

Influence of Fungicides Application and Seed Processing on Sunflower Seed Quality

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Summary

The aim of the research was to determine influence of methods of seed processing and application of fungicides on mass of 1000 seeds, intergrowth energy and seed germination of sunflower hybrids 'Favorit' and 'Apolon' in 2005 and 2006. Selected untreated seeds of both sunflower hybrids (control) had a minimal mass of 1000 seeds (55-59 g), intergrowth energy (18-37 %) and seed germination (39-52 %). In both years of research maximal seed quality, mass of 1000 seeds (67-69 g), intergrowth energy (84-85 %) and seed germination (87-89 %) were after application of the method of seed processing T-4 and after the fungicides application TF-4. The results showed that unfavorable weather conditions over the production year result with low quality seeds. However, by applying the target methods of seed processing and optimal combination of fungicide doses we can produce the sunflower seeds with regular legislation quality for the market.

Key words

sunflower, seed processing, fungicide, treatment, mass of 1000 seeds, intergrowth energy, seed germination

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Introduction

Sunflower (*Helianthus annuus* L.) is one of the four most oil plants in the world, planted on more than 20 million hectares, with grain yield from 0.5 to 3.6 tha^{-1} or averagely 1.16 tha^{-1} (FAOSTAT Database, 2002). Sunflower yield in Croatia significantly varied over the last 25 years. The average grain yield goes from 1.9 to 2.5 tha^{-1} , depending on the climate factors in the production year (Liovic et al., 2006). With the production of high quality seeds we create basic preconditions for maximal use of cultivar's genetic potential. Basically more seeds are produced than what is needed and portion of the seeds produced is kept as a stock. The reason for that is the fact that production agrotechnique and seed yield depend on variety of factors (ecological stress, especially drought).

According to the literature the following factors can influence the quality of seeds: climate conditions, pests in the field, oil content of the grain (cultivar's genotype), grain damage in processing, method and duration of grain storage, package, favourable water content in the grain, pesticide effect, storage temperature, biochemical damage of the tissue of stored seed (oxidative stress), disease incidence, pests and high oil content in the grain (Andric et al., 2004; Balasevic-Tubic et al., 2005; Hunyadi et al., 2007; Hudec, 2006; Simic et al., 2008). All mentioned factors directly and indirectly influence optimal field germination and grain yield.

Material and methods

Selected natural seeds of sunflower hybrids 'Apolon' and 'Favorit' (natural T-1) were prepared for laboratory examination of the following characteristics: mass of 1000 grains, intergrowth energy and seed germination. After that natural grains were processed: T-2 with round sieves (3.5 mm), T-3 with round sieves 3.5 mm + gravity and T-4 with cut sieves 3.5 mm + gravity. After that the following fungicides were

applied on T-4: F1-Vitavax 200FF (karboksini + tiram, 200 ml/100 kg of seeds) + Apron 60DS (metaksil 0.6 kg/100 kg of seeds), F2- Vitavax 200FF + Apron 60DS (250 ml/100 kg + 0,6kg/100 kg of seeds), F3- Vitavax 200FF + Apron 60DS (300 ml/+0.6 kg/100 kg of seeds). Seeds samples (F1, F2 and F3) were wet treated in charge sprayer. Intergrowth energy, seed germination and mass of 1000 grains were determined with standard methods ("Manual on control of quality of seeds"). Obtained values are the average of repetition and statistical work was done with Mstat.

Results and discussion

Results show that the quality of seeds of sunflower hybrids is in strong correlation to the method of processing and fungicide application (Table 1 and 2).

In each year of research the lowest mass of 1000 grains of both hybrids was following the selection of the grain (natural grain). The highest mass of 1000 grains of both hybrids was after T-4 processing – 'Apolon' 63 g and 'Favorit' 67 g in 2005, and 'Apolon' 59 g and 'Favorit' 69 g in 2006. The difference in the value of 1000 grain mass is significant on the level $P < 0.05$ (Table 1).

Intergrowth energy of both hybrids for both years was the lowest at control level (18-39 %) and the highest with the treatment T-4 (79-80 %) and with use of F-3. In both years hybrid Favorit had higher intergrowth energy compared to hybrid Apolon – from 7 to 12 %. The difference in the intergrowth energy was reduced with processing for 4 to 8 % and with application of fungicide 3 to 4 % (Table 1 and 2).

