FOLOSIREA UNOR FUNGICIDE IN CONTROLUL RAPANULUI SI A BOLILOR DE DEPOZIT LA MAR

USE OF SOME FUNGICIDES IN CONTROL OF APPLE SCAB AND STORAGE DISEASES

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Abstract

The paper present an analysis of the biological efficacy of some new experimented during 2008-2011 at RIFG Pitesti, in order to protect the stored apples against apple scab, brown rot and other damaging storage diseases. During the experiment, 11 fungicides, including 9 single active ingredients and 2 new actives mixes, were tested by preventive treatments applied in the orchards on 4 winter apple cultivars 'Golden Delicious', 'Idared', 'Nured Jonathan' and 'Starkrimson'. The biological material was stored in the cold warehouse then assessed under lab conditions. The results obtained revealed that in control of brown rot, the best results were obtained with: Chorus 75 WDG - 0.3 kg/ha/treatment, Rovral 500 SC - 1.5L/ha/treatment, Switch 62.5 - 1kg/ha/treatment and Bellis 38 WG 0.8 kg/ha/treatment (F%: 0.75%; 0.25; 0%; 0%). As regard the control of apple scab, under storage conditions, the finest results were obtained with: Chorus 75 WDG - 0.3 kg/ha/treatment, Mystic Extra 0.75L/ha/treatment, Topsin M70 1kg/ha/treatment, Score 250 EC 0,2L/ha/treatment, Indar 5 EW 1,2 kg/ha/treatment, Toledo 430 SC 0.45L/ha/tratment, Folicur Solo 0.75L/ha/treatment (F%: 0%; 0.36%; 0.75%; 1.37%; 1.75%; 2.01%; 2.25%; 3.75%). Also, the treatments applied in 2011 with Bellis 38 WG 0.8 kg/ha and Switch 62.5 - 1kg/ha/treatment protected very well the stored apples against the apple scab and 4 other specific storage diseases (F%: 0).

Keywords: apple cultivars, scab, storage diseases, fungicides.
Cuvinte cheie: soiuri de măr, rapăn, boli de depozit, fungicide

1. Introduction

Development of modern fruit growing to stand up to the competition pressure, requires beside the contribution of the land and climatic resources, human skills, technical and financial resources and constant efforts to reduce the inputs, optimization of growing technologies and better valorization of the yield, to obtain consistent profits (Sumedrea, et all, 2010, 2011).

In Romania fruit growing is an important branch of the agriculture sector, a traditional activity of the peoples living in countryside area and important source of incomes as well. The fruit growing area, estimated at 180.000-195.000 ha is located mainly on hilly regions, inside and outside the Carpathian Mountains, on a wide range of soils and climatic conditions, providing more than 132.000 t fruits per year. The apple culture is holding about 72.000 ha, which gave more than 65.300 t apples per year, so, Romania is holding the place 9 among the apple growing European countries. (FAOSTAT, 2000-2010). Grown in many systems, the most spread apple cultivars are 'Jonathan' (20%), 'Golden Delicious' (15%), 'Starkrimson' (15%), 'Idared' (10%), 'Florina' (10%), and others cultivars (Braniste, 2011), the technological level is different according to area, but, in the last five years, the situation is changing very fast.

For these reasons, to obtain high quality fruits, use of performant cultivars, of innovative cultivation techniques and phytoprotection programs are key components of production chain in the modern super-intensive orchards (Amzar, 2002, 2003; Braniste, 1999, 2011, Brun et all., 2005, Sumedrea et all., 2006, Şerboiu et all. 2001, Teodorescu et all. 2000, 2001, 2003, 2006, Tomşa, 2003).

The pest and disease affecting the activity in the Romanian apple growing sector are mainly codling moth, leaf miners, aphids, mites, apple scab, brown rot and storages diseases caused by fungi, 12-14 treatments/ha/year being applied, to obtain marketable fruits. Also, recent estimations reveal that in absence of appropriate orchard phytoprotection programs, the losses can reach at least 1100 Euro/ha/year.

In the last decades, there is an increase of interest among the apple growers, inputs suppliers, food chains and consumers to find solutions to preserve fruits health status, and to decrease the looses caused by the pathogenic fungi in the orchard and on stored and marketed apples. (Achour Amiri, Bompeix G., 2004;

Brun et all., 2005; Janisiewicz J. W., 1999, Janisiewicz J. W., Korsten Lise, 2005; Lennox C.L., et all. 2003; Maouni A. et all. 2002; Puia C.E., et all. 2003; Rosenberger A. D., 2009; Weibel P. F. et all., 2005; Yoder K.S., Biggs A.R., 1999).

Achour Amiri, Bompeix G., 2004 noticed that in some apple orchards trained with low inputs of pesticides or in organic system, the natural contamination level with specific pathogenic fungi can range between 20 and 50 spores /m^3 of air; after 4-5 month of apples storage, the contamination can reach up to 300-400 spores /m^3 of air. In storage facilities, with high relative humidity, the rate of product contamination can rise from 12.000-16.000 to 22.000 spores /m^3 of air.

Under favorable conditions the brown rot (*Monilia laxa)* can produce more than 60% damages if the pathogen strike during the spring (Amzar V., Ivascu A., 2003),

In our conditions, the most frequent pathogenic fungi that might occur in storage facilities are *Alternaria* spp., *Botrytis spp., Coletotrichum spp., Cladosporium spp., Fusarium* spp. *Gloeosporium album, Monilia fructigena, Penicillium expansum, Rhisopus nigricans, Thricothecium roseum*, etc.).

