Efficacy of Some Fungicides in *Tilletia tritici* Control

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Abstract: Biological examination of fungicide efficacy based on tebuconazol (Orius 6FS) in recommended dose, in protection of *Tilletia tritici* (syn. *Tilletia caries*) were done since 2004 on winter wheat – KG-100 in localities "Selekciona stanica" (Inđija) and "Institut Tamiš" (Pančevo). Experiments were done in wheat at standard method OEPP/EPPO, PP 1/19 (2) (1997). Phytotoxicity by PP (1/135(2). Intensity of infestation was calculated by method of Towsend-Heuberger, efficacy by Abbott, and statistical analyses by LSD and Duncan test. Infested wheat in control variant are 85.13% to 70.38% and efficacy of fungicides in variant with Orius 6FS and Raxil – T 515 FS are 100% for both of tested fungicides. Results with data of seed wheat germination pretreated with tested fungicides are 97.5–97.0 and control variant 95.5, immediately after sowing and after six months 98.5 (tested fungicides) to 96.5 (control variant). Yield are on variants with fungicides 7.6–8.6 and 11.6 compared with control variant 3.8 and 11.5. In winter wheat experiments, the infection of common bunt was high without affection the germination vigour of the seeds and on plants.

Keywords: wheat; variety; common bunt (*Tilletia caries*); efficacy; fungicide

Common bunt caused by the fungus *Tilletia tritici* (syn. *T. caries*) is one of the most devastating plant diseases in wheat. In conventional agriculture in Europe, common bunt is one of the diseases most intensively treated with pesticides, and about 80–90% all seed lots of winter wheat in industrialized agriculture are treated with synthetic fungicides (Nielsen *et al.* 1998). In the arid zones of less industrialized agriculture, common bunt is still one of the diseases causing most devastating yield losses of up to 30% in some areas (Mamluk 1998). In organic agriculture common bunt is a difficult disease to control in the absence of fungicides (Borgen 2000a).

The use of resistant cultivars (Milošević *et al.* 1998) and chemical seed-treatments are the current control measures used to combat this disease. The results of investigation showed that fungicides from triazol group, as difenoconasol, prepared good protection. Systemic fungicides oxatine-carboxin and oxicarboxin were evaluated in 1966 (Schmeling & Kulk 1966), but 1968 bensimidasoles (benomile, carbendasim, tiabendazol, fluberidazol) and fungicide with contact efficacy quasatin (Jackons *et al.* 1973). Then was used selective pirimidines, inhibitor of sterol (etirimol) (Bebbington *et al.* 1969), imazalil (Bartlett & Ballard 1973), metalaxyl (Schwinn *et al.* 1977), dimetrimol, nuarimol. From the early of 1970 fungicides from triasol group (DMI) were used, triadimenol and bitertanol (Frohberger 1978). At the same time was started using of imidasole (imasalil and prochloras) (Bartlet & Ballard 1973; Batheman *et al.* 1986), fenopiolonil (Coch & Leadberger 1992) and difenoconasol. From dicarboximide group iprodion was used as soil fungicide in formulation for seed treatment (Edith & Lyr 1987).

In this paper we used Orius 060 FS fungicide for seed treatment of winter wheat. It is systemic fungicide but this fungicide is efficacy until 3 leaves, and has effect on diseases in the beginning of vegetation. Orius 060 FS prepared protection zone in seed surroundings and on this way has effect on pathogens on seed surface and pathogens which can be translocated by soil. In the phase with using water, seed takes tebuconazol, and later the plant takes it from seed zone. On this way, Orius 060 FS has effect on pathogens which are inside in seed as *Ustilago nuda* f.sp. *tritici*.

The demethylation inhibiting (DMI) fungicides, tebuconazole, from triazole group, was evaluated for the control of common bunt (*Tilletia tritici*). Mode of action: Systemic fungicide with protective, curative and eradicant action. Rapidly adsorbed into the vegetative parts of plant, with translocation principally acropetally.

MATERIAL AND METHODS

The seeds of the winter wheat variety KG-100 were contaminated with 5 g spores of *Tilletia tritici* per kg seeds, which resulted in a contamination of 1.7×10^6 spores per gram seeds when tested by ISTA haemocytometer method (Kietreiber 1984). Then seeds were treated by tested fungicides. After treatment the seeds were stored at 5°C. Samples were removed for sowing of field tests 4 days after seed treatment. Germinating tests were conducted 1 week later.

Experiments on fields were done by method PP 1/19(2) (EPPO 1997a–d) in locality Inđija – Selekciona stanica, Pančevo – Institut "Tamiš". Seedling was done 06. 11. 2004 in Inđija and 29. 10. 2004 in Pančevo. The type of soil are sandy chernosem. Experiments were done at instructions of method PP 1/152(2) (EPPO 1997a–d), the plan of completely stochastic event, in 4 replicates in 5 m^2 plots of a rate of 400 seeds/m^2.

On both localities were tested: Orius 6 FS – 0.50 ml/kg (50 ml on 100 kg of seed); Raxil – T 515 FS – 2.00 ml/kg (200 ml on 100 kg of seed) and check – untreated.

The type of treatment and quantity of water on surface. Seed treatment was done in The Mini Rotostat, Plant Protect. Divis. ICI England with 5 ml of water per 1 kg of seed.

Symptoms and type of estimation. Estimated the number of infested ears in percentage.

