Impact of foliar application of auxiliary preparations on quantitative and qualitative parameters of organic strawberry production under plastic tunnel

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Abstract

The effect of auxiliary preparations on quantitative (yield) and qualitative (Refractometric Brix value - °Brix, fruit penetration) of strawberry fruits was evaluated during 2014 and 2015 growing season in the Research and Breeding Institute of Pomology, Holovousy Ltd. Strawberry cultivars ´Flair´, ´Rumba´ and ´Darselect´ were chosen for the testing. Following products: Alginure, Prev B2 and Trifender WP were used for the treating purpose. The strawberry plants were treated by mentioned products and as a control variant were used untreated plants. There were observed no positive impact of auxiliary preparations on evaluated parameters. The highest yield reached the cultivar ´Darselect´ treated by Alginure in the second evaluated season. There were not investigated any significant differences in the Refractometric Brix value (°Brix) of strawberry fruits between treated variants and untreated control variant in 2014 and 2015 growing season.

Keywords: organic strawberry production, varieties, yield, Brix value

Introduction

Strawberry plants (*Fragaria* x *ananassa* Duch.) are damaged by several pests and diseases that occur mostly during flowering and fructification period. Growes spray chemicals to manage them and consequently residues of pesticides have been recurrent in surveys carried out during several years in Brazil (Anvisa, 2010). The conventional system produced the highest yield, as a consequence of the higher fruit number per plant, while the organic management resulted in increased berry mean weight. Organic fruits showed higher values of dry and higher content of glucose, sucrose, vitamin C and ß-carotene but lower nitrate (Conti *et al*., 2014).

In organic production, cultural practices are important preventive strategies against pests and diseases and are the first phase in the control management. In this way, adequate soil management including fertilization, as well as other cultural practices may be used to contribute to pest reduction in the field (Zehnder *et al*., 2007). In addition to preventive strategies, curative options must be available to reduce pests and diseases in the field when just preventive strategies are not enough to keep occurance bellow damaging levels. (Chagas *et al*., 2001; Venzon *et al*., 2006). Organic farming has been proposed to be a means to alleviate the decreasing biodiversity in agricultural landscapes (Bengtsson *et al*., 2005). It mainly differs from conventional farming by the prohibition of most pesticides and inorganic fertilisers (EC, 2007). Necessitating more elaborate crop-rotations such as the use of nitrogen-fixing plants (Stockdale *et al*., 2001).

In organic strawberry production, there is a need for vigorous cultivars with high tolerance to pests and diseases, particularly to Botrytis cinerea. Root diseases (first of all *Verticillium dahliae* and *Phytophthora cactorum*) can lead to yield and plant

losses on farms which lack land for a wide crop rotation, especially when using susceptible cultivars. Differences in the susceptibility of commercially used cultivars to these root diseases are well documented, however, completely resistant cultivars are not known.

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(Zebrowska *et al*., 2006; Shaw *et al*. 2008, 2010). The choice of organic system as an alternative to the conventional practice could be justified by the better fruit quality, lower environmental impact and higher market prices (Conti *et al*., 2014).

The goal of this study was to investigate impact of auxiliary preparations on quantitative and qualitative parameters.

Material and methods

The experiment was investigated in experimental field in Research and Breeding Institute of Pomology in Holovousy (Holovousy, Czech Republic) in spring 2014 and 2015. There was done twice the soil preparation by sowing of legume – cereal mixture as a green fertilizer before planting of strawberry plants. Two row beds, which was covered by mulching black nonwoven textile (50 $g.m^2$) with drip irrigation was created three weeks before planting. The interrow spacing was 0,8 m and in the row was spacing 0,3 x 0,3 m.The trial was conducted on one location. Strawberry cultivars ´Flair´, ´Rumba´and ´Darselect´(origin from Netherland, company Goossens Flevoplant B.V.) as a cold stored plants was planted in april 2014. The trial was devided into four variants and each of variant had three repetitions (3 x 20 plants).There was carried out application of auxiliary preparations Alginure, Prev B2,Trifender WP and control variation without aplication. All these products are registred for organic farming. Preparation Trifender WP is based on spores of *Trichoderma asperellum.* Prev-B2 is consist of boron and orange extracts. Alginure is consist of extract from seaweed (24 %) and plant aminoacids. The foliar application for preparation Alginure and Prev B2 was done five times per one vegetative season, three times in flowering time (BBCH scale 57-65), once after flowering (BBCH scale 67) and once after harvest (BBCH scale 89). The dose for product Prev B2 was 1,8 $l.ha^{-1}$ and for Alginure was 3,5 $l.ha^{-1}$. The product Trifender WP was applicated by dipping of roots in 1 % concentration solution before planting and by watering in dose 4-6 $kg.ha^{-1}$ after rooting of plants. The dose of products was setted out according to recommended rules from producers.

