Preliminary Research on the Wheat Pests and on Their Integrated Control during 2015-2016, at Agricultural Research-Development Station Turda

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ABSTRACT

In Transylvania, the evolution of wheat insect pests is strongly influenced by the ecotechnological conditions, by climate change and current technology (Malschi, 2009; Malschi et al., 2015). The paper presents the dynamics and importance of the main pests of wheat (thrips, aphids, leafhoppers, wheat flies, cereal sunbugs, investigated under the integrated pest control system suitable of the area. During 2015-2016, the investigations were conducted at the Agricultural Research and Development Station Turda, from the wheat no tillage cultural system with cereal rotation of three years and applying all zonal recommendations of technology and phytosanitary complex. The pest monitoring was performed based on the samples collected with entomological net, by decadal 100 sweep-net catches/sample. The study data shows the danger of the attack of abundant populations of wheat flies (*Phorbia securis*, *Delia coarctata*, *Opomyza florum*, *Oscinella frit* etc.; wheat fleas (*Chaetocnema aridula*) and cereal leaf beetle (*Oulema melanopa*); leafhoppers (*Psammotettix alienus*, *Javesella pellucida*, *Macrosteles laevis*); aphids (*Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum padi*); thrips (*Haplothrips tritici*), sunbugs (*Eurygaster maura*, *Aelia acuminata*) etc., and the necessity of applying insecticide treatments on the vegetation.

Since 2015, a stronger impact of global warming on the wheat pests structure (%) are found. This change began on the last ten years. The importance of cereal sunbugs is increasing, well as the importance of the wheat flies, aphids and leafhoppers, which requires professional study on the pest dynamics and adequate integrated control of wheat pests.

Keywords: wheat flies, thrips, aphids, leafhoppers, sunbugs

INTRODUCTION

The evolution of wheat insect pests in Transylvania is strongly influenced by the eco-technological conditions (Malschi, 2007, 2009, Malschi et al., 2015). In the last years the research conducted at Agricultural Research and Development Station Turda, revealed the main groups of pests of wheat: Thysanoptera, Diptera, Homoptera (aphids and leafhoppers), Coleoptera,

Heteroptera etc. and the importance of integrated control of them (Malschi Dana, 1995, 2000, 2001, 2003, 2007, 2008, 2009 a, b, 2014; Malschi et al. 2003; 2009; 2010; 2011; 2012), according to other data from the literature (Oltean et al. 2004; Perju, Malschi, 2001; Perju, Mustea, Malschi, 2001; Popov et al. 2005; Porca, Oltean, 2004; Rosca et al., 2011).

Tab. 1. The integrated protection systems of wheat crops from the lots of observation and testing at ARDS Turda, during 2015 – 2016

Phenology of culture and application of complex treatments	
2015	2016
Wheat variety: ANDRADA, Preceding plant: Soybean Density of sowing: 600 germinable grains / m ² Administered fertilizers: In Autumn: NPK(18:46:0), 200 kg/ha. In the Spring: NH NO ₃ (33,3% s.a) 150 kg/ha. Sowing time: 15.10.2014. Emergence: 24.10.2014. Beginning of tillering: 16.11.2014. Density: 560 plants / m ² First Treatment: at Herbicidal appl.: 19.04.2015 Herbicide: Sekator 0,15 l/ha, DMA 6 – 0.6 l/ha + Foliar fertilizer: Agrofeed 19:19:19 4 kg/ha + Insecticide: Calypso 0.1 l/ha + Fungicide: Falcon 460 – 0.7 l/ha. Treatment 2. At flag leaf/ear appar. 25.05.2015 Insecticide: Fastac 0.1 l/ha + Fungicide: Evolus 1 l/ha + Foliar fertilizer: Agrofeed 19:19:19 4 kg/ha	Wheat variety: ANDRADA, Preceding plant: Soybean Density of sowing: 550 germinable grains / m ² Administered fertilizers: In Autumn: NPK(18:46:0) 200 kg/ha + Seedsprint 25 kg/ha; In the Spring: N – 150 kg/ha. Sowing time: 08.10.2015. Emergence: 20.10.2015. Beginning of tillering: 15.11.2015. Density: 550 plants / m ² First Treatment: at Herbicidal appl.: 6.04.2016 Herbicide: Floramix 0.260 kg/ha + DASH 0.5 l/ha Foliar fertilizer: Synergizer 2.5 l/ha Insecticide: Biscaya 0.2 l/ha + Fungicide: Falcon PRO 0.8 l/ha Treatment 2. At flag leaf/ear appar.: 19.05.2016 Insecticide: Fastac 0.1 l/ha Fungicide: Evolus 1 l/ha Foliar fertilizer: Agrofeed 3 kg/ha

