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VERIFICATION OF THE EFFECTS OF LIGNOHUMAT B AND SYNERGIN® IN ORGANIC STRAWBERRY PRODUCTION

Š. Kremláčková, P. Salaš, S. Boček

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Abstract

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The objective of this work is to determine the effect of auxiliary plant preparations such as Lignohumat B and biostimulant Synergin® on yield and quality of strawberry production. The two year trial was carried out on two plots of the Horticultural Faculty in Lednice Mendeleu. Among different cultivars the 'Honeoye' and 'Symphony' have been selected, they are recommended for organic production. Lignohumat B was applied to strawberries according to the manufacturer instructions: soaking the root system, watering after planting, spraying on the leaves two weeks before flowering and after flowering in 1% concentration. Synergin® was applied before flowering by means of foliar sprayer and two weeks after flowering in the recommended dose of 3 $l.ha^{-1}$.
In trial No. 1, the average yield for the two years 2007 and 2008 was 24.69 $t.ha^{-1}$ for the 'Honeoye' cultivar and 35.48 $t.ha^{-1}$ for 'Symphony'. The average yield per plant for 'Honeoye' cultivar was 296.16 g and for 'Symphony' it was 426.36 g. Trial No. 2 was carried out in 2008–2009, the yield for 'Honeoye' cultivar was 35.91 $t.ha^{-1}$ and for 'Symphony' variety 36.5 $t.ha^{-1}$. On average for two years trials, the yield of one plant for 'Honeoye' cultivar was 429.27 g and for 'Symphony' cultivar 439.02 g. The result is that the auxiliary plant preparations (Lignohumat B and Synergin®) had a limited effect on strawberry plants and the results were not statistically significant. Experiments demonstrate that the two selected cultivars can be recommended to the organic production.

strawberry, organic production, Lignohumat B, Synergin®

The current trend in the field of small fruit cultivation technology is also focused on organic strawberry production. The frigo plants are very suitable for this purpose. The planting is performed from April to May. Compared to green plants in the autumn frigo plants has a better survival rate, does not suffer from the autumn drought and subsequent frost-killing in winter after planting. The yield rate of strawberry plantation made from green plants with root neck diameter of 15 mm can achieve 2–3 $t.ha^{-1}$ in 60 days in the first year and up to 10–20 $t.ha^{-1}$ the next year (Sikma, 2000).

The most commonly used are single-line or two-row planting methods. The plants are usually densely planted, because the plantation lasts for one or two years (Vachůn, 2004). Gengotti *et al.* (2002) states that it is better to plant strawberry using singe-row because of better preventive protection against fungus pathogen *Botryotinia fuckeliana* (the cause of fruit grey rot), with simultaneous use of tolerant varieties.

Barth *et al.* (2002) on the basis of experiments recommended 'Honeoye' and 'Symphony' cultivars for organic production in Austria. Cornell University in the U. S. A. recommended 'Honeoye' cultivar-for organic cultivation because of its high yields, fruit quality and resistance to pathogens (Rhainds *et al.* 2002). In Latvia, it is also recommended to use 'Honeoye' cultivar as it has high quality fruits for this method of cultivation (Laugale, Bite, 2009). Spornberger *et al.* (2005) on the basis of evaluation of experiment on three farms in eastern Austria in terms of yield, fruit quality and disease resistance has recommended 'Symphony' cultivar for bio

production. In Denmark cultivars in 1920 20 were examined for their suitability for organic cultivation. The best cultivar was 'Honeoye' followed by 'Symphony', 'Pandora', 'Kent' and 'Cortina' (Daugaard and Lindhard, 2000). During strawberry planting mulch film is normally used it can be made of different materials such as polyethylene, biodegradable non-woven fabric or foil (Gengotti and Mosconi, 2003). An integral part of strawberry culture became drip irrigation.

