

EFFECT OF FUNGICIDES ON MASS OF THE ABOVE GROUND PART, AND ROOT OF WHEAT

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ABSTRACT

The effect of 15 fungicides on fresh, and dry mass of above ground part, and root of wheat (Novosadska rana 5 variety) was tested under laboratory conditions. The achieved fresh mass of the above ground part remained at the control level, while other applied formulas caused significant decrease for reliability intervals of 95 and 99% (sample n = 8) when Vitavax 200 FF, Raxil – S 040 FS, liquid Zorosan, Mankogal S, Real 300, and Temetid super were applied. Dry mass of the above ground part remained at the control level with applied Vitavax 200 FF, and Temetid super for both levels of reliability, while Dividend star 036 FS, Raxil – S 040 FS, Vincit f, and Real 300 were equal to the control only for reliability level of 99% (sample n = 8). The other applied formulas caused significant decrease in dry mass of the above ground part for both levels of reliability. All applied formulas, except Vitavax extra, and Baytan univerzal 19,5 WS caused significant increase in fresh mass in relation to control for both levels of reliability, while the two above mentioned formulas caused the fresh mass to be at the level equal to the control (sample no 8). The achieved root dry mass remained at the control level when Vitavax extra at both levels of reliability, and Vitavax 200 FF and Raxil T 515 FS at the reliability level of 99% were applied. The remaining formulas caused significant increase in root dry mass (sample n = 8).

Key words: fungicides, wheat, seed, above ground parts, root.

IZVLEČEK

VPLIV FUNGICIDOV NA MASO NADZEMNIH DELOV IN KORENINSKEGA SISTEMA PŠENICE

V laboratorijskih razmerah smo preučevali vpliv 15 fungicidov za tretiranje semena na svežo in suho maso nadzemnega dela in korenin pšenice, sorta Novosadska rana 5. Z uporabo pripravka Vitavax 200 FF, Raxil – S 040 FS, Zorosan tečni, Mankogal S, Real 300 i Temetid super je bila obstoječa sveža masa nadzemnega dela na ravni kontrole, s tem da so ostali uporabljeni pripravki povzročili značilno zmanjšanje pri intervalu verjetnosti 95 in 99 % (vzorec n = 8). Z uporabo pripravkov Vitavax 200FF in Temetid super je bila sveža masa nadzemnega dela na ravni kontrole pri obeh stopnjah verjetnosti, s tem da so Dividend star 036 FS, Raxil – S 040 FS, Vincit F i Real 300 na ravni kontrole samo pri stopnji verjetnosti 99% (vzorec n = 8). Ostali uporabljeni pripravki so povzročili značilno zmanjšanje suhe mase nadzemnega dela na obeh stopnjah verjetnosti. Vsi uporabljeni pripravki, razen Vitavax extra in Baytan universal 19,5 WS, so povzročili značilno povečanje sveže mase korenin glede na kontrolo pri obeh stopnjah verjetnosti pri tem, da sta navedena dva pripravka povzročila razvoj mase korenin na stopnji kontrole (vzorec n = 8). Vitavax extra pri obeh stopnjah verjetnosti ter Vitavax 200 FF in Raxil T 515 FS so pri stopnji verjetnosti 99 % ustvarili suho maso korenin na stopnji kontrole pri tem, da so ostali uporabljeni pripravki povzročili značilno povečanje suhe mase korenin (vzorec n = 8).

Ključne besede: fungicidi, pšenica, seme, nadzemni deli, korenina.

1 INTRODUCTION

The basic purpose of the fungicide for seed treatment is to control phytopathogenic fungi. The main feature of the efficacy of the formulation is its ability to reduce the causing agent of the diseases, however other, sides effects can be observed too (Vujaković 2001), especially if one have in mind that the seed by its nature is a very variable material (Milošević i Ćirović 1990). As side effects of fungicide for seed treatment, among others, the influence on elongation, and reduction of seedlings, enlargement or reduction of dry mass of above-ground part and root is also observed. Effects of fungicide for seed treatment can be expressed via number and development of normal seedlings, length and fresh mass of above-ground part and root. The mentioned values represent basic parameters used for estimation of viability i.e. seed vigor (Yalkich i Culick 1979, Mekersie and Tomas 1982, Anfinrund and Schneiter 1984, Aschermann-Koch *et al.*, 1992, Edwards and Sadler 1992, Indjić *et al.*, 2001).