Time of estimating of efficacy. Estimation was done 04. 07. 2005 (Inđija) and 05. 07. 2005 (Pančevo).

Type of statistical methods. Results were calculated by standard statistical methods (intensity of disease by Towsend-Heuberger, efficacy by Abott, analyses of variance and Duncan test) and method PP 1/181(2) (EPPO 1997a–d). Importance of difference in disease intensity was estimated by analyse of variance and intensity of diseases difference was estimated by analyses of variance and LSD-test.

Estimation of phytotoxicity. Phytotoxicity was controlled by method PP (1/135(2) (EPPO 1997a–d). During the experiment there was no phytotoxicity but later we can expect. In our experiments there is no phytotoxicity.

Germination tests were conducted as cold sand-test, testing the germination speed of treatments (Borgen 2000a, b; Borgen & Kristensen 2001; Borgen & Nielsen 2001).

RESULTS

In Table 1 are showed results of infested ears in control variant (85.13–70.38%) and efficacy of

Table 1. Percentage of infested ears and fungicide efficacy on locality of Inđija and Pančevo

No.	Fungicide	Doses (ml/kg)	Infection(%)	Efficacy (%)	Standard (Raxil-T515 FS = 100%)
Inđija					
1.	Orius 6 FS	0.5	0.00[a]	100	100
2.	Raxil-T 515 FS	2.0	0.00[a]	100	100
3.	Check – untreated	–	85.13[c]	–	–
	$LSD_{0.05}$		8.33		
Pančevo					
1.	Orius 6 FS	0,5	0.00[a]	100	100
2.	Raxil-T 515 FS	2.0	0.00[a]	100	100
3.	Check – untreated	–	70.38[c]	–	–
	$LSD_{0.05}$		6.43		

Different small letters indicate statistically significant differences

Table 2. Germination vigour in variants treated with fungicides and untreated variant (%)

Variants	Immediately after treatment germination	e.g. days	V. No.	After 6-month germination	e.g. days	V. No.
Orius 6 FS	97.5	4.1	101.7	98.5	5.0	106.5
Raxil-T 515 FS	97.0	4.1	101.3	98.5	5.0	106.5
Check – untreated	95.5	4.1	100	96.5	5.2	100

Table 3. Yield in locality of Pančevo and Inđija

No	Fungicide	Doses (ml/kg)	Yield (t/ha)	Weight of 1000 seeds	rH (%)
Pančevo					
1.	Orius 6 FS	0.5	7.6[a]	72.3[a]	12.0[a]
2.	Raxil-T 515 FS	2.0	8.6[a]	73.9[a]	12.8[a]
3.	Check-contaminated	–	3.8[b]	68.9[b]	13.3[b]
	$LSD_{0.05}$		1.0	0.08	0.2
Inđija					
1.	Orius 6 FS	0,5	11.6[a]	36.8[a]	11.6[a]
2.	Raxil-T 515 FS	2.0	11.6[a]	42.2[a]	11.7[a]
3.	Check-contaminated	-	11.5[b]	31.5[a]	11.6[b]
	$LSD_{0.05}$		0.01	0.08	0.01

fungicide Orius 6 FS and Raxil T 515 FS (100% for both tested fungicides).

Germination vigour of seed. In Table 2 are shown data of seed germination of wheat treated by fungicides and check variant immediately after seed treatment and after 6 months. The results show that there is no negative influence of fungicides on seed germination.

DISCUSSION AND CONCLUSION

Tebuconazol is active ingredient with good biodegradability and low oral toxicity to humans, game birds and others who normally come in contact with seeds treated with fungicides. There are no phytotoxicity on plants after seed treatment with this fungicide (Tomlin 2000). Precautions should therefore be taken to insure human health and safety at work. Retardation of seed germination is at unusual weather conditions for germinating and germination, in soil which is not correctly prepared, soil with much water, at late sowing and sowing on depth bigger then 4 cm, using seed with bad germinating energy and storage of seed longer than recommended.

Tebuconazol is a.i. from triasole group (IBS) with specific effect on fungus. These fungicides are specific and polyvalent. They act on biosynthesis of sterol, inhibiting activity of ferment C-14 demetilase, and fungus resistance on this a.i. is possible (ACTA 1995; Anonymous 1998; Heaney *et al.* 1994; Tomlin 2000).

In winter wheat experiments, the infection of common bunt was high as was the reduction of infection by 100% in both locality at infection 85.13–70.38% in controlled variants. Germination vigour of the seeds were 97.5–97.0 in treated variants and 95.0 in controlled variant.

Yield in both locality were better (7.6–11.6) then in controlled variant (3.8–11.5). There are no significant statistical differences between variants (Table 3).

Common bunt is a very devastating plant disease since only a few plants can give the hole crop an odour of rotten fish. The sum of treatments must therefore have a very high effect against this disease (Rajković 1999). The effects of 100% as shown in this experiments are adequate in cases with a high spore load in susceptible varieties as used in these experiments (Rajković 1999).

In recent years, soil borne infection of common bunt has been of increasing importance in wheat production (Borgen 2000a, b). Some systemic pesticides are effective also against soil borne infection, and have a higher effectiveness also against seed borne infection of near to 100%. In organic agriculture, conventional fungicides are prohibited; therefore it will be interesting to find alternative to the current practice of discarding all infected seed lots or to be used in combination with other treatments (Spiess 2000).

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