Seed germination had the same variability as the mass of 1000 grains and intergrowth energy. The highest value was after the treatment T-4 in 2005 for hybrid Favorit and the lowest for hybrid Apolon in 2005 after the grain selection (40 %). The significance of the change of the intergrowth

Table 1. Influence of the method of processing on the mass of 1000 grains, intergrowth energy and seed germination of sunflower hybrids

Hybrid	Method of processing	Mass of 1000 grains 2005	Intergrowth energy	Seed germination	Hybrid	Method of processing	Mass of 1000 grains 2006	Intergrowth energy	Seed germination
Apolon	T - 1	55	18	39	Apolon	T - 1	57	37	52
	T - 2	59	66	71		T - 2	61	60	72
	T - 3	60	71	77		T - 3	63	68	78
	T - 4	63	75	79		T - 4	65	79	81
Favorit	T - 1	57	25	41	Favorit	T - 1	60	49	70
	T - 2	59	68	72		T - 2	62	71	78
	T - 3	62	70	77		T - 3	63	72	80
	T - 4	67	79	82		T - 4	69	80	83

Analysis of variance

Source of variation	Mass of 1000 grains			Intergrowth energy			Seed germination		
	F test	LSD test (0.05)	LSD test (0.01)	F test	LSD test (0.05)	LSD test (0.01)	F test	LSD test (0.05)	LSD test (0.01)
Hybrid A	n.s	2.54	3.18	7.632*	11.52	6.15	11.56*	9.78	15.18
Year B	n.s.	2.87	3.26	18.567**	9.62	11.57	568.25**	11.64	17.63
Treatment C	8.857*	6.72	7.13	678.562**	12.26	14.34	642.15**	6.78	7.56
Interaction (ABC)	7.145*	9.17	11.52	358.587**	10.56	12.87	356.478**	4.56	5.17

Table 2. Influence of fungicide application on the intergrowth energy and seed germination of sunflower hybrids

Hybrid	Method of processing	Mass of 1000 grains 2005	Intergrowth energy	Seed germination	Hybrid	Method of processing	Mass of 1000 grains 2006	Intergrowth energy	Seed germination
Apolon	T - 1	55	20	40	Apolon	T - 1	59	39	53
	T - 2	60	74	78		T - 2	61	76	79
	T - 3	60	78	81		T - 3	64	78	81
	T - 4	64	81	85		T - 4	65	83	85
Favorit	T - 1	57	25	41	Favorit	T - 1	60	49	70
	T - 2	58	79	81		T - 2	62	79	81
	T - 3	63	80	84		T - 3	63	82	85
	T - 4	67	84	87		T - 4	69	86	89

Analysis of variance

Source of variation	Mass of 1000 grains			Intergrowth energy			Seed germination		
	F test	LSD test (0.05)	LSD test (0.01)	F test	LSD test (0.05)	LSD test (0.01)	F test	LSD test (0.05)	LSD test (0.01)
Hybrid A	n.s.	5.59	7.24	n.s.	11.52	6.156	14.21*	12.468	21.48
Year B	n.s.	3.17	3.51	127.512**	14.87	21.07	724.147**	10.614	11.24
Treatment C	74.156**	3,56	4,21	715.154**	10.18	11.34	578.495**	3.17	4.74
Interaction (ABC)	67.851**	4.32	4,84	512.234**	9.16	10.23	412.137**	5.12	5.86

energy and seed germination was on the level $P < 0.01$. With the fungicide treatment values of intergrowth energy and seed germination were significantly increased and the mass of 1000 grains was statistically insignificantly higher (Table 2). Mass of 1000 grains in both years and with both hybrids was from 60 to 67 g. The increase was a result of processing. After processing and fungicide application the energy of germination was higher for hybrid Favorit in both years (81-86 %) with the treatment T-3. Compared to selected (natural) grains treatment T-4 increased the intergrowth energy for 44-61 % ('Apolon') and from 36 to 59 % ('Favorit'). Seed germination was also significantly higher after the fungicide application T-4 in both research years and with both hybrids.

Conclusion

Based on the conducted research on the influence of method of processing and fungicide application on the quality of seeds of sunflower hybrids we can conclude the following:

- natural - selected grains of both hybrids had the lowest mass of 1000 grains (55-59 g), intergrowth energy (18-37 %) and seed germination (39-52 %).
- Hybrid Apolon in both years had lower seed quality after processing and fungicide application compared to hybrid Favorit.
- After processing mass of 1000 grains (69 g), intergrowth energy (80 %) and seed germination (83 %) were significantly higher. After fungicide application the quality of seeds of both hybrids was even higher.

- Obtained research data shows that even in unfavourable production years high quality of seeds can be reached with appropriate processing and fungicide application.

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