Evaluation of products suitable for scab (*Venturia inequalis* (Cke.) Wint.) control in organic fruit production and implementation of sea algae based product Alginure to the IP scab control in Czech Republic.

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Abstract
Products for scab control in organic apple production and different scab control systems were evaluated in three separate trials in Czech Republic. Results are presented.
Small plot field trial on solo applications of different product for scab control suitable for organic fruit growing was conducted in 2010 in South Moravia. The evaluated products were lime sulphur Polisenio, Sulikol K (sulphur), VitiSan, Alginure. Lime sulphur and Alginure achieved efficacy 81 and 87 % respectively.
The influence of Alginure was tested in semi-field trials on three localities in Czech Republic in 2011. IP scab control schedule was compared to the same schedule where Alginure was added 3-5 times together with contact fungicide. The use of Alginure markedly increased the efficacy of the treatment. The infestation on the variation with Alginure was 57 % lower on average.
Organic scab control schedule was compared to the IP control schedule in field trial at another locality in South Moravia, Czech Republic. Products used in organic variation were: copper, sulphur, lime sulphur, Alginure, Prev-B2, VitiSan, Myco-Sin, calcium hydroxide. The results were comparable or better than the standard chemical fungicide control.

Keywords: scab control, ecological, apple, fruit

Introduction

The ecological fruit production in Czech Republic does not have a big tradition. The surface of organic orchards increased after government support to ecological agriculture was established. However, there is still a lack of experience and technical information, especially in pest and disease control. Situation has improved within the last few years, as some institutions started to pay more attention to this topic.
In presented experiments we focused especially to the scab control on apple, which is the main crop and the main disease in our region.

Material and Methods

1. Small plot trial for evaluation of different products on scab

Small plot trial was conducted in Nosislav, South Moravia in the season 2010 in 30 years old orchard with variety Idared, span 3x4,5 m. There were 6 variations in three repetitions. The product were applied preventively as a solo application by backpack sprayer Stihl with the start on April 16th (BBCH 15), following on Apr. 22, 27, May 3, 6, 11, 15, 19, 24, 28, 31, June 7, 17, 25 and July 19 and 29th. The variants were: Untreated control, Sulikol K (sulfur 50%) 6 kg/ha, lime sulfur Polisenio (lime sulfur 27 %) 8 l/ha, VitiSan (Potassium hydrogen carbonat) 5 kg/ha, Alginure (algae extract 24%, plant aminoacids 7%, phosphates 20%) 3 l/ha and Alginure 5 l/ha. Evaluation was done on June 11th and August 2nd. Efficacy was counted by Abbott formula, the differences between variations were evaluated by Fischer LSD test.

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2. Influence of Alginure placed into a regular IP chemical spraying program against scab

Three semi field trials were carried out in Czech Republic in 2011 in localities Určice, Central Moravia (3 applications of Alginure), Stošíkovice, South Moravia (4 applications of Alginure) and Bašnice, East Bohemia (5 applications of Alginure). Sea algae based product Alginure (algae extract 24%, plant aminoacids 7%, phosphates 20%; producer Tilco Biochemie GmbH) was applied in tank mix with the other fungicide products in IP spraying schedule. Trials were in commercial apple orchards with a regular spraying schedule. The testing plot of size 3-4 ha was within the orchards just beside the standard plots. Alginure was applied around the flowering time within the intensive infection period. Spraying Schedule:

Bašnice: 19.4. (DD.MM.) (Alginure) + Kumulus, 28.4. (Alginure), Dithane, 4.5. (Alginure), Captan, 16.5. (Alginure), Delan, 2.6. (Alginure), Tercel, 11.6. Syllit , 23.6. Delan, Kumulus, 13.7. Captan, Kumulus, 11.8. Flint

Určice: 7.4. FUNGURAN, 14.4. FUNGURAN, 21.4. POLYRAM, 28.4. MYTHOS, 6.5. DISCUS, DELAN, (ALGINURE), 13.5. POLYRAM, (ALGINURE), 19.5. TERCEL, (ALGINURE), 26.5. SYLLIT 65 WP, 31.5. SYLLIT 65 WP, 7.6. POLYRAM, 14.6. SCORE, DELAN, 21.6. SYLLIT, 29.6. POLYRAM, 14.7. DELAN, 26.7. DELAN

Stošíkovice: 31.3. Champion 50 WP, 4.5. Novozir MN 80 New, Kumulus WG, 11.4. Thiram granuflo, Kumulus WG, 22.4. (Alginure), Delan 700 WDG, Mythos 30 SC, 29.4. (Alginure), Captan 80 WG, Kumulus WG, 5.5. (Alginure), Delan 700 WDG, 13.5. (Alginure), Zato 50 WG, Score 250 EC, 26.5. Novozir MN 80 NEW, Dithane DG Neo, Kumulus WG, 30.5. Merpan 80 WG, Score 250 EC, 13.6. Kumulus WG, 22.6. Kumulus WG, 8.7. Kumulus WG, 26.7. Thiram granuflo, Kumulus WG, 27.7. Captan 80 WG, 4.8. Discus

Evaluation of infection on leaf and fruits was done three times in Určice and Stošíkovice and twice in Bašnice. First evaluation was a short time after the last application of Alginure, and the last evaluation was before the harvest. Leaf infection was evaluated by 0-4 scale, fruit infection by 0-1 scale.