The variable results obtained in chemical control of pathogen fungi living in storage facilities can be explained by short life cycle, easy recombination and occurrence of new strains, favorable living media etc., so it is very important to keep investigate and find solutions to preserve fruits health status, and to decrease the looses caused by the pathogenic fungi first in the orchard and on stored and marketed apples as well.

New released fungicides can reduce losses on stored winter apples caused by postharvest fungal diseases, but choosing the best options for preventing molds, and ensuring food safety requires knowledge of the available options, together and careful assessment of these products to meet the apple growers, inputs suppliers, food chains and consumers exigencies for clean high quality apples.

2. Material and method

The researches were conducted during 2009-2011, at Research Institute for Fruit Growing Pitesti Romania [44.51.30 N, 24.52.00 E; 240 m altitude], where the plantings are located on loam-clay soils, poor in nitrogen and phosphorus (nitrogen index 0.33-1.43; PAL 1.3-2.5 mg/100g) but well supplied with potassium (up to 40 mg /100g). The soil physical properties, (the cationic exchange capacity 68.4 me /100g, water holding capacity 50%, organic matter content less than 1.8, and the soil pH 5.6 being favorable for growing apples. However, the multi-annual climatic data (1969-2011) reveals annual rainfall plus of 109 mm, from October to February and annual rainfall deficits of 151 mm, from March to September.

The biological material for the trials consisted of winter apple cultivars 'Golden Delicious', 'Jonathan', 'Idared' and 'Starkrimson' cultivars, grafted on M106 rootstocks, 18-20 years old, and planted in experimental orchards with density ranging between 675 and 1000 trees/ha, trained as palmetto or spindle-bush.

The treatments were precise forecasted, based on the reserve of the pathogens which survived over winter, the apple trees phenological stages, and also related to the evolution of the climatic parameters, monitored and registered with the WatchDog automate weather station and its software. Meteorological data were stored, processed and analyzed using the facilities of the SpecWare 7.0 Profesional software (Spectrum Technologies Inc. 60544 Plainfield Illinois, USA).

The phytosanitary treatments were applied using the OSELLA 1000 spraying machinery powered by U 650 DTC tractor.

During the experimented period, 11 fungicides, including 9 single active ingredients and 2 new actives mixes, were tested by preventive treatments applied in the orchards to control both apple scab and fungal storage diseases. Biological efficacy of the treatments was assessed periodically.

The apples samples were stored in the cold warehouse for at least 2 months, at 1-4*C, then brought back in the lab at about 21-26 C for detailed investigations. Here the pathogenic fungi were identified assessed under lab conditions, using Bell Photonics stereomicroscope and IOR ML-4 microscope.

The damages caused in by pathogenic fungi were estimated both as attack frequency (F%) and as attack intensity (I). The attack frequency was calculated using the formula: **F = n / Nx100**, where, n = number of affected organs, and N = total number of the de observed organs. For the attack intensity (I) was used the 0-3 scale, where, note '0' = lack of strike and note '3' = strike between 76 and 100% (scale agreed also by the food chains).

Relevant photos were taken with SONY Cybershoot F828 (optic block Carl Zeiss Vario-Sonnar T*, 2-2.8/7.1-51) and HP 525, 6.0MP (optic block HP Precision 6.0-18.0.), and processed with Irfan View and Photo Philtre free software.

The huge amounts of data were stored, ranged and processed MS Excel 7.0 software statistical functions) and the final results are presented as tables or graphs.

3. Results and discussions

A. Results regarding the products efficacy in control of apple scab

The researches carried out during the experimentation period reveal that under our conditions, on winter apples cultivars, the pathogen that cause major economical looses is the apple scab *Venturia inaequalis*.

During 2008-2010 vegetation periods there were favorable conditions for apple scab infections on winter apples fruits. In absence of any treatment, (untreated control variant) the fruit infection was high, the average disease incidence F% being 24.13% in 2008, 67.5% in 2009 and 37.5% in 2010 (Tables 1-3). Under such conditions, **preventive treatments** with different active ingredients were applied in the experimental orchards in order to reduce the apple crop contamination prior to their storage with fungicides based on tebuconazole, thiopanate methyl, difenoconazole or fenbuconazole. Their efficacy was checked periodically in the orchard and in many assessments under lab conditions.

Assessment of the table 1 reveals that the apples produced under 2008 conditions, when were treated with fungicides Toledo 430 SC (tebuconazole 430g/L) at 0.45 L/ha/treatment or Folicur Solo (tebuconazole 250 g/l) at 0.45 L/ha/treatment were very well protected against apple scab, the average disease incidence F% being not higher than 2.0-3.0% on 'Golden Delicious' and 'Nured Jonathan', 2.0-3.5% on 'Idared' and 3.0-4.5%, on 'Starkrimson' cultivar.

Analysis of the table 2 shows that the apples produced under 2009 conditions when were treated with fungicides Topsin M 70 (thiophanate methyl 70%) 1.0 kg/ha/treatment or Mystic Extra 0.75 L/ha/treatment well protected against apple scab, the average disease incidence F% being not higher than 0.0-0.5% on 'Nured Jonathan', 0.5-1.33% on 'Golden Delicious', 0.25-1.66% on 'Idared', and 1.67-2.0% on 'Starkrimson' cultivar. Also, in these variants, the average disease severity I [1-3] did not overpass the note 1 (one little spot per fruit).