The trials were treated according to organic farming rules. The experimental treatments were randomized in a split-plot design. The field was covered by hyght plastic tunnel, to avoid rain and hail damage. The harvest was carried out three times per week. Harvested fruits were sorted according to EU marketing standards (no. 843/2002) to quality classes market yields (selection, 1. class and 2. class) and category non-standard (small fruit, demaged fruit, rotten and deformed fruits). Internal quality parameters as refraction (°Brix) and penetration (index 1 – 100) and quantity parameters as yield and fruit weight was evaluated after harvest. Refraction was measured by digital refractometer HI 96801 (HANNA instruments, USA) and penetration by Durofel instrument (Copa-Technology, France). Statistical analysis was performed by analysis of variance (ANOVA) and Tukey‘s test (α 0.05) in STATISTICA software (version 12, Stat Soft) and in Excel Microsoft.

Results

Results in Table 1 – 3 and Figure 1 are sumarized from two years evaluation. The market yield and non-standard parameters are the sum of both year and penetration and refraction parameters are the average of both year. Results of evaluation ´Flair´ cultivar are shown in Table 1. The ´Flair´ cultivar had the highest market yield in variation control without treatment (595.7 g/plant) second highest market yield (590.7 g/plant) was found in variation with application of Trifender WP. The lowest total non-standard fruit yield was observed for variation treated by Prev-B2, only 48.2 g/plant. The impact of preparation on

penetration and refraction were not investigated and the differences between variation were minimal.

The results of ´Rumba´cultivar (Table 2) were similar like for ´Flair´ cultivar. The highest market yield on level 550.8 g/plant was observed in variation treated by Trifender WP. The lowest amount of market yield in variation Alginure was found on level 499.4 g/plant. The lowest non-standard fruit yield 49.7 g/plant in variation treated by Prev – B2 was found. Penetration and refraction for ´Rumba´ cultivar for all variants was almoust the same and only small differences were observed.

The highest yielding cultivar according to results was ´Darselect´ (Table 3). The highest yield 590.8 g/plant had the variant treated by Alginure. The lowest amount of non-standard fruit 61 g/plant was observed after application of preparation Prev-B2. Almost no differences between variants in case of penetration and refraction were observed. Penetration was approximately around 40 and refraction around 10 °Brix for all variants.

Table 1: Results of evaluated parameters for ´Flair´ cultivar.

Variants	Market yield (g/plant)	Non-standard (g/plant)	Penetration (index 1-100)	Refraction (°Brix)
Alginure	516.2 a	65.6 b	40.3 a	10.6 a
Prev-B2	531.6 a	48.2 a	39.1 a	10.5 a
Trifender WP	590.7 b	69 b	39.6 a	10.4 a
Controlf	595.7 b	70 b	39 a	10.2 a

Table 2: Results of evaluated parameters for ´Rumba´ cultivar.

Variants	Market yield (g/plant)	Non-standard (g/plant)	Penetration (index 1-100)	Refraction (°Brix)
Alginure	499.4 a	57 ab	39.5 a	9.0 a
Prev-B2	519.9 a	49.7 a	39.6 a	8.9 a
Trifender WP	550.8 b	55.7 ab	38.9 a	8.8 a
Control	522.3 a	63.6 b	39.2 a	9.2 a

Table 3: Results of evaluated parameters for ´Darselect´ cultivar.