3. Comparison of organic and IP scab control system

Scab control spraying schedule based on products for organic agriculture was compared with an IP chemical spraying schedule in Buchlovice, South Moravia in 2011. Apple orchard with variety Idared of size 2 ha and age 25 years was chosen to be tested with the organic treatment. Neighbouring orchard with the same variety but younger age of 15 years was evaluated for a comparison. The treatment was following:

Organic schedule 2011: 31.3. Funguran (CuOH 77%) 1,5 kg + rape seed oil 2%, 8.4. Alginure 3l/ha, Kumulus (sulphur 80%) 3,5 kg, 20.4. Kumulus 4 kg, Prev-B2 (B 2%, d-limonen 4,2%) 0,3 l, 27.4. Lime sulfur Polisenio 6 l/ha, 29.4. Kumulus 3 kg, Alginure 6 l, 5.5. Kumulus 3 kg, Funguran 0,5, Alginure 5 l, 11.5. Kumulus 10 kg, Prev-B2 0,25 l, 16.5. Kumulus 7 kg, Prev-B2 0,25 l, 19.5. Kumulus 5 kg, Prev-B2 0,2 l, 27.5. Kumulus 5 kg, Myco-Sin 8 kg, 31.5. Ca(OH)2, 6.6. lime sulfur Polisenio 6 l/ha.

Chemical fungicide schedule 2011: 31.3. Funguran 1,5 kg, Olej 2%, 8.4. Syllit 1,2 l, Kumulus 3 kg, 19.4. Syllit 1,2 l, Kumulus 3 kg, 28.4. Mythos 1 l, Kumulus 3 kg, 2.5. Zato 0,15, Delan 0,5 kg, 11.5. Syllit 1,4 l, Kumulus 5,8 kg, 17.5. Zato 0,15, Delan 0,35 kg, 23.5. Thiram 3 kg, Kumulus 3 kg, 31.5. Punch 0,3 l, Captan 80 1,8 kg, 2.6. Zato 0,15 kg, Syllit 1,2 l

Evaluation was done after the end of the main infection period on June 7th.

Results and discussion

1. Small plot trial for evaluation of different products on scab

Table 1.: Average number of infected fruit per variant and efficacy % by Abbott.

Variation	Evaluation June 11th		Evaluation Aug. 2nd	
	infestation %	**efficacy %**	infestation %	**efficacy %**
Lime sulphur	1,00B	**85,01**	2,00B	**80,64**
Sulikol K	5,00A	**25,04**	4,00B	**61,28**
VitiSan	3,66A	**45,13**	5,33A	**48,40**
Alginure 3 l ha^{-1}	4,00A	**40,03**	3,00B	**70,96**
Alginure 5 l ha^{-1}	1,33A	**80,00**	1,33B	**87,12**
UTC	6,67A		10,33A	

The products lime sulfur Polisenio and Alginure showed quite high efficacy on the scab even in the high infection conditions of that season. The lower efficacy of VitiSan was probably due to its preventive application in this trial as the product is recommended as a stop treatment.

2. Influence of Alginure placed into a regular IP chemical spraying program against scab

Table 2.: Comparison of leaf infestation of fungicide treatment with and without Alginure

variety	**Locality/treatment**	Date of evaluation/leaf infestation degree		
	Locality: Bašnice, (ANOVA: F 0.0029 P 0.997090)			
	Variant	June 23		September 15
Idared	Alginure + fungicides	4,2A		7,3A
	Fungicides alone	8,5A		11,3A
Gloden delicious	Alginure + fungicides	1A		1,3A
	Fungicides alone	2A		1,8A
Jonagold	Alginure + fungicides	1A		9,8A
	Fungicides alone	2A		12,3A
	Locality: Stošíkovice, (ANOVA F 1.4326 P 0.239104)			
		June 6	July 27	September 8
Gala	Alginure + fungicides	0A	2,5A	2A
	Fungicides alone	2,8A	7B	7,5B
Golden delicious	Alginure + fungicides	1A	2A	4,3A
	Fungicides alone	6,3B	6,3B	10,3B
	Locality: Určice, (ANOVA F 2.6104 P 0.016661)			
		June 7	July 28	September 13
Golden delicious	Alginure + fungicides	6A	6,5A	4,5A
	Fungicides alone	9,5B	11,8B	10,5A

The results show that the incorporation of Alginure into the conventional spraying program brings important reduction of infestation. The average reduction on all localities was 57 %

comparing to a standard treatment. The differences on the locality Bašnice were not significant, but on the other two localities the differences were significant (on level 0,05). Influence of the Alginure treatment on the infection decrease lasted till the harvest time. Using this kind of product can have great importance for low residue production and also for antiresistance strategies. It is planned to continue with this study by looking for optimal dosage and timing of the product.

3. Comparison of organic and IP scab control system

Table 3.: Comparison of leaf and fruit infection and cost of the ecological and conventional treatment in 2011

variation	leaf infection degree	% infected fruits	scab control costs	% comparison of costs
ecological	0,3	0	10 409 CZK (416 EUR)	103,9
conventional	1,3	0,75	10 009 CZK (400 EUR)	100

The trial shows that in this season the ecological scab control got slightly better results than the IP spraying program. That corresponds to the previous results in Czech Republic (Falta, 2010) which showed that the ecological scab control got comparable results to the chemical. Also the treatment costs were in Czech conditions comparable, when the ecological scab treatment was about 3,9 % more expensive than the IP. This also corresponds to the previous results from Czech Republic (Vávra, 2010).

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