Examination of the table 3 reveals that under 2010 conditions, when were treated with fungicides Score 250 EC (difenoconazole 250 g/L) 0.2 L/ha/treatment or Indar 5 EW (fenbuconazole 50 g/L) 1,2L/ha/treatment the apples were very well protected against apple scab, the average disease incidence F% ranging between 0.0-1.0% on 'Nured Jonathan', 0.0%-1.83% on 'Golden Delicious', 2.0-3.0% on 'Idared', and 2,69-4.0% on 'Starkrimson' cultivar.

The figures 1-3 offers a clear overview on the tebuconazole, thiopanate methyl, difenoconazole or fenbuconazole based fungicides and their efficacy in control apple scab, on winter apples. Their inclusion as special treatments in complexes phytoprotection schemes applied in the orchards, offer feasible solutions **to prevent** apple scab occurrence and spreading under cold storage facilities conditions on marketable apples.

B. Results regarding the products efficacy in control of brown rot

Assessment of the table 4 reveals that the apples produced under 2008-2009 conditions, when were treated with fungicides Rovral 500 SC (iprodione 500 g/L)1.5L/ha/treatment or Chorus 75 WDG (cyprodinil 75%) 0.3 kg/ha/treatment were very well protected against *Monilia* spp. rot the average disease incidence F% being 0% for 'Idared' and 'Nured Jonathan' apples 0.0-1.0% on 'Golden Delicious' and 1.0-2.0% on 'Starkrimson' cultivar apples.

The figure 4 offers a clear overview on the cyprodinil and iprodione based fungicides efficacy in control of *Monilia* spp. on stored winter apples which in described conditions, when were used preventively, reduced the brown rot attack frequency with more than 16%. Also, the average rot attack intensity ranged between 0.25-0.5.

C. Results regarding the products efficacy in control of apple and fungal storage diseases

In the table 5 reveals the results obtained the apples produced under 2011 conditions, treated with two new fungicides against the apple scab and fungal storage diseases.

Assessment of the table reveals that when were treated with fungicides Switch 62.5 WG (cyprodinil… + fludioxonil…) 1.0 kg/ha/treatment or Bellis 38 WG (piraclostrobin …+ boscalid…) 0.8 kg/ha/treatment the apples were excellently protected specific fungal storage diseases.

The above mentioned fungicides protected excellently the apples against specific fungal storage diseases produced by *Alternaria* spp., *Botrytis cinerea*, *Fusarium* spp. and *Gloeosporium* spp., the average disease incidence F% being 0% on all winter apple cultivars studied. In comparison on the apples from the untreated control variant, *Alternaria* spp., affected all the cultivars with a frequency F% of 2.9-3.9%, grey mold - *Botrytis* spp. affected mostly the cultivar 'Starkrimson' with a frequency F% of 3.0%, *Fusarium* spp.

and *Gloeosporium* spp. affected the cultivar 'Golden Delicious' with the frequencies F% of 2.7% and respectively 1,2%.

More over, the apple scab (*Venturia inaequalis*) and brown rot (*Monilia fructigena*) were absent even after two month of storage and many weeks of lab assessments.

The figures 5 and 6 offer a clear overview on the efficacy of the cyprodinil + fludioxonil and piraclostrobin + boscalid based fungicides in control of fungal storage diseases on the studied winter apples. Also, under lab conditions, on the untreated apples *Penicillium expansum Rhisopus nigricans,* and *Thricothecium roseum*, molds were detected but with very low frequencies on 'Nured Jonathan' and 'Golden Delicious' apples.

Their inclusion as special treatments in complexes phytoprotection schemes applied in the orchards, offer feasible solutions to prevent specific fungal storage diseases occurrence and spreading under cold storage facilities conditions on marketable apples.

4. Conclusions

In many apple orchards producing winter apples, trained with low inputs of pesticides, the most damaging disease remain the apple scab, and some fungal storage diseases and only by preventive treatments, with the most effective fungicides, can be reduced the treatment number in the orchard and the damages in the warehouses.

During the experimented period, 11 fungicides, including 9 single active ingredients and 2 new actives mixes, were tested by preventive treatments applied in the orchards to control both apple scab and fungal storage diseases.

In control of brown rot, the best results were obtained with: Chorus 75 WDG - 0.3 kg/ha/treatment, Rovral 500 SC - 1.5L/ha/treatment, Switch 62.5 - 1kg/ha/treatment and Bellis 38 WG 0.8 kg/ha/treatment (F%: 0.75%; 0.25; 0%; 0%).

As regard the control of apple scab, under storage conditions, the finest results were obtained with: Chorus 75 WDG - 0.3 kg/ha/treatment, Mystic Extra 0.75L/ha/treatment, Topsin M70 1kg/ha/treatment, Score 250 EC 0,2L/ha/treatment, Indar 5 EW 1,2 kg/ha/treatment, Toledo 430 SC 0.45L/ha/tratment, Folicur Solo 0.75L/ha/treatment (F%: 0%; 0.36%; 0.75%; 1.37%; 1.75%; 2.01%; 2.25%; 3.75%).

