New alternative products Memcomba and Altela for apple scab control in organic orchards

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Abstract

Apple scab caused by pathogen Venturia inaequalis is a major disease of apples worldwide. The traditional spray programme in organic apples is based on the use of copper, sulphur, lime sulphur and potassium bicarbonate. Finding and incorporation of new alternative products to copper and sulphur and optimizing of treatment timing is necessary. For this purpose biostimulants Altela and Memcomba (Gaiago, France) were involved into experimental spray programme of scab control in organic apple orchard. Memcomba is acting in a preventive way before expected infection whereas Altela shows curative effect. The products were tested on cultivar ´Golden Delicious´ which is one of the most sensitive apple cultivars to V. inaequalis. The infestation of untreated control, the variant treated by tank mix of sulphur + VitiSan and the alternation of Memcomba and Altela was 98.8 %, 14.5 % and 3.5 %, respectively. Efficacy calculated according to Abbott´s formula was 85.5 % in the case of the variant with sulphur + potassium carbonate and 96.5 % in the variant with the alternation of Memcomba and Altela. Fruits were harvested and placed in the both common cooling storage and ULO storage to evaluate the effect of products on store diseases.

Keywords: *Venturia inaequalis*; plant protection; treatment efficacy, infestation, fruit production

Introduction

Scab caused by *Venturia inaequalis* (Cooke) Wint. is globally the most serious apple disease causing economic losses up to 70% in the regions with cool and humid spring and early summer (Bowen et al., 2011; Bus et al., 2011). Management of this pathogen is essential to provide effective and sustainable apple production throughout the world. Apple scab management is often based on high frequency of fungicide applications. Finding new solutions in scab control, namely alternatives to copper and sulphur is necessary. In addition, further studies on ecology of *V. inaequalis* and its epidemiology are required to improve current disease control. Intensive research in the management of apple scab using bio-agents, improved cultural practices and developing resistance varieties should be emphasized in the future to enhance to overall efficacy of both organic and conventional apple production (Belete and Boyraz, 2017). Results of trials aimed to effect of biostimulants Memcomba and Altela upon apple scab are presented in the paper.

Material and Methods

Biostimulants Memcomba (active substance dry yeast extract, Saccharomyces cerevisiae 14 g/l) and Altela (active substance extract from production fermentation of Lactobacillus sp. 42 g/l and dry yucca extract 10 g/l) were tested in the experimental organic orchard in Holovousy situated northwest part of the Czech Republic. As a standard variant the combination of Sulphur (798.4 g/kg) and potassium carbonate (994.9 g/kg, product VitiSan)

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was used. In the untreated control the degree of scab pressure was monitored. Climatic conditions of Holovousy are characterized by average annual temperature of 8.1°C and average annual rainfall of 655 mm. The soil is medium loam sandy with rather deep cultivated layer on gravel substrate. The orchard was located at the altitude of 300 – 370 m. Experimental trees were trained as spindles using supports. The weed control in the tree canopy tree was carried out using mechanical cultivator whereas periodical mulching took place in alleys between the tree rows. Biostimulants were tested in the year 2019 in ´Golden Delicious´ cultivar showing high sensitivity to apple scab. Schedule of fungicide application and dosages are presented in the table 1.

Table 1. List of fungicide application against apple scab in 2019

Date	Compound	Dosage/hectare
March 23d	Copper	3 kg
March 29th	Copper	3 kg
April 25th	Sulphur + VitiSan + Wetcit	4 kg + 4 kg + 1 l
May 2nd	Sulphur + VitiSan+ Wetcit	4 kg + 4 kg + 1 l
May 8th	Sulphur + VitiSan+ Wetcit	4 kg + 4 kg + 1 l
May 10th	Sulphur + VitiSan+ Wetcit	4 kg + 4 kg + 1 l
May 15th	Lime sulphur	10 l
May 21st	Variant A: Sulphur + Wetcit Variant B: Memcomba + Wetcit	A: 4 kg + 0.4 l B: 2 l + 0.4 l
May 23d	Variant A: Sulphur + VitiSan + Wetcit Variant B: Altela + Wetcit	A: 4 kg + 4 kg + 0.4 l B: 2 l + 0.4 l
May 27th	Variant A: Sulphur + Wetcit Variant B: Memcomba + Wetcit	A: 4 kg + 0.4 l B: 2 l + 0.4 l
July 23d	Variant A: Sulphur + Wetcit Variant B: Memcomba + Wetcit	A: 4 kg + 0.4 l B: 2 l + 0.4 l
August 1st	Variant A: Sulphur + Wetcit Variant B: Altela + Wetcit	A: 4 kg + 0.4 l B: 2 l + 0.4 l

Spray scheduling was based on forecast model RIMpro obtaining data from meteorological station MeteoUNI (AMET, Velké Bílovice) situated near the testing orchard. The course of real apple scab infections recorded in 2019 is shown in RIMpro output (figure 1).