In the recent years, the research of ARDS Turda have indicated the importance of adjusting the technology of integrated pests management (IPM) to the structural changes of harmful entomofauna, which is highlighted in relation to climatic warming and increased aridity, by higher abundance of wheat thrips (as eudominant species), wheat flies Chloropidae, leafhoppers, aphids, wheat fleas (as dominant groups), cereals bugs, etc. IPM recommends special attention to preventing measures for zone specific pests: cereal flies, leafhoppers, aphids, thrips, etc., by respecting the optimal sowing time, agro-technical methods, seed treatment with systemic insecticides and complex plant protection measures. Due to increased aridity and climate warming, the critical attack moments were recorded 3-4 weeks earlier and overlapped (Malschi *et al.* 2013 a, b; 2014; 2015 a, b, c, d, f; 2016 a, b).

During 2015-2016 periode, some of long term research which is performed at ARDS Turda in the last of 40 years, were continued by the present study.

MATERIAL AND METHODS

The investigations were conducted in wheat crops: in no tillage cultural system with a three years cereal rotation, applying all zonal

recommendations of technology and phytosanitary complex, during 2015-2016, (Tab.1).

The pest monitoring was performed based on the samples collected with entomological net, by decadal 100 sweep-net catches / sample.

Have been studied the species inventory, according the morphological /biological / ecological / geographical criteria and populations abundance and dynamics/ according to the density factors (technological, climatic, biological limiters / entomophagous).

The variants from experimental lots included different treatment moments: T1 (at the end of tillering in the 25-33 DC stage, at herbicides time) and T2 (at flag leaf stage and ear appearance in the 45-59 DC stage); and the variants of treated lots in large experimental plots of 0.5 Ha (5 000 m²): V1 = untreated; V2 = treated with pyrethroids at T1; V3 = treated with pyrethroids at T1+T2; V4 = treated with neonicotinoid at T1+treated with pyrethroids at T2.

The determination of species, the tables with species decadal dynamics and annual abundance, the pests and entomophagus annual structure (tab. 2, Fig 2, 3, 4), the immediate biological efficiency after insecticidal treatment and the total long term efficiency of treatments, the entomophagus mortality after the treatments (Fig. 5, 6, 7, 8, 9),

and the variance analysis for production data with Polifact Programme (Tab. 3, 4; Fig. 10) were carried out.

RESULTS AND DISCUSSIONS

In the last 10 years, the data on the pests structure of wheat crops at ARDS Turda show: the dominance of thrips - 57%, the numerical importance of dangerous populations of Chrysomelidae - 10% (*Oulema*, *Chaetocnema* etc.); of aphids - 14% and leafhoppers - 4%, of wheat flies - 12% and sunbugs - 2%. The pest abundance represents a risk situations in wheat fields. Into the structure of arthropods fauna collected with entomological net, an weight of 14 % only presents the beneficial entomophagous (Malschi et al. 2015).

The paper presents the dynamics and importance of the main wheat pests (thrips, aphids, leafhoppers, wheat flies, leaf beetles, wheat fleas, cereals sunbugs etc., investigated under the integrated pest control system suitable of the area, depending to: climate changes, current technology and different insecticides application. The data of study shows the danger of the abundant pest populations of wheat flies (*Phorbia securis*, *Delia coarctata*, *Opomyza florum*, *Oscinella frit* etc.; wheat fleas (*Chaetocnema aridula*) and cereal leaf beetle (*Oulema melanopus*); leafhoppers (*Psammotettix alienus*, *Javesella pellucida* etc.); aphids (*Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum padi* etc.); thrips (*Haplothrips tritici*), sunbugs (*Eurygaster maura*, *Aelia acuminata* etc.) and the necessity of applying insecticide treatments on the vegetation.