The treatments applied in with Bellis 38 WG 0.8 kg/ha and Switch 62.5 - 1kg/ha/treatment protected very well the stored apples against the apple scab and 4 other specific storage diseases (F%: 0).

New released fungicides can reduce losses on stored winter apples caused by postharvest fungal diseases, but choosing the best options for preventing molds, preserving fruit quality, and ensuring food safety requires knowledge of the available options together and careful assessment of these products and their rotation into storage diseases management strategies, to preserve their efficacy and to meet the apple growers, food chains and nowadays fruits consumers exigencies.

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Tables and figures

Tab. 1 Efficacy of tebuconazole formulations in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2008

V	Products and rates	Active ingredients	Cultivar	*Venturia inaequalis*			
				Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]
1	Untreated control	-	Golden Delicious	600	141	**23,5**	3
	Untreated control	-	Idared	600	162	**27**	3
	Untreated control	-	Nured Jonathan	600	102	17	3
	Untreated control	-	Starkrimson	600	174	**29**	3
			AVG	**600**	**144,75**	**24,13**	**3**
			STDEV	**0,000**	**31,595**	**5,266**	**0,000**
2	Folicur Solo 250 EW 0,75L/ha	tebuconazole 250 g/l	Golden Delicious	600	18	**3,0**	2
	Folicur Solo 250 EW 0,75L/ha	tebuconazole 250 g/l	Idared	600	21	3,5	2
	Folicur Solo 250 EW 0,75L/ha	tebuconazole 250 g/l	Nured Jonathan	600	12	4,0	2
	Folicur Solo 250 EW 0,75L/ha	tebuconazole 250 g/l	Starkrimson	600	27	**4,5**	2
			AVG	**600**	**19,5**	**3,75**	**2**
			STDEV	**0,000**	**6,245**	**0,645**	**0,000**
3	Toledo 430 SC 0,45 L/ha	tebuconazole 430 g/L	Golden Delicious	600	12	2,0	1
	Toledo 430 SC 0,45 L/ha	tebuconazole 430 g/L	Idared	600	12	2,0	1
	Toledo 430 SC 0,45 L/ha	tebuconazole 430 g/L	Nured Jonathan	600	12	2,0	1
	Toledo 430 SC 0,45 L/ha	tebuconazole 430 g/L	Starkrimson	600	18	**3,0**	1
			AVG	**600**	**13,5**	**2,25**	**1**
			STDEV	**0,000**	**3,000**	**0,500**	**0,000**

Tab. 2 Efficacy of tebuconazole and thiophanate methyl formulations in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2009

V	Products and rates	Active ingredients	Cultivar	*Venturia inaequalis*			
				Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]
1	Untreated control	-	Golden Delicious	600	48	8,0	3
	Untreated control	-	Idared	600	48	8,0	3
	Untreated control	-	Nured Jonathan	600	84	**14,0**	2
	Untreated control	-	Starkrimson	600	90	**15,0**	2
			AVG	**600**	**67,5**	**11,25**	**2,5**
			STDEV	**0,000**	**22,650**	**3,775**	**0,577**
2	Topsin M 70 1,0 kg/ha	tiophanate methyl 70%	Golden Delicious	600	8	1,33	1
	Topsin M 70 1,0 kg/ha	tiophanate methyl 70%	Idared	600	10	1,66	1
	Topsin M 70 1,0 kg/ha	tiophanate methyl 70%	Nured Jonathan	600	3	**0,5**	1
	Topsin M 70 1,0 kg/ha	tiophanate methyl 70%	Starkrimson	600	12	2,0	1
			AVG	**600**	**8,25**	**1,3725**	**1,0**
			STDEV	**0,000**	**3,862**	**0,643**	**0,000**
3	Topsin 500 SC 1,5 kg/ha	tiophanate methyl 500 g/l	Golden Delicious	600	15	2,5	2
	Topsin 500 SC 1,5 kg/ha	tiophanate methyl 500 g/l	Idared	600	12	**2,0**	1
	Topsin 500 SC 1,5 kg/ha	tiophanate methyl 500 g/l	Nured Jonathan	600	12	**2,0**	1
	Topsin 500 SC 1,5 kg/ha	tiophanate methyl 500 g/l	Starkrimson	600	12	**2,0**	1
			AVG	**600**	**12,75**	**2,125**	**1,3**
			STDEV	**0,000**	**1,500**	**0,250**	**0,500**
4	Mystic Extra 0,75 L/ha	tebuconazole 250 g/l	Golden Delicious	600	3	0,5	1
	Mystic Extra 0,75 L/ha	tebuconazole 250 g/l	Idared	600	1,5	0,25	1
	Mystic Extra 0,75 L/ha	tebuconazole 250 g/l	Nured Jonathan	600	0	**0,0**	0
	Mystic Extra 0,75 L/ha	tebuconazole 250 g/l	Starkrimson	600	4	0,67	1
			AVG	**600**	**2,125**	**0,355**	**0,8**
			STDEV	**0,000**	**1,750**	**0,293**	**0,500**

Tab. 3 Efficacy of difenoconazole and fenbuconazole in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2010