The aim of this investigation was to determine the influence of fungicide for seed treatment on fresh and dry mass of wheat seedling at initial stage of development.

2 MATERIAL AN METHODS

Table 1: Fungicides applied to wheat seed

Formulation	Active material	Quantity of applied formulation (cm ³ ; g) na 100 kg seed	Prescribed water quantity (cm ³)	Applied water quantity (cm ³)
Dividend star 036 FS	difenokonazol 30g/l + ciprokonazol 6,3 g/l	200	600	300
Dividend 030FS	difenokonazol 30g/l	200		300
Maxim star 025 FS*	fludioksinil + ciprokonazol	200		300
Vitavax 200FF	tiram 200g/l + karbaksin 200g/l	300		900
Vitavax extra*	tiram + karbendazim + imazalil	250		600
Raxil 060 FS	tebukonazol 60g/l	50	500-700	600
Raxil T 515FS*	tiram 500g/l + tebukonazol 15g/l	200		600
Raxil S 040 FS**	tebukonazol 20g/l + triazoksid 20g/l	100	200	300
Vincit F	tiabendazol 25g/l + futriafol 25g/l	200	200	600
Zorosan liquid	fenil merkuri acetat 1%	200		600
Baytan univerzal 19,5 WS*	triadimenol 15% + fuberidazol 2% + imazalil 2,5%	200		600
Mankogal S	mankozeb 60%	200	400-600	800
Sumiosam 2-FS	dinikonazol 2%	100	600-1000	400
Real 300*	tritikonazol	20		4000
Temetid super	benomil 250g/l + tiram 250g/kg	200		

* formulations are not registered in Yugoslavia

** formulations registered only for barley seed (Mitić 2002)

Test plant - wheat (*Triticum aestivum* L.), variety Novosadska rana 5 (Anonimus 1997) from 1998. Wheat seed was inoculated with teleutospore suspension of *Tilletia tritici* (Bjerk) Wint. 2 g/kg of seed. Fungicides were applied using procedure of wet seed treatment accomplished using laboratory apparatus (type Hege 11). The applied fungicides as well as active materials, and recommended water quantities are given in the table 1.

Viability of treated seed was determined using test of intensity of seed growth. This test is especially suitable for estimation of fungicide effects, because the effect of toxicity strongly depends on medium sorption.

Incubation of wheat seed on wet blotting paper is done in the chamber in the absence of light, at 20°C during seven days (Hampton i Tekroy 1995). The trial was set for two samples I and II, with for replications of 25/each (n=4), and average sample (n=8). Upon final testing fresh mass of seedlings were measured. Dry mass of seedling was determined by drying at 80°C for 24 hours. The results were presented as an average mass per germinated plant. Fresh and dry mass of above-ground part and root were tested by applying method of variance analysis (ANOVA), one-dimensional classification (Hadživuković 1991), using statistic computer program MSTAT.

3 RESULTS AND DISCUSSION

The influence of fungicides for wheat seed treatment was considered in relation to fresh and dry mass of above-ground part, and root as vigor parameters for confidence intervals of 95% and 99% respectively.

Significant decrease of fresh mass of above-ground part was achieved by all applied formulation for sample I, for both level of confidence, except Vitavax 200 FF, and Temetid super, the values of which were at the level of control (table 2).

For sample II significant decrease of fresh mass for both level of confidence was achieved for Dividend star 036 FS, Maxim star 025 FS, and Baytan univerzal 19,5 WS. For level confidence level of 95% significant decrease of fresh mass of above-ground part was achieved by application of Dividend 030 FS Vitavax extra, and Vincit F.

Significant increase of fresh mass of above-ground part was achieved by application of Vitavax 200 FF, Real 300, and Temetid super only for the level of reliability of 95% in sample no. II. Analysis of sample n = 8 revealed that for both level of reliability, Vitavax 200 FF, Raxil – S 040 FS, Zorosan lequid, Mankogal S, Real 300, and Temetid super, the obtained fresh mass of above-ground part remained at the control level, while other applied formulations caused significant decrease.