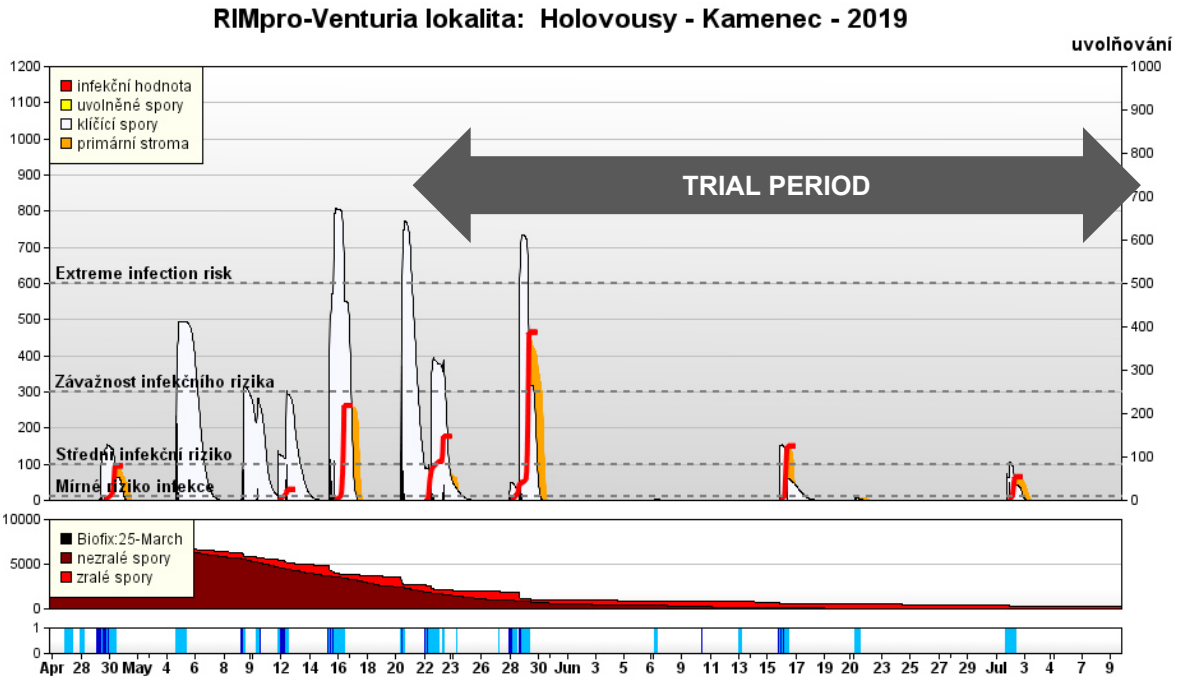

Figure 1: Records of scab infections for location Holovousy in 2019

Alternative products Memcomba and Altela were tested from the late May until late July for primary infections and for the secondary infections in the rest of the season. Scoring of apple scab infestation was evaluated on fruits before harvest. Scale 0 - 4 for evaluation (table 2) was used (0 = no scab; 1 = ≥25 mm^2; 2 = <25 – 100 mm^2; 3 = <100 – 400 mm^2; 4 = < 400 mm^2). Totally 100 fruits from each variant were tested (twenty fruits in each sample collected in five repetition). Scab infestation intensity on fruits was expressed by using of Townsend–Heuberger formula (Townsend & Heuberger, 1943). The efficacy of treatment was calculated by comparing the disease severity with the untreated control according Abbott formula.

Table 2. Scale for evaluation of scab fruit infestation

Scale 1 - 4	Description	Lesion size
0	no scab	0
1	1 or 2 small lesions	>25 mm^2
2	3 - 4 small lesions or 1 large lesions	25 - 100 mm^2
3	more than 5 small or more than 2 large lesions	< 100 - 400 mm^2
4	heavy infestation	< 400 mm^2

Results

Biostimulants Memcomba and Altela showed higher efficacy than tank mix of sulphur and potassium carbonate. Results are presented in figures 2 and 3. Based on harvest evaluation the degree of fruit infection was 3.5%, 14.5% and 98.8% in the variant with Memcomba and Altela, in the case of sulphur, potassium carbonate combination, and in untreated control, respectively. The efficacy of potassium carbonate with sulphur and of Memcomba with Altela was 85.8 % and 96.5 %, respectively. The extreme scab infestation 98.8 % observed in the untreated control refers to high pathogen pressure in the experimental orchard in 2019.