V	Products and rates	Active ingredients	Cultivar	*Venturia inaequalis*			
				Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]
1	**Untreated control**	-	Golden Delicious	600	210	35,00	3
	Untreated control	-	Idared	600	216	36,00	3
	Untreated control	-	Nured Jonathan	600	204	**34,00**	3
	Untreated control	-	Starkrimson	600	270	**45,00**	3
			AVG	**600**	**225**	**37,5**	**3**
			STDEV	**0,000**	**30,397**	**5,066**	**0,000**
2	**Score 250 EC 0,2 L/ha**	difenoconazole 250 g/l	Golden Delicious	600	0	**0,0**	0
	Score 250 EC 0,2 L/ha	difenoconazole 250 g/l	Idared	600	12	2,0	1
	Score 250 EC 0,2 L/ha	difenoconazole 250 g/l	Nured Jonathan	600	6	**1,0**	1
	Score 250 EC 0,2 L/ha	difenoconazole 250 g/l	Starkrimson	600	24	4,0	1
			AVG	**600**	**10,5**	**1,75**	**0,75**
			STDEV	**0,000**	**10,247**	**1,708**	**0,500**
3	**Indar 5 EW 1,2L/ha**	fenbuconazole 50 g/l	Golden Delicious	600	11	1,83	1
	Indar 5 EW 1,2L/ha	fenbuconazole 50 g/l	Idared	600	21	3,5	2
	Indar 5 EW 1,2L/ha	fenbuconazole 50 g/l	Nured Jonathan	600	0	**0,0**	0
	Indar 5 EW 1,2L/ha	fenbuconazole 50 g/l	Starkrimson	600	16	2,69	2
			AVG	**600**	**12,0**	**2,005**	**1,25**
			STDEV	**0,000**	**8,981**	**1,501**	**0,957**

Tab. 4 Efficacy of treatments with cyprodinil and iprodione in control of *Monilia* spp. rot on stored winter apples RIFG Pitesti ROMANIA, 2008-2009

V	Products and rates	Active ingredient	Cultivar	*Monilia spp.*			
				Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]
1	**Untreated control**	-	Golden Delicious	600	72	12,0	3
	Untreated control	-	Idared	600	96	16,0	3
	Untreated control	-	Nured Jonathan	600	48	8,0	3
	Untreated control	-	Starkrimson	600	180	**32,0**	3
			AVG	**600**	**99**	**17,00**	**3**
			STDEV	**0,000**	**57,446**	**10,520**	**0,000**
2	**Chorus 75 WDG 0,3 kg/ha**	cyprodinil 75%	Golden Delicious	600	6	1,0	1
	Chorus 75 WDG 0,3 kg/ha	cyprodinil 75%	Idared	600	0	**0,0**	0
	Chorus 75 WDG 0,3 kg/ha	cyprodinil 75%	Nured Jonathan	600	0	**0,0**	0
	Chorus 75 WDG 0,3 kg/ha	cyprodinil 75%	Starkrimson	600	12	2,0	1
			AVG	**600**	**4,5**	**0,75**	**0,5**
			STDEV	**0,000**	**5,745**	**0,957**	**0,577**
3	**Rovral 500 SC 1,5 L/ha**	iprodione 500g/l	Golden Delicious	600	0	**0,0**	0
	Rovral 500 SC 1,5 L/ha	iprodione 500g/l	Idared	600	0	**0,0**	0
	Rovral 500 SC 1,5 L/ha	iprodione 500g/l	Nured Jonathan	600	0	**0,0**	0
	Rovral 500 SC 1,5 L/ha	iprodione 500g/l	Starkrimson	600	6	1,0	1
			AVG	**600**	**1,5**	**0,25**	**0,25**
			STDEV	**0,000**	**3,000**	**0,500**	**0,500**

Tab. 5 Efficacy of cyprodinil + fludioxonil and piraclostrobin + boscalid in control of storage diseases frequency on stored winter apples RIFG Pitesti ROMANIA, 2011