Data on dry mass of above-ground part (table 3) depending on sample are very different. For sample I, all formulation caused significant decrease of dry mass of above-ground part, and for sample II, the dry mass remained at control level. Analysis of data for sample no. = 8 changes this picture in some way, in relation to individual samples, but gives more complete picture in comparison with fresh mass of above-ground part. At the control level, for both intervals of reliability, dry mass of above-ground part was achieved by application of Vitavax 200 FF and Temetid super, and Dividend star 036 FS, Raxila – S 040 FS, Vincit F, and Real 300 for reliability interval of 99%. Other formulations caused significant decrease of dry mass of above-ground part for both intervals of reliability.

Table 2: Fresh stem mass (mg) per germinated plant – average value

Formulation	n = 4						n = 8			K 100 %
	Sample no. I			Sample no. II						
Control	68,83	a	a	58,85	a	a	63,84	a	a	100
Dividend star 036 FS	46,47	b	b	46,94	b	b	46,71	b	b	73
Dividend 030 FS	48,29	b	b	51,49	b	a	49,89	b	b	78
Maxim star 025 FS	40,83	b	b	49,74	b	b	45,28	b	b	71
Vitavax 200 FF	70,84	a	a	65,58	#	a	68,21	a	a	107
Vitavax extra	49,29	b	b	50,98	b	a	50,13	b	b	114
Raxil 060 FS	52,15	b	b	59,79	a	a	55,97	b	b	88
Raxil – T 515 FS	49,58	b	b	54,86	a	a	52,22	b	b	82
Raxil – S 040 FS	55,96	b	b	62,90	a	a	59,43	a	a	93
Vincit F	49,45	b	b	52,27	b	a	50,86	b	b	80
Zorosan liquid	60,62	b	b	64,83	a	a	62,72	a	a	98
Baytan univerzal 19,5 WS	46,58	b	b	47,71	b	b	47,15	b	b	74
Mankogal S	54,16	b	b	64,17	a	a	59,36	a	a	93
Sumiosam 2 FS	47,11	b	b	63,29	a	a	55,64	b	b	87
Real 300	60,12	b	b	66,29	#	a	61,71	a	a	97
Temetid super	68,41	a	a	66,33	#	a	67,37	a	a	105
NZR 5 %	5,40			6,57			5,13			
NZR 1 %	7,21			8,78			6,78			

statistically significant elongation of above-ground part

Observing fresh and dry mass of above-ground part (n = 8) formulations Vitavax 200 FF and Temetid super caused no changes for both reliability intervals, while other formulations caused noticeable variations depending on the level of reliability and observation of tested variety. The effect of Vitavax 200 FF on fresh above-ground mass can be explained by presence of carboxyne which stimulates the growth of winter crops (Pavlova *et al.*, 2002).

Table 3: Dry mass of stem (mg) per germinated plant – average value

formulation	n = 4						n = 8			K 100 %
	Sample no. I			Sample no. II						
control	7,53	a	a	4,90	a	a	6,21	a	a	100
Dividend star 036 FS	5,33	b	b	5,28	a	a	5,30	b	a	85
Dividend 030 FS	4,93	b	b	4,70	a	a	4,82	b	b	77
Maxim star 025 FS	3,94	b	b	5,27	a	a	4,61	b	b	74
Vitavax 200 FF	6,27	b	b	5,77	a	a	6,02	a	a	97
Vitavax extra	4,40	b	b	5,15	a	a	4,77	b	b	77
Raxil 060 FS	4,50	b	b	4,94	a	a	4,72	b	b	76
Raxil – T 515 FS	4,44	b	b	4,81	a	a	4,62	b	b	74
Raxil – S 040 FS	5,39	b	b	5,39	a	a	5,39	b	a	87
Vincit F	5,17	b	b	5,48	a	a	5,33	b	a	87
Zorosan liquid	4,85	b	b	4,82	a	a	4,83	b	b	78
Baytan universal 19-5 WS	4,83	b	b	4,84	a	a	4,83	b	b	78
Mankogal S	4,10	b	b	5,61	a	a	4,86	b	b	78
Sumiosam 2 FS	3,71	b	b	5,39	a	a	4,55	b	b	73
Real 300	5,49	b	b	5,26	a	a	5,37	b	a	86
Temetid super	6,36	b	b	5,11	a	a	5,73	a	a	92
NZR 5 %	0,81			0,87			0,78			
NZR 1 %	1,08			1,17			1,03			