In accordance with previous research the paper shows the importance of insecticide applications at two different moments: at the end of tillering phase and at ear emergence. At the first treatment, the pest groups that focus on spring crops (cereal flies, fleas, leafhoppers, thrips, bugs, etc.) are controlled simultaneously, by recommending the shock and systemic insecticides (pyrethroids, neonicotinoid etc.) at the herbicides application. At the second treatment moment, the ear pests (thrips, aphids, bugs, etc.) are controlled simultaneously and shock insecticides (pyrethroids etc.) with a low negative effect on the entomophag arthropod fauna, are recommended (Malschi et al. 2012; 2013 a, b; 2014; 2015 a, b, c, d, f; 2016 a, b).

The climate condition in 2015-2016 indicate an increase of the average temperature in the all months of spring and summer. Rainfall shows the characteristic aspects of wettest years toward normal (Fig. 1). Climatic condition, especially the climate warming are very important for the development of entomofauna. The population increasing of Diptera, aphids, leafhoppers, leaf beetle, wheat fleas, sunbugs, thrips etc. has caused by climate warming (Tab.2).

The investigations revealed new data on the changes concerning the structure (%) of wheat pests in 2015 and 2016, at ARDS Turda, comparatively with the average of pest structure by the past 10 years (Malschi et al. 2015, 2016):

- a higher share of aphids from 52% and 20 % comparatively with the 14 % from the past 10 years;
- a higher percent share of wheat flies (24-27%) comparatively with the 12% from the past 10 years;
- a higher share of leafhoppers (10-18%), values which are much higher than the average of 4% of the last 10 years;
- the structure percent of sun bugs achieved an average increase of up to 4% in 2016, values which are higher than the average of 2% of the last 10 years;
- a smaller percent share of the thrips at 7% and 17%), values which are much lower than the average of 57% of the last 10 years (Fig. 2).

The structure (%) of entomophagous (Fig. 3) has been established highlighting the all groups also known in the scientific literature and signaled in the previous years (Malschi, 2007) from ARDS Turda: Aranea and predators insects: Coccinellidae, Cantharidae, Malachiidae, Staphylinidae, Nabidae, Chrysopidae, Empididae, Syrphidae etc. and parasitical Hymenoptera.

Given all these pest population increases and the favorable conditions of vegetation, temperature and humidity conditions, have been developed the entomophagous populations, natural limiting of the main pests. Especially the abundance of thrips adults and larvae was much reduced as compared to the situation of the past 10 years. There has been evidenced a fort limmitation of thrips by the important predators of Diptera Empididae (*Platipalpus*). There has been evidenced the increases of the aphidophagus species abundance, especially of aphids parasites and of different

Fig. 1. Average of monthly temperatures (°C) and sum of monthly precipitations (mm).
Source of data: meteorological station Turda (longitude: 23° 47' ; latitude 46° 35' ; altitude 427m)

predators (Syrphidae, Coccinellidae, Malachiidae, Chrysopidae, Nabidae, Aranea etc.) (Fig 3, 4, 5).

Can observe a an important growth in the structural share of entomophages arthropod fauna collected, from 14% in the last 10 years at 21.85% and 29.85% in 2015 and 2016 respectively. The application of two treatments with insecticides on experimental variants has affected the entomophages annual abundance, especially on the case of variant V4 which included the treatment with neonicotinoid at the moment T1.

But it is highlighted that in the conditions of 2015, the two treatments with pyrethroids from V2 have been protective for the entomophagous, their percentage being higher compared to the untreated control (Fig. 4).

The integrated pest control system, adequated at the climate changes and eco-technological facthors, need to contain the application of insecticides treatments (neonicotinoides and pyrethroi-

des), in two moments of treating (at herbicides time and at flag leaf stage and ear appearance).

First insecticidal treatment is recommended in April, at the end of tillering in the 25-33 DC stage (at herbicidal treatment) using systemic insecticides: neonicotinoids to control wheat flies and wheat fleas (*Chaetocnema*), *Oulema* adults, leafhoppers and sun bugs. At this moment, entomophagous were at the beginning of field occurrence and less exposed to insecticides (Fig. 6, 7).

The second treatment is recommended at the flag-leaf appearance and ear emergence, in the 45-59 DC stage, in May 10-15, to control wheat thrips adults (*Haplothrips tritici*), aphids, bugs and other pests, using pyrethroids etc. with an immediate control of the pest complex, with along time effect and efficiencies against the development of thrips larvae on the ears, resulting in yield increases (Fig. 5, 7, 8).