V	Product and active ingredients	Cultivar	*Alternaria spp.*				*Botrytis cinerea*				*Fusarium spp.*				*Gloeosporium spp.*				*TOTAL DAMAGES (SUM)*			
			Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]	Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]	Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]	Assessed fruits [n]	Attacked fruits [n]	Frequency [%]	Intensity [notes]	Assessed fruits [n]	Attacked fruits [n]	Frequency [%_sum	Intensity [avg_notes]
	Untreated control	Golden Delicious	600	4,3	3,0	2,75	600	1	0,2	0,5	600	0	0,0	0	600	7,0	1,2	2,3	3000	12,3	4,3	1,1
	Untreated control	Idared	600	4,8	3,2	3	600	0	0,0	0,0	600	16	2,7	3	600	0,0	0,0	0,0	3000	20,8	5,8	1,2
1	**Untreated control**	Nured Jonathan	600	4,3	2,9	3	600	0	0,0	0,0	600	0	0,0	0	600	0,8	0,5	1,5	3000	5,0	3,3	1,0
	Untreated control	Starkrimson	600	5,8	3,9	3	600	3	2,0	3,0	600	0	0,0	0	600	0,0	0,0	0,0	3000	8,8	5,8	1,2
		AVG	**600**	**4,75**	**3,21**	**2,9**	**600**	**1**	**0,54**	**0,88**	**600**	**4**	**0,67**	**0,75**	**600**	**1,94**	**0,42**	**0,94**	**3000**	**11,7**	**4,80**	**1,13**
		STDEV	*0,000*	*0,177*	*0,111*	*0,031*	*0,000*	*0,354*	*0,244*	*0,359*	*0,000*	*2,000*	*0,333*	*0,375*	*0,000*	*0,848*	*0,138*	*0,281*	*0,000*	*1,686*	*0,306*	*0,024*
	Switch 62,5 WG 1 kg/ha	Golden Delicious	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
	Switch 62,5 WG 1 kg/ha	Idared	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
2	**Switch 62,5 WG 1 kg/ha**	Nured Jonathan	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
	Switch 62,5 WG 1 kg/ha	Starkrimson	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
		AVG	**600**	**0**	**0**	**0**	**600**	**0**	**0**	**0**	**600**	**0**	**0**	**0**	**600**	**0**	**0**	**0**	**3000**	**0,0**	**0,0**	**0,0**
		STDEV	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*
	BELLIS 38 WG 0,48 kg/ha	Golden Delicious	600	2,0	1,3	2	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	2,0	1,3	0,4
	BELLIS 38 WG 0,48 kg/ha	Idared	600	1,5	1,0	2	600	0	0,0	0,0	600	1,5	1,0	2,0	600	0,0	0,0	0,0	3000	3,0	2,0	0,8
3	**BELLIS 38 WG 0,48 kg/ha**	Nured Jonathan	600	1,8	1,2	2,25	600	0	0,0	0,0	600	0	0	0	600	1,5	1,0	2,0	3000	3,3	2,2	0,8
	BELLIS 38 WG 0,48 kg/ha	Starkrimson	600	1,8	1,2	2	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	1,8	1,2	0,4
		AVG	**600**	**1,75**	**1,17**	**2,06**	**600**	**0**	**0**	**0**	**600**	**0,38**	**0,25**	**0,5**	**600**	**0,38**	**0,25**	**0,50**	**3000**	**2,53**	**1,68**	**0,60**
		STDEV	*0,000*	*0,051*	*0,035*	*0,031*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,188*	*0,124*	*0,250*	*0,000*	*0,188*	*0,124*	*0,250*	*0,000*	*0,184*	*0,125*	*0,058*
	BELLIS 38 WG 0,8 kg/ha	Golden Delicious	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
	BELLIS 38 WG 0,8 kg/ha	Idared	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
4	**BELLIS 38 WG 0,8 kg/ha**	Nured Jonathan	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
	BELLIS 38 WG 0,8 kg/ha	Starkrimson	600	0,0	0,0	0	600	0	0,0	0,0	600	0	0	0	600	0,0	0,0	0,0	3000	0,0	0,0	0,0
		AVG	**600**	**0**	**0**	**0**	**600**	**0**	**0**	**0,0**	**600**	**0**	**0**	**0**	**600**	**0,00**	**0,0**	**0,00**	**3000**	**0,0**	**0,0**	**0,0**
		STDEV	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*

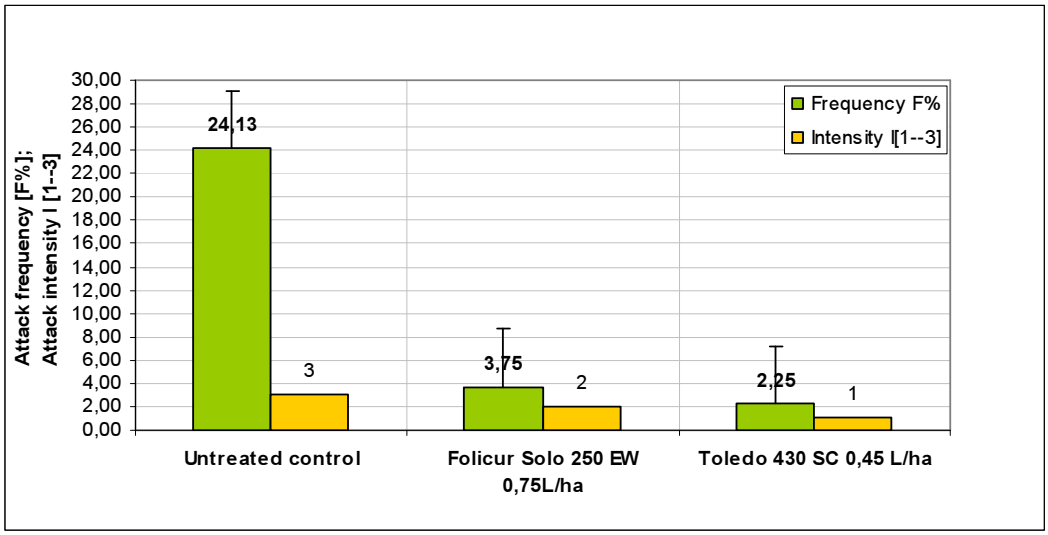

Fig. 1. Efficacy of tebuconazole formulations in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2008