Fresh mass of root was significantly increased in relation to control for reliability level of 95% (sample I), independent of applied formulation (table 4). For reliability level of 99%, at the control level, fresh root mass was achieved by applied Dividend 030 FS, Vitavax extra and Baytan univerzal 19,5 FS, while other formulations caused significant increase. Fresh root mass (sample II) was significantly increased by application of all formulations except Vitavax 200 FF, Vitavax extra, Baytan univerzal 19,5 FS, and Temetid super. for reliability level of 95%. At reliability level of 99% significant increase of fresh root mass in relation to control, was achieved by application of Dividend star 036 FS, Dividend 030 FS, Maksim star 025 FS, Raxil 060 FS, Zorosan liquid, Sumiosam 2 FS, and Real 300

Analysis of sample n = 8, for both reliability intervals, revealed that increase of fresh root mass was achieved by application of all formulations except Vitavax extra and Baytan univerzal 19,5 WS. By application of two above-mentioned two formulations, fresh root mass remained at the control level. None of tested formulations caused significant decrease of fresh root mass of wheat.

Table 4: Fresh root mass (mg) per germinated plant – average value

Formulation	n = 4						n = 8			K 100 %
	Sample I			sample II						
control	45,64	a	a	59,76	a	a	52,70	a	a	100
Dividend star 036 FS	79,85	#	#	82,37	#	#	81,11	#	#	154
Dividend 030 FS	55,26	#	a	72,37	#	#	63,81	#	#	121
Maksim star 025 FS	70,14	#	#	81,88	#	#	76,01	#	#	144
Vitavax 200 FF	66,73	#	#	62,50	a	a	64,61	#	#	122
Vitavax extra	56,80	#	a	57,85	a	a	57,32	a	a	108
Raxil 060 FS	67,74	#	#	76,13	#	#	71,94	#	#	136
Raxil – T 515 FS	60,47	#	#	70,45	#	a	65,46	#	#	124
Raxil – S 040 FS	59,62	#	#	69,29	#	a	64,46	#	#	122
Vincit F	64,25	#	#	68,30	#	a	66,28	#	#	126
Zorosan tečni	75,57	#	#	71,68	#	#	73,62	#	#	140
Baytan universal 19-5 WS	57,66	#	a	58,65	a	a	58,15	a	a	110
Mankogal S	64,35	#	#	70,88	#	a	67,61	#	#	128
Sumiosam 2 FS	63,42	#	#	76,13	#	#	69,77	#	#	132
Real 300	70,84	#	#	83,85	#	#	77,34	#	#	147
Temetid super	59,53	#	#	67,10	a	a	63,31	#	#	120
NZR 5 %	9,19			7,91			6,73			
NZR 1%	12,27			11,85			8,90			

significant increase of fresh root mass

Measurement of dry root mass, independent of sample and reliability intervals, revealed no significant decrease (table 5). All applied formulations significantly increased dry root mass (sample n = 8) for reliability interval of 95%, except Vitavax extra, which remained at the control level. Dry root mass remained at the control level for reliability interval of 99%, when Vitavax 200 FF, Vitavax extra i Raxil – T 115 FS, were applied, while other formulations caused significant increase.

Formulations applied to seeds of Novosadska rana 5 variety, caused no significant decrease of fresh and dry root mass, similar finding were reported by Rajković (1999). However, there are

data confirming decrease of these parameters (Gilbert, 1995) upon application of these formulations to seeds.

4 CONCLUSIONS

The achieved fresh mass of the above ground part remained at the control level, while other applied formulas caused significant decrease for reliability intervals of 95 and 99% (sample n = 8) when Vitavax 200 FF, Raxil – S 040 FS, liquid Zorosan, Mankogal S, Real 300, and Temetid super were applied.

Dry mass of the above ground part remained at the control level with applied Vitavax 200 FF, and Temetid super for both levels of reliability, while Dividend star 036 FS, Raxil – S 040 FS, Vincit f, and Real 300 were equal to the control only for reliability level of 99% (sample n = 8). The other applied formulas caused significant decrease in dry mass of the above ground part for both levels of reliability.

All applied formulas, except Vitavax extra, and Baytan univerzal 19,5 WS caused significant increase in fresh mass in relation to control for both levels of reliability, while the two above mentioned formulas caused the fresh mass to be at the level equal to the control (sample no 8). The achieved root dry mass remained at the control level when Vitavax extra at both levels of reliability, and Vitavax 200 FF and Raxil T 515 FS at the reliability level of 99% were applied. The remaining formulas caused significant increase in root dry mass (sample n = 8).

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