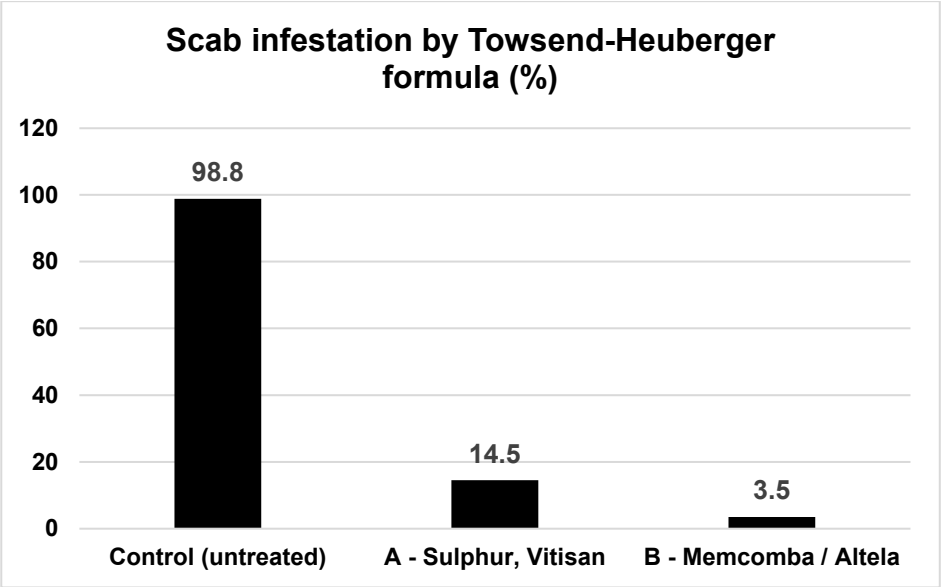

Figure 2: Scab infestation calculated by using Towsend–Heuberger formula

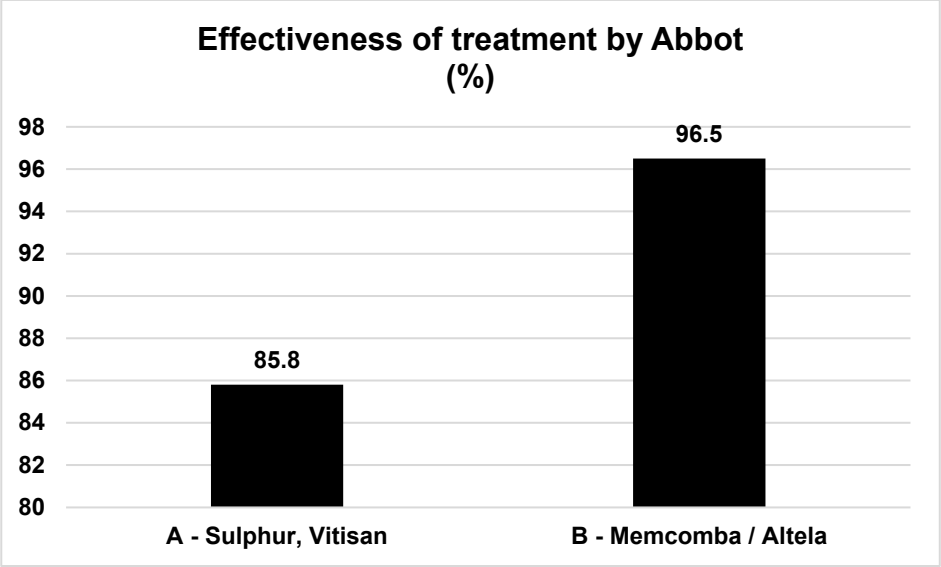

Figure 3: Effectiveness of treatment expressed by Abbott formula

Discussion

The preliminary results presented in this paper suggest high efficacy of biostimulants Memcomba and Altela against apple scab even in the conditions of a high pressure of pathogen. Both biostimulants were integrated into spraying schedule together with products commonly used in organic apple production for protective and curative protection against scab as copper, sulphur, lime sulphur and potassium carbonate. However, the efficacy especially of curative treatments is often not satisfying (Zimmer at al., 2012). Lower scab infestation on fruits have been achieved by incorporating of biostimulants Memcomba and Altela. Therefore, new strategies are needed to further increase both protective and curative effect of known products. Although more evaluation should be done during next years, we assume that the incorporation of products Memcomba and Altela appears to be a promising alternative to the traditional scab control in organic apple orchard. In addition, the efficacy of products on store diseases or other pathogens should be evaluated.

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