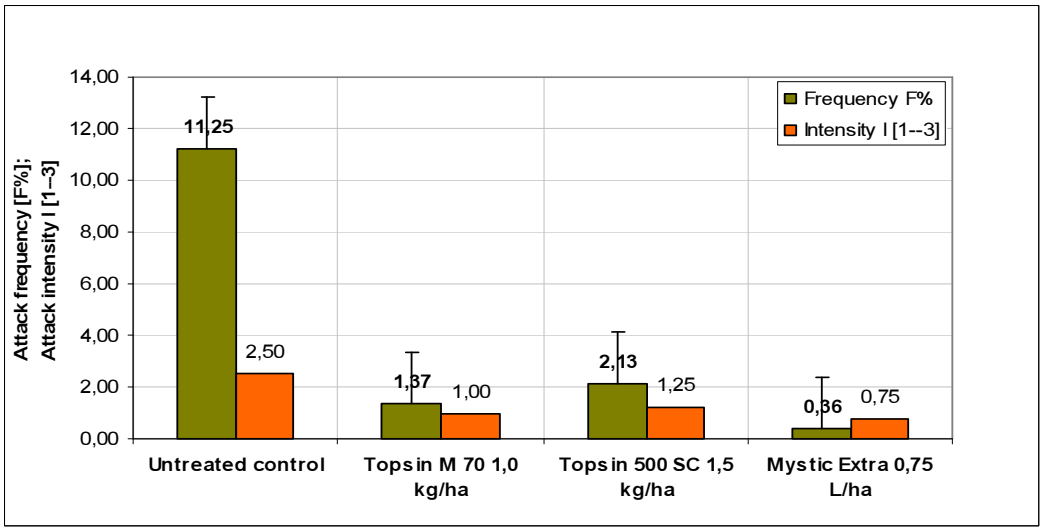

Fig. 2. Efficacy of tebuconazole and thiophanate methyl formulations in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2009

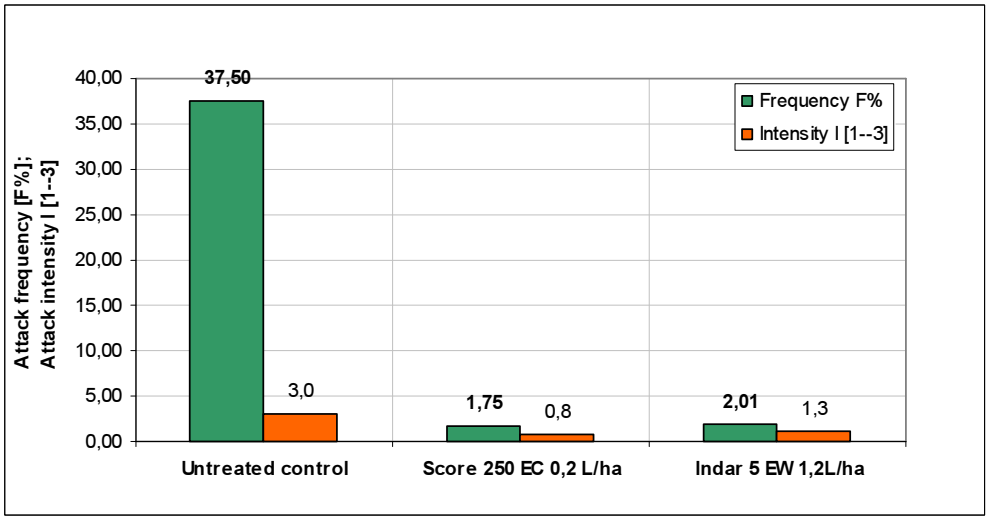

Fig. 3. Efficacy of difenoconazole and fenbuconazole in control of apple scab *Venturia inaequalis* on stored winter apples RIFG Pitesti ROMANIA, 2010

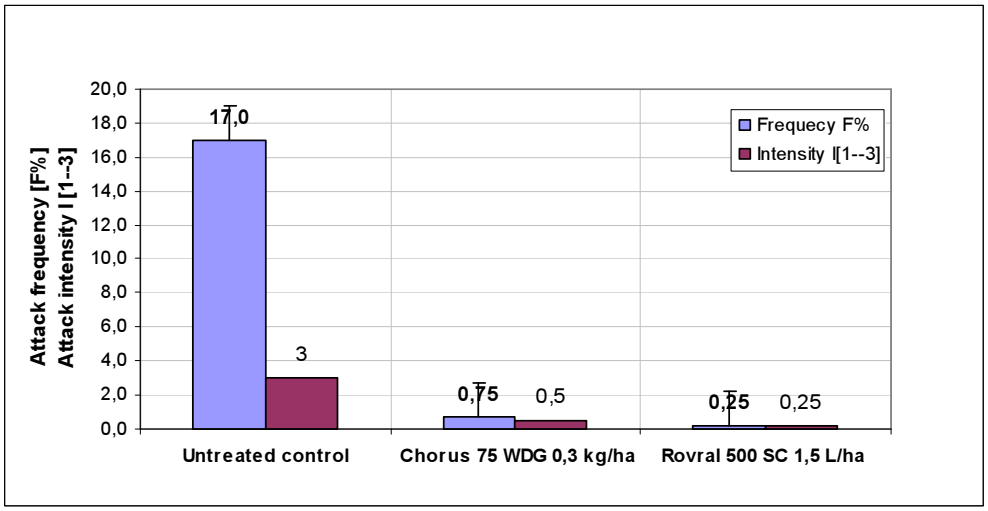

Fig. 4. Efficacy of treatments with cyprodinil and iprodione in control of *Monilia fructigena*. rot on stored winter apples RIFG Pitesti ROMANIA, 2008-2009