Tab. 2. Abundance of phytophagus and entomophagus depending on insecticide treatments applied at wheat crops at ARDS Turda, during 2015 and 2016). Treatment moments: T1 (at herbicides time) and T2 (at the ear emergence); Lot variants: V1=untreated; V2=treated with pyrethroids (Fastac) at T1+T2; V3 = treated at T1 with neonicotinoid (Calypso or Biscaya) + T2 with pyrethroids. (Exemplary number collected by decadal 100 sweep-net catches/sample)

	2015		2016		
Abundance (nr.)	Total		Total		
Variants / treatments	V1	V2	V1	V2	V3
Phytophages :					
Thrips (<i>Haplothrips tritici</i>)	98	70	90	6	13
Diptera (<i>Oscinella etc.</i>)	174	56	62	29	39
Diptera (<i>Phorbia, Opomyza etc.</i>)	130	89	80	143	168
Oulema melanopus	29	16	14	9	3
Chaetocnema aridula	21	9	11	4	6
Phyllotreta vitulla	15	3	39	8	25
Aphids (<i>Sitobion avenae etc.</i>)	229	347	106	176	132
Leafhoppers (<i>Javesella, Psammottetix s.a.)</i>	99	49	92	64	81
Sun bugs (<i>Eurygaster, Aelia / s.a.</i>)	15	32	21	15	20
Hymenoptera (<i>Cephus, Trachelus</i>)	2		1	7	
Lepidoptera etc.	1		5	1	4
Orthoptera	1	1	1	2	
Diptera (<i>Bibio, Tipula</i>)	11	5	2		1
Entomophages :					
Coccinellide (<i>Coccinella 7-punctata</i>)	6	13	12	2	1
Coccinellide (<i>Propylaea 14-p.</i>)	4	5		1	1
Cantharidae	33	38	8	7	4
Malachiidae	2	1	4	2	2
Nabidae etc.	33	4	7	5	8
Staphylinidae (<i>Tachyporus, Staphylinus</i>)			3		
Chrysopidae	5	5	6	2	2
Syrphidae	30	139	15	6	7
Empididae (<i>Platypalpus s.a.</i>)	51	41	18	17	8
Hymenoptera (Colyria)			5	3	1
Hymenoptera (Aphydius)			8		
Hymenoptera (<i>different parasits</i>)	30	39	30	17	10
Hymenoptera (<i>Formicidae</i>)	9	17	9	2	8
Aranea	111	76	98	51	52
Variants / treatments	V1	V2	V1	V2	V 3
Annual abundance	Total	Total	Total	Total	Total
Phytophages	825	685	524	464	492
Entomophages	314	378	223	115	104
Sum of collected arthropods	1139	1063	747	579	596
Report of Phytophages / Entomophages	2.6 / 1	1.8 / 1	2.35 / 1	4.0 / 1	4.73 / 1

Fig. 2. Structure (%) of wheat pests in the untreated lots of experimental field at ARDS Turda, in 2015- 2016

Structure of entomophagous of wheat pests in 2015

Structure of entomophagous of wheat pests in 2016

Fig. 3. Structure (%) of entomophagous arthropods fauna in the untreated lots of experimental wheat field at ARDS Turda, in 2015- 2016

Fig. 4. Structure (%) of arthropods fauna (phytophagus / entomophagus) depending on insecticide treatments applied at wheat crops (ARDS Turda, 2015 and 2016).

Treatment moments: T1 (at herbicides time) and T2 (at the ear emergence);

Lot variants: V1 = untreated; V2 = treated with pyrethroids (Fastac) at T1+T2;

V3 = treated at T1 with neonicotinoid (Calypso or Biscaya) + T2 with pyrethroids (Fastac).

Fig. 5. Abundance and dynamics of wheat thrips (*Haplothripstritici*) in 2015 and 2016 depending on the insecticide treatment moments: T1 (at the time of herbicides application /19.04.2015 and 6.04.2016) and T2 (at the ear emergence/25.05.2015 and 19.05.2016), in the variants: V1= untreated; V2= treated with pyrethroids (Fastac) at T1; V3= treated with yrethroids (Fastac) at T1+T2; V4 treated at T1 with neonicotinoid (Biscaya)+T2 with pyrethroids (Fastac). E%=efficiency: Immediate efficiency after the T1 or T2 treatment moment; Total efficiency at the end of wheat crop variants V1, V2, V3, V4 and total pest abundance).

