Twenty days after desiccation, the genotypes were harvested. Table 1 presents seed moisture of analyzed treatments and genotypes. As we expected, the highest seed moisture was found in the control (8.48%), then Harvade 25F, and a statistically significant lower moisture content than the control (1.28%) was found with the Reglone forte treatment. Among the genotypes, statistically significant differences were also found. The pollinator line had a statistically significant higher moisture content in relation to the hybrid (0.40%) and the female line (0.55%).

Table 1. Sunflower seed moisture at harvest of tested variants and genotypes

		Seed moisture (%)
Treatment	Control	8.48
	Reglone forte	7.20
	Harvade 25F	8.21
	LSD 0.05	0.36
Genotype	Favorit	7.88
	Female line	7.73
	Pollinator line	8.28
	LSD 0.05	0.36

Laboratory germination was estimated in the seed laboratory of the Agricultural Institute Osijek on four subsequent dates at 2-month intervals (Table 2). In the first count on October 23, 2006, seed vigor was very low (29.89%) as well as germination (53.83%). This could be explained by distinctive seed dormancy. In the second and third count, seed vigor and germination had almost the same values. In the fourth, final count on April 23, 2007, seed vigor was 91.39%, and germination 92.39%, respectively, which was statistically significantly greater ($P < 0.05$) than in the previous count.

Table 2. Seed vigor and germination in subsequent germination tests

Germination test	Seed vigor (%)	Germination (%)
October 23, 2006	29.89	53.83
December 21, 2006	87.18	89.37
February 22, 2007	87.27	89.58
April 23, 2007	91.39	92.39
LSD 0.05	2.40	2.40

Among the treatments evaluated, we found statistically significant differences for seed vigor and germination (Table 3). In relation to control, the Harvade 25F variant had a statistically significant higher germination of 4.38%, while Reglone forte showed a statistically significant higher germination in relation to control and Harvade 25F of 7.32% and 2.95%, respectively. Among the genotypes, hybrid Favorit and female parental line did not exhibit any statistically significant differences in seed vigor and

germination, but the pollinator line had distinctly lower seed vigor and germination in relation to both hybrid Favorit and female parental line of almost 10%.

Table 3. Seed vigor and germination of tested variants and genotypes.

		Seed vigor (%)	Germination (%)
Treatment	Control	70.77	77.39
	Reglone forte	77.52	84.71
	Harvade 25F	73.51	81.77
	LSD 0.05	2.08	2.08
Genotype	Favorit	77.36	84.03
	Female line	77.05	84.74
	Pollinator line	67.39	75.10
	LSD 0.05	2.08	2.08

Among the treatments, differences in field emergence were small, statistically non-significant (Table 4). Again, Reglone forte treatment, as in the laboratory germination test, had the highest field emergence (78.55 %), which was higher than control and Harvade 25F for 2.94% and 2.86%, respectively.

Table 4. Field emergence of tested treatments and genotypes

		Field emergence (%)
Treatment	Control	75.61
	Reglone forte	78.55
	Harvade 25F	75.69
	LSD 0.05	ns
Genotype	Favorit	82.39
	Female line	77.45
	Pollinator line	70.02
	LSD 0.05	6.02

Among the genotypes, the highest field emergence was shown by hybrid Favorit (82.39%), which had a field emergence significantly higher (12.38%) than pollinator line and non-significantly higher (4.94%) in relation to female line. Also, the female line had statistically significant higher field emergence (7.43%) than the pollinator line.

DISCUSSION

Desiccation is a very important agro-technical measure, which has a positive influence on grain yield and seed quality in seed production. According to the research of Miklič et al. (2006), the highest germination occurs when moisture in harvest is below 32%, and in most cases between 22-23%. Desiccation accelerates moisture reduction in seed and plant parts, enabling earlier sunflower harvesting. After application of Reglone forte, moisture decreased at harvest level for 5-10 days (Dembinski et al., 1974; Kosovac and Sudimac, 1980), and with Harvade 25F application for 3-4 weeks (Ames and Walz, 1988).

In this research, when the seeds were harvested 20 days after the desiccant treatments seed moisture was distinctly reduced by 26.12% in the pollinator line, 16.12% in the hybrid, and 15.07% in the female line, enabling a considerably earlier harvest.

With the aim of estimating seed quality, after harvesting, laboratory germination of analyzed sunflower seed variants was tested. In the first count, seed vigor and germination were very low, which can be attributed to seed dormancy. Also, there was a large difference between seed vigor and

germination rate (23.94%). In further counts, seed vigor and germination increased, and the differences between them greatly declined.

Tested desiccants have shown different responses regarding seed vigor and germination of analyzed genotypes. Reglone forte showed statistically significant higher germination in relation to the control. These results are in accordance with those of Dembinski et al. (1974), Palmer and Sanderson (1976) and Miklič et al. (2004).

Harvade 25F is a growth regulator which shows good results in years when there have been many precipitations during maturation (Ames and Walz, 1988; Lebedev et al., 1997). Because this was not the case in this research, the results given with Harvade 25F were as expected. Germination of variants treated by Harvade 25F was significantly higher in relation to the control, but lower in relation to Reglone forte. Among the genotypes tested, almost the same values of seed vigor and germination were shown by the hybrid Favorit and female line, while for the pollinator line differed from both of them. In the field emergence test, Reglone forte had the highest statistically non-significant field emergence, while Harvade 25F and the control had almost the same behaviour.

On the basis of these results, a chemical desiccation had a favorable influence on seed maturity acceleration. Desiccant Reglone forte showed higher seed vigor and germination in laboratory germination and field emergence tests, hence its recommendation for use in seed production.

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