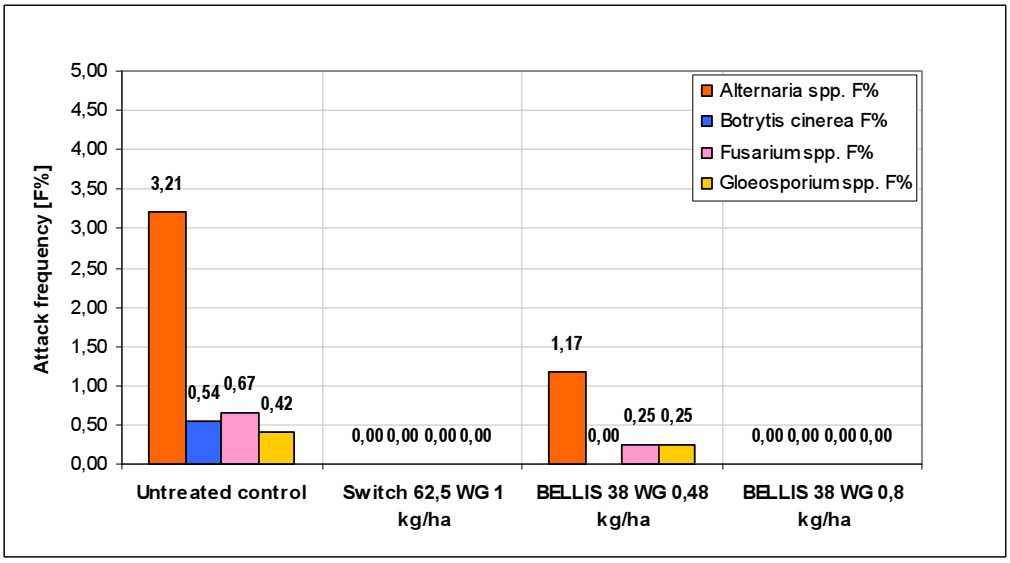

Fig. 5 Efficacy of cyprodinil + fludioxonil and piraclostrobin + boscalid in control of storage diseases frequency on stored winter apples RIFG Pitesti ROMANIA, 2011

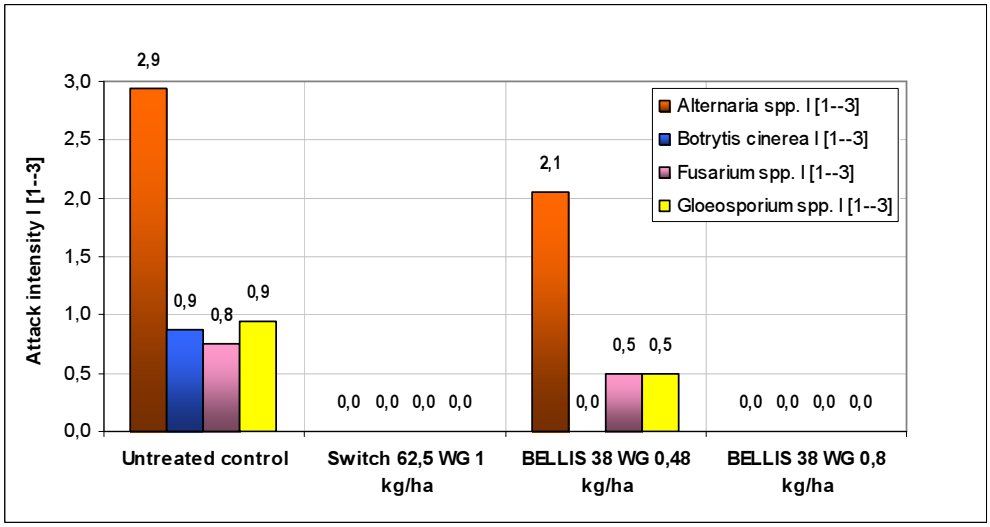

Fig. 6 Efficacy of cyprodinil + fludioxonil and piraclostrobin + boscalid in control of storage diseases intensity on stored winter apples RIFG Pitesti ROMANIA, 2011

Untreated control variants

Fig.7 *Alternaria* spp. on 'Golden Delicious'

Fig. 8 *Alternaria* spp. on 'Starkrimson'

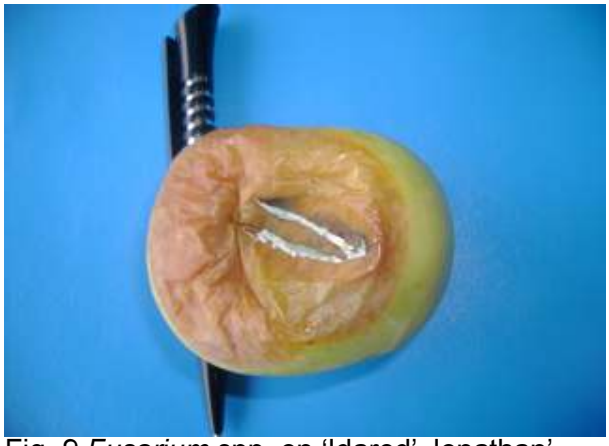

Fig. 9 *Fusarium* spp. on 'Idared' Jonathan'

Fig. 10 *Gloeoporium* spp. on 'Nured Jonathan'

Fig .11 *Botrytis cinerea* and *Gloeosporium* spp. on 'Idared'

Fig. 12 *Monilia fructigena* on 'Golden Delicious'

Variants treated against apple scab and fungal storage diseases.

Fig. 13 Golden Delicious

Fig. 14 Idared

Fig. 15 Starkrimson

Fig. 16 'Nured Jonathan'