Fig. 6. Abundance and dynamics of wheat flies Chloropidae (*Oscinella frit*, *Meromyza* etc.) in 2015 and 2016, depending on the insecticide treatment: T1 (at herbicides application/19.04.2015 and 6.04.2016), T2 (at ear emergence/25.05.2015 and 19.05.2016), in the variants:

V1= untreated; V2= treated with pyrethroids (Fastac) at T1; V3= treated with pyrethroids (Fastac) at T1 + T2; V4= treated at T1 with neonicotinoid (Biscaya) + at T2 with pyrethroids (Fastac); E%= efficiency:

Immediate efficiency after the T1 or T2 treatment moment;

Total efficiency at the end of wheat crop variants V1, V2, V3, V4 and total pest abundance).

Fig. 7. Abundance and dynamics of leaf beetle (*Oulema melanopus*) in 2015 and 2016 depending on the insecticide treatment moments: T1 (at the time of herbicides application) and T2 (at the ear emergence); in the variants: V1=untreated; V2=treated with pyrethroids (Fastac) at T1; V3=treated with pyrethroids (Fastac) at T1+T2; V4 treated at T1 with neonicotinoid (Biscaya)+at T2 Fastac.

Fig.8. Abundance and dynamics of aphids (*Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum padi* etc.) in 2015 and 2016 depending on the insecticide treatment moments: T1 (at the time of herbicides application) and T2 (at the ear emergence); in different variants of plots: V1=untreated; V2=treated with pyrethroids (Fastac) at T1; V3=treated with pyrethroids (Fastac) at T1 + T2; V4 treated at T1 with neonicotinoid (Biscaya) + at T 2 with pyrethroids (Fastac).

Fig. 9. Abundance and dynamics of sunbugs (*Eurygaster maura*, *Aelia acuminata*) in 2015 and 2016 depending on the insecticide treatment moments: T1 (at the time of herbicides application) and T2 (at the ear emergence); in the variants: V1=untreated; V2=treated with pyrethroids (Fastac) at T1; V3=treated with pyrethroids (Fastac) at T1+T2; V4 =treated at T1 with neonicotinoid (Biscaya) +at T 2 with pyrethroids (Fastac).

Tab. 3. The table of variance analysis for polifactorial experience: *Effect of insecticide treatments applied in integrated technological system for wheat production, in 2015-2016, at ARDS Turda*

Variation source	Sum of squares	Freedom degrees	Average square	F test
1. Years	0.08178	1	0.08178	9.460 (Ft = 19.0)
2. Treatments	7.36463	3	2.45488	58.814* (Ft = 3.49)
Interaction Years x Treatments	0.76003	3	0.25334	6.07* (Ft = 3.03)
Error 1.	0.01729	2	0.00865	
Error 2.	0.50087	12	0.04174	
T o t a l	9.06951	23

Fig. 10. Contribution (%) of technological factors on the formation of wheat yield production (ARDS Turda, 2015-2016)

The particular aspects are reported regarding the effect of applied insecticides to the entomophages mortality or on increasing the abundance of some pests in connection with the destroying entomophages. So it can explain, in the case of aphids or phytophagous Diptera, the pests abundance developing in the variants treated with insecticides which determined the mortality of the auxiliaries (Fig. 5, 6, 7, 8, 9).

The percentage contribution (%) of technological factors on the formation of wheat yield production values indicate the percentage contribution of 81% for the insecticidal treatments factor. It is found that in context of studied factors the system with two insecticidal treatments applied at optimal times has been most important contribution to the formation of production, and there are significant differences between variants, statistically assured. The years of vegetation have been a minimal effect. The interaction years x treatments and other interactions into the applied technology have contributed with 8.1% and 10%

respectively on the formation of wheat yield production (Tab. 3, Fig. 10).

From the data of Tab. 4 is established that into the two years have achieved the highest levels of production (8.14 t / ha) when applying of two treatments of pyrethroids (V 3) at the moments T1 and T2, with a very significant differences of positive and the average yield increases at 18,6 %. For the V4 variant, in which has been applied a neonicotinoid at the T1 moment, the average production level has been 7.47 t / ha, a very significant of positive with averages increases of 8.8%. But, for this variant, the increasing values of TGW (Thousand grain weight) to 52 g respective by 4.5% is distinguished compared to the control, with significant differences and statistically assured.