Variants	Market yield (g/plant)	Non-standard (g/plant)	Penetration (index 1-100)	Refraction (°Brix)
Alginure	590.8 b	76.4 b	40.5 a	10.5 a
Prev-B2	546.3 b	61 a	39.8 a	10.2 a
Trifender WP	524.8 a	62.1 a	40.9 a	10.5 a
Control	577.7 b	88.4 b	38.9 a	10.7 a

Very important indicator is ratio between market yield quality and non-standard fruit quality. The worst ratio was for control variants without any treatment. On the other hand the best results were observed for variants after application Prev-B2 preparation in case of all cultivars (Figure 1). Occurence of fungal diseases and sun demages was evaluated as well (Figure 2). ´Flair´cultivar had the highest susceptibility on demage caused by fungal deseases and sunburn. The most resistant against this demage was ´Rumba´cultivar. The best impact of preparation was observed for Prev-B2 in case of ´Flair´ and ´Darselect´ cultivar and for ´Rumba´ cultivar had best impact Trifender WP.

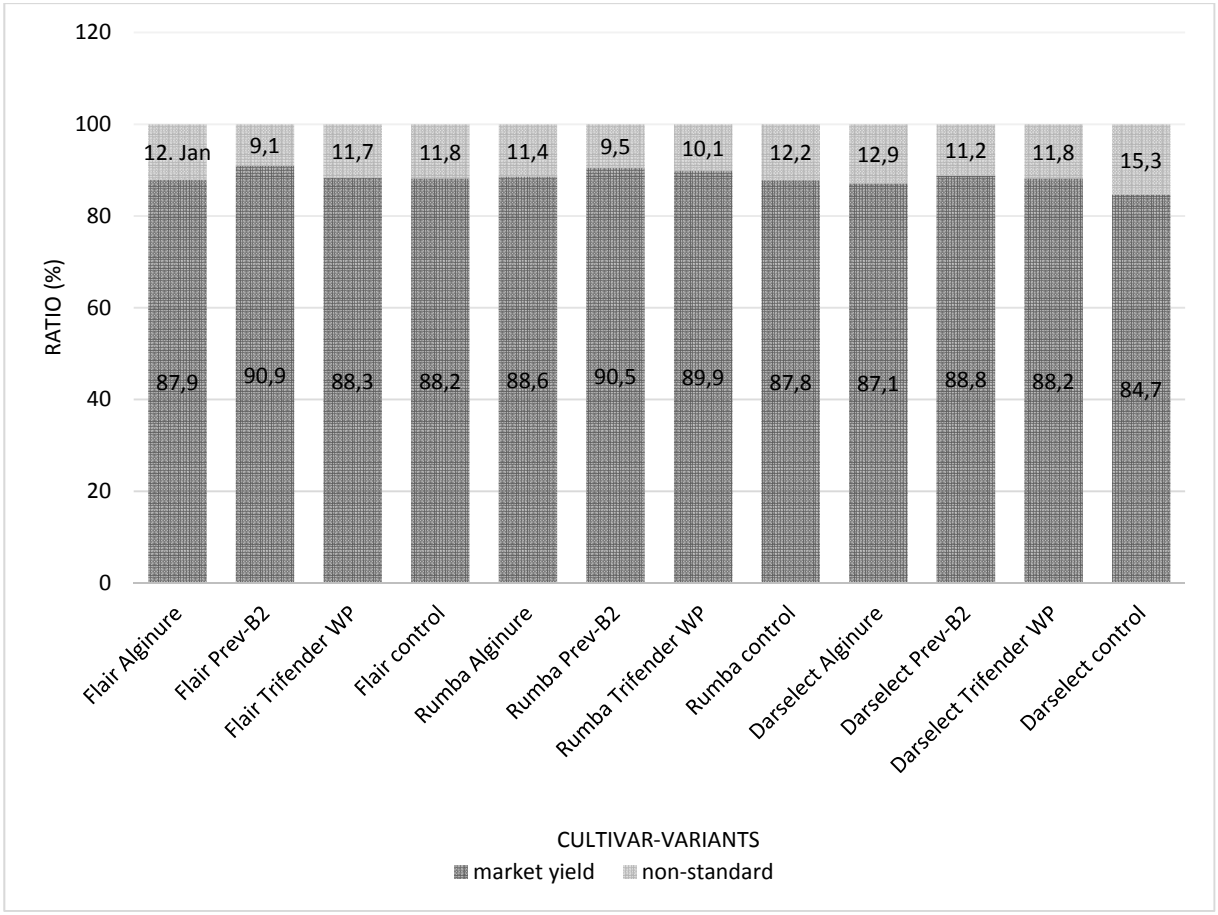

Figure 1: Ratio between market yield and non-standard fruit quality for all variants.

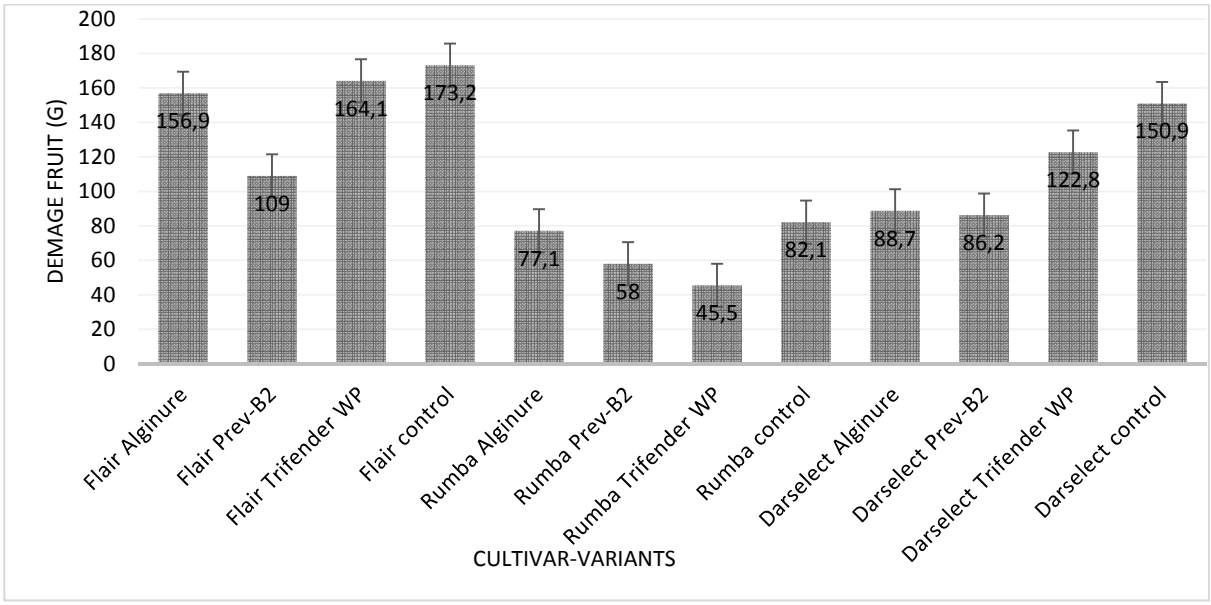

Figure 2: Occurence of fungal diseases and sun demages for all variants.

Discussion

The use of auxiliary preparation in strawberry organic farming is still discussed and use of various auxiliary plant preparations based on growth promoters or humic substances is quite attractive. Currend trend in the cultivation technology is also focused on organic strawberry production. According to Sikma (2000), the frigo plants are very suitable for the

purpose of organic growing and the planting is performed from April to May. The differences between control variants and treated variants by preparations were not significant in our evaluated parameters except the occurrence of fungal diseases and sunburn demage. This parameter is very important because of very fast spreading of fungal diseases in the crop. Zahradníček *et al*. (2006) investigated the effect of auxiliary preparations on physiological activity, for instance: chlorophyll content or anti-stress effect. Kremláčková *et al*. (2011) evaluated the impact of Lignohumat B and Synergin auxiliary preparations on ´Symphony´ and ´Honeoye´ cultivars under organic cultivation. The effect was very weak like in our study and the results were not statistically significant.

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