Nowadays the use of various auxiliary plant preparations based on growth promoters or humic substances is quite attractive. Rákos (2006) presents the possibility of using Lignohumat B, a representative of the latest generation of ecological devices based on organic humic compounds. The author states that the application of Lignohumat B through watering or spray reduces plant stress response, and supports its regeneration. It stimulates growth of tissues, plants have increased leaf area and more saturated color, the photosynthesis became more intensive and the formation of storage compounds increases, resulting in higher yields and product quality. The positive effect on size and fruit attractiveness, skin color, pulp consistency, taste, content in vitamins, antioxidants, color and other substances has been noted.

Zahradníček *et al.* (2006) evaluated Synergin®, which is physiologically active and growth-regulatory preparation that has positive influence on plant metabolism and key anabolic process – photosynthesis. Experimental results show a significant positive impact of Synergin® on increase of chlorophyll content in leaves, at the same time the product has anti-stress effect under adverse weather conditions such as hail, water deficit, freezing, high temperature, and solar heatstroke.

MATERIALS AND METHODS

The trials were established and evaluated on experimental plots of Faculty of Horticulture in Lednice in 2007–2009. Lednice is located in one of the hottest areas in the Czech Republic, at an altitude of 174 m above sea level. Experimental material was frigo plants of 'Honeoye' and 'Symphony' cultivars obtained from the company Berryservis, Ltd (originated in Netherlands, the company Goossens Flevoplant B. V.) There was a conventional planting, since organic plants in Czech Republic is not certified.

'Honeoye' cultivar originated from the U.S.A. as the cross of 'Vibrant' and 'Holiday' cultivars. It's early fruiting cultivar. The fruits are large to very large, uniform in size, cone shaped, with attractive appearance. The color is bright red and shiny. The pulp is of high quality, solid, but less firm. The taste is aromatic, slightly acidic, and good. (Ludvíková and Paprštejn, 2003). 'Symphony' cultivar is the cross of 'Rhapsody' and 'Holiday' cultivars, originated from Scotland. It's late fruiting variety. Fruits are very firm and shiny, easy to transport, juicy in taste, they don't prone to deformations. The size of the fruit is medium to large (Kerby et McNicol, 1997).

Synergin® is a biostimulant of plant growth, which contains a number of natural physiologically active compounds: 6-benzylaminopurin, precursors of auxins and heteroauxins, cytokinins and natural porphyrins derived from food materials. Other substances are hydrolyzed amides and amino acids, glycosides, tannins and other heterocyclic organic compounds, derived from aromatic and narcotic plants. It is authorized by UKZUZ as a non-toxic and ecological product. It is a dark brown liquid, that is applied by spraying the leaves, the recommended dose is 2 $l.ha^{-1}$ (Zahradníček *et al.*, 2006).

Lignohumat B is a liquid, concentrated product is brown-black in color, contains only the active salts of humic and fulvic acids in 1:1 ratio and trace amounts of microelements bounded to chelates. The basic raw material (technical lignosulfonate) is a waste product of paper production, created from pure wood, the waste-free technology. The great advantage is the absence of heavy metals. Recommended application in strawberry cultivation: soaking the root system, watering after planting, foliar application two weeks before flowering, foliar application after flowering (Rákos, 2006).

The trials have been established by a completely randomized blocks in split plots with 4 modalities of treatment in 4 replications of the 25 plants. A total of 1600 plants were planted.

Trial variants were:

1. Lignohumat B
2. Synergin®
3. Lignohumat B + Synergin®
4. Control (untreated with bioactive substances).

In autumn 2006, the entire experimental area was treated with organic horse manure, obtained from the organic farm, the previous crop was parsley. Before planting the soil samples were collected and then performed analysis according to Mehlich III. On the half of unplanted area a green manure was sowed in 2007.

The planting of the trial No. 1 was conducted on April 12, 2007 and No. 2 on April 29, 2008 in black non-woven fabric, under which was pulled drip irrigation. Irrigation dose was based on an evaluation of soil moisture sensor VIRRIB. Non-woven mulch covers all variants. Frigo plantings were planted in one row with plant spacing 0.60 × 0.20 m. Foliar spraying with preparation was conducted by hand sprayers.

Treatments of independent plots:

Variant No. 1 – Synergin®

- 1. Foliar application before flowering in concentration (dose 3 $l.ha^{-1}$)
- 2. Foliar application two weeks after flowering in concentration (dose 3 $l.ha^{-1}$).

Variant No. 2 – Lignohumat B

- soaking the root system before planting (1% solution)
- watering after planting (1% solution, dose of 200 ml to each plant)
- foliar application before flowering (dose 1 l.ha^{-1})
- foliar application two weeks after flowering (dose 1 l.ha^{-1}).

Variant No. 3 – combination of Synergin® and Lignohumat B

- soaking the root system before planting in Lignohumat B (1% solution)
- watering with Lignohumat B (1% solution, dose of 200 ml to each plant)
- foliar application of Lignohumat B before flowering (dose 1 l.ha^{-1})
- foliar application of Synergin® just before flowering (dose 3 l.ha^{-1})
- foliar application of Lignohumat B after flowering (dose 1 l.ha^{-1})
- foliar application of Synergin® 2 weeks after first application (dose 3 l.ha^{-1}).

Variant No. 4 – Control (without application of preparations)

Harvest evaluation

During harvest the fruits have been sorted into classes according to commercial standards of the EU (No. 843/2002): Extra Class – a regular shape, all-over color, diameter min. 25 mm. Class I – slight defect in shape, white tips up to 1/10 fruit, diameter min. 18 mm. Class II – permitted shape deformation, the white tips of the fifth fruit, diameter min. 18 mm. Determination of vitamin C content in strawberry fruits was performed using the high-performance liquid chromatography (HPLC). Soluble solids ware determined using optical methods based on light refraction, depending on the concentration of the substance in the sample, using hand-held refractometer RR1. For statistical evaluation analysis of variance was used and Tukey HSD test with a 95% level of significance. During the search for significant differences independent groups were marked with individual letters.

RESULTS AND DISCUSSION

Trial No. 1 (2007–2008)

In 2007 there were six harvests at 3–4 day intervals. The first harvest of 'Honeoye' cultivar was on May, 31 and the last one on June, 19. The largest marketable yield was observed on the untreated plots (control). The lowest was in plots treated with Synergin® (Tab. I).

The harvest of 'Symphony' cultivar began on June, 4, and six harvests were finished on June, 25. The highest yield reached the variant treated with Lignohumat B and at least once again treated with Synergin® (Tab. II).

Market yield is the sum of categories Extra Class, Clas I and II Class. The fruits with deformed shape, mechanically damaged, dry, bite, small and affected by the disease were evaluated as a non-standard. Quality classification of 'Honeoye' and 'Symphony' cultivars in 2007 is shown on Fig. 1 and 2.

In the second year of experiment (2008) the first harvest of 'Honeoye' cultivar has been already

I: *Yields comparison for 'Honeoye' cultivar in 2007 and 2008*

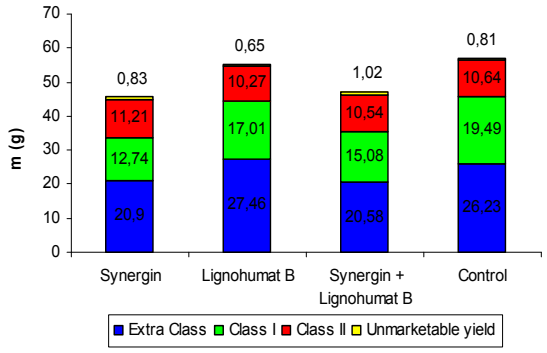
Treatment	Average fruit weight [g] 2007	Average number of fruits per plant 2007	Market yield [t.ha^{-1}] 2007	Average fruit weight [g] 2008	Average number of fruits per plant 2008	Marked yield [t.ha^{-1}] 2008
Synergin	6.71 a	6.68 a	3.74 a	12.79 a	18.76 a	**21.68 a**
Lignohumat B	7.30 a	7.52 a	4.56 a	14.44 a	16.35 a	21.64 a
Synergin + Lignohumat B	6.60 a	7.00 a	3.85 a	14.08 a	15.62 a	20.78 a
Control	7.13 a	7.90 a	**4.70 a**	14.12 a	13.81 a	17.82 a

Different letters between rows indicate statistically significant difference P ≤ 0,05 (Tukey test)

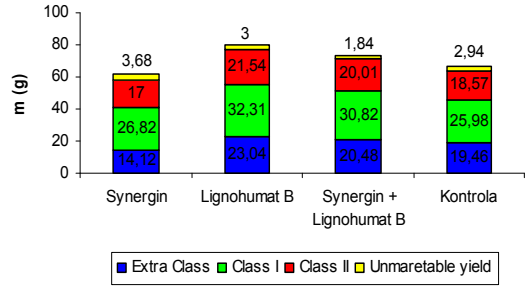
II: *Yields comparison for 'Symphony' cultivar in 2007 and 2008*

Treatment	Average fruit weight [g] 2007	Average number of fruits per plant 2007	Market yield [t.ha^{-1}] 2007	Average fruit weight [g] 2008	Average number of fruits per plant 2008	Marked yield [t.ha^{-1}] 2008
Synergin	6.34 a	9.14 a	4.8 a	12.17 a	27.89 a	29.73 a
Lignohumat B	6.70 a	11.47 a	**6.4 a**	12.74 a	29.07 a	**32.47 a**
Synergin + Lignohumat B	6.61 a	10.79 a	5.9 a	12.62 a	27.35 a	29.59 a
Control	6.72 a	9.53 a	5.3 a	12.29 a	25.69 a	27.73 a

Different letters between rows indicate statistically significant difference P ≤ 0,05 (Tukey test)



1: *Fruit quality classification of 'Honeoye' cultivar in 2007 [g.plant^{-1}]*



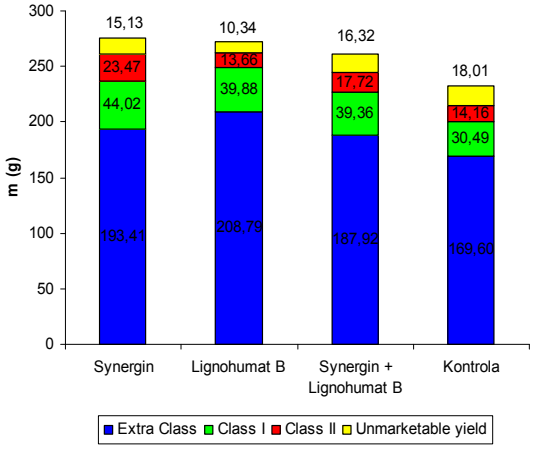
2: *Fruit quality classification of 'Symphony' cultivar in 2007 [g.plant^{-1}]*

on May, 26, the last one on June, 16. There were seven harvests in total. The largest market yield was harvested from variant treated with Synergin® (see Tab. I). The lowest yield was harvested from an untreated plot (control).

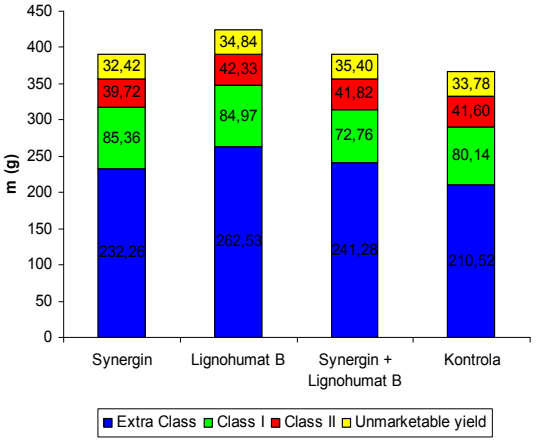
'Symphony' cultivar was harvested from June 2 to June 23, and had seven harvests as well. The largest marketable yield was harvested from plots treated with Lignohumat B, the lowest yield was harvested from control plot (Tab. II).

For studied cultivars, there weren't detected statistically significant differences in yields between variants. After evaluating the market yield for a two-year field experiment it was revealed that maximum yields were for variants treated with Lignohumat B (Tab. III). The yields were higher than Sikma states (2000). Fruit quality classification in the second year experiment is shown in Fig. 3 and Fig. 4.

The differences in vitamin C content for different variants were not statistically significant in one year.



3: *Fruit quality classification of 'Honeoye' cultivar in 2008 [g.plant^{-1}]*



4: *Fruit quality classification of 'Symphony' cultivar in 2008 [g.plant^{-1}]*

Though the application of both products increased vitamin C content in fruits. In 2007, the vitamin C content ranged for 'Honeoye' within the interval (279.0 to 831.0 mg.kg^{-1}) and 'Symphony' (192.0 to 920.7 mg.kg^{-1}). In 2008, measured for 'Honeoye' (218.04 to 830.66 mg.kg^{-1}) and 'Symphony' (from 189.79 to 631.31 mg.kg^{-1}). Measured values confirmed previously published data of the authors (Kopec, 1998) and (Hakala *et al.*, 2003).

The highest value of refraction for 'Honeoye' cultivar had fruits treated with Lignohumat B. The lowest was measured at a combination of Synergin®

III: *Comparison of two two-year market yields for 'Honeoye' and 'Symphony' cultivars in 2007–2008 and 2008–2009*

Treatment	Market yield in 2007 and 2008 [t.ha^{-1}] Honeoye	Market yield in 2008 and 2009 [t.ha^{-1}] Honeoye	Market yield in 2007 and 2008 [t.ha^{-1}] Symphony	Market yield in 2008 and 2009 [t.ha^{-1}] Symphony
Synergin	25.42 a	**38.63 a**	34.53 a	35.16 a
Lignohumat B	**26.20 a**	32.32 a	**38.87 a**	35.93 a
Synergin + Lignohumat B	24.63 a	34.07 a	35.49 a	36.08 a
Control	22.52 a	**38.63 a**	33.03 a	**38.72 a**

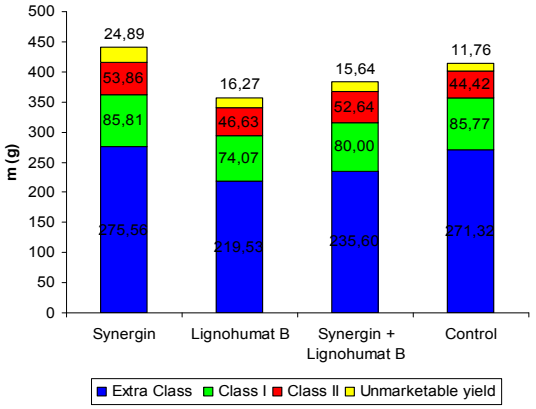
and Lignohumat B. The average value of this early cultivar in 2007 was 10.1 °Brix. 'Symphony' cultivar also had the lowest value of the refraction when treated with both preparations, but the highest after application of Synergin®. The average value of this late cultivar was 10.99 °Brix. Statistically significant difference was found neither between treatments nor between cultivars.

The harvest in 2008 of 'Honeoye' cultivar had the exact same values of refraction sequence of variants as in the previous year. The highest sugar content was after treatment with Lignohumat B and the lowest after joint application of both products. The mean refraction of 'Honeoye' cultivar in 2008 was 8.25 °Brix. 'Symphony' cultivar had the opposite sequence than in the previous year. The highest value was measured at treatment with both preparations and the lowest after application of Synergin®. The mean refraction in a given year was 7.91 °Brix (Fig. 8).

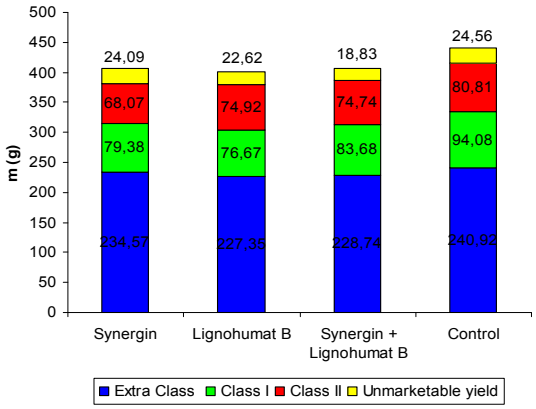
Trial No. 2 (2008–2009)

The harvest from new plantations of 'Honeoye' cultivar established in 2008 began on June, 12, and six harvests (3–4 day intervals) were finished on July, 1. The largest market yield was harvested from the untreated plots (control). The lowest was from the plots treated with Lignohumat B (Tab. IV).

The harvest of 'Symphony' cultivar began on June, 19, and five harvests were finished on July, 7. The highest yield reached the variant treated with two different preparations Synergin® and Lignohumat B, the minimum yield had variant treated with Synergin® (Tab. V). Fruit quality classification is shown in Fig. 5 and Fig. 6.



5: *Fruit quality classification of 'Honeoye' cultivar in 2008 [g.plant^{-1}]*



6: *Fruit quality classification of 'Symphony' cultivar in 2008 [g.plant^{-1}]*

IV: *Yields comparison for 'Honeoye' cultivar in 2008 and 2009*

Treatment	Average fruit weight [g] 2008	Average number of fruits per plant 2008	Market yield [t.ha^{-1}] 2008	Average fruit weight [g] 2009	Average number of fruits per plant 2009	Marked yield [t.ha^{-1}] 2009
Synergin	7.48 a	6.10 a	3.80 a	11.69 a	35.53 a	**34.83 a**
Lignohumat B	7.31 a	5.99 a	3.65 a	11.24 a	30.28 a	28.67 a
Synergin + Lignohumat B	8.14 a	6.06 a	4.11 a	11.56 a	31.87 a	29.96 a
Control	8.18 a	6.37 a	**4.34 a**	12.05 a	33.33 a	34.29 a

Different letters between rows indicate statistically significant difference P ≤ 0,05 (Tukey test)

V: *Yields comparison for 'Symphony' cultivar in 2008 and 2009*

Treatment	Average fruit weight [g] 2008	Average number of fruits per plant 2008	Market yield [t.ha^{-1}] 2008	Average fruit weight [g] 2009	Average number of fruits per plant 2009	Marked yield [t.ha^{-1}] 2009
Synergin	6.78 a	6.04 a	3.38 a	11.41 a	33.48 a	31.78 a
Lignohumat B	7.43 a	6.74 a	4.21 a	10.79 a	35.12 a	31.72 a
Synergin + Lignohumat B	7.52 a	7.12 a	**4.45 a**	10.94 a	35.38 a	31.63 a
Control	7.25 a	6.56 a	3.99 a	11.05 a	37.62 a	**34.73 a**

Different letters between rows indicate statistically significant difference P ≤ 0,05 (Tukey test)

In the second year of experiment (2009) the first harvest of 'Honeoye' cultivar has been already on May, 13, the last one on June, 12. There were nine harvests in total. The largest market yield was harvested from variant treated with Synergin®, the lowest yield was harvested after application of Lignohumat B (Tab. IV).

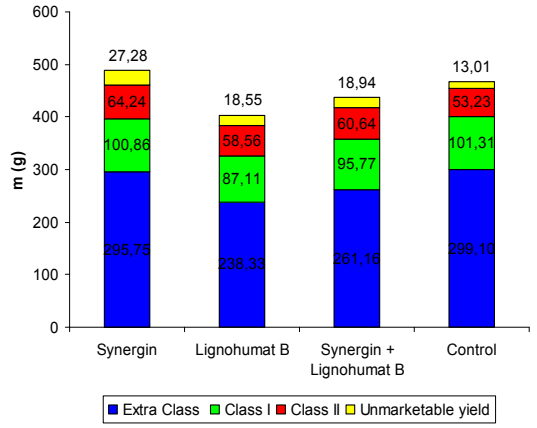
The total market yield found in two years showed that untreated plots and those with foliar application of Synergin® have comparable and the highest yield (Table III).

'Symphony' cultivar was harvested from