CONCLUSIONS

Since 2015, a stronger impact of global warming on the wheat pests structure (%) are found. The importance of wheat pests is increasing

Tab. 4. Effect of insecticide treatments on wheat grain yield and on TGW (thousand grain weight), depending on the treatment moments: T1 (at the time of herbicides application) and T2 (at the ear emergence); in different variants of plots: V1 = untreated; V2 = treated with pyrethroids at T1; V3 = treated with pyrethroids (at T1 + T2; V4 treated at T1 with neonicotinoid + at T2 with pyrethroids, applied in wheat integrated technological system, during 2015-2016, at ARDS Turda

Factors and variants	Grain yield (t/ha)				TGW (g)			
	Grain yield (t/ha)	%	Dif.	Semnif.	TGW (g)	%	Dif.	Semnif.
Years Factor								
Average of years (Control)	7.31	100.0	0.00	-	50.74	100.0	0.00	-
2015	7.36	100.8	0.06	-	50.16	98.9	-0.58	-
2016	7.25	99.2	-0.06	-	51.31	101.1	0.58	-
DL (p 5%)			0.16				0.87	
DL (p 1%)			0.38				2.00	
DL (p 0.1%)			1.20				6.38	
Testul F (F tab.=19)	F=9.46				F=32.775*			
Insecticidal treatments Factor								
V1	6.86	100.0	0.00	Mt.	49.78	100.0	0.00	Mt.
V2	6.75	98.3	-0.11	-	50.36	101.2	0.58	-
V3	8.14	118.6	1.28	***	50.81	102.1	1.03	-
V4	7.47	108.8	0.60	***	52.00	104.5	2.22	*
DL (p 5%)			0.26				1.82	
DL (p 1%)			0.36				2.55	
DL (p 0.1%)			0.60				3.60	
Testul F (F tab.=3.49)	F=58.814*				F=2.553			
Interaction years x treatments								
2015								
V1	7.12	100.0	0.00	Mt.	48.23	100.0	0.00	Mt.
V2	6.56	92.0	-0.57	oo	50.40	104.5	2.17	-
V3	8.33	116.9	1.21	***	49.93	103.5	1.70	-
V4	7.45	104.5	0.32	-	52.07	107.9	3.83	**
2016								
V1	6.61	100.0	0.00	Mt.	51.32	100.0	0.00	Mt.
V2	6.94	105.1	0.34	-	50.32	98.1	-1.00	-
V3	7.95	120.4	1.35	***	51.68	100.7	0.36	-
V4	7.49	113.3	0.88	***	51.93	101.2	0.61	-
DL (p 5%)			0.36				2.57	
DL (p 1%)			0.51				3.60	
DL (p 0.1%)			0.72				5.09	
Testul F (F tab.=3.03)	F= 6.07*				F=1.750			

in 2015 and 2016, for wheat flies, aphids and leafhoppers, thrips, leaf beetle and wheat fleas, as well as the importance of cereal sunbugs, which requires professional study on the pest dynamics and adequate integrated control of wheat pests.

Entomophagous populations are very active and efficient on the pest natural limitation.

They are particularly abundant and present an important species diversity on the agro-ecosystems.

The integrated pest control system, adequate at the climate changes and eco-technological factors, need to contain the application of insecticides (neonicotinoides, pyrethroides), in two moments of treating (at herbicides time and at flag leaf stage and ear appearance).

First insecticidal treatment is recommended in April, at the end of tillering in the 25-33 DC stage (at herbicidal treatment) using systemic insecticides (neonicotinoids) to control wheat flies and wheat fleas (*Chaetocnema*), *Oulema* adults, leafhoppers and sun bugs. At this moment, entomophagous were at the beginning of field occurrence and less exposed to insecticides.

The second treatment is recommended at the flag-leaf appearance and ear emergence, in the 45-59 DC stage, in May 10-15, to control wheat thrips adults (*Haplothrips tritici*), aphids, bugs and other pests, using pyrethroids etc. with an immediate control of the pest complex, with along time effect and efficiencies against the development of thrips larvae on the ears, resulting yield increases.

Have been achieved the best results for production on the variants lots treated with pyrethroids, which are an immediate biological efficiency for pests and is protective for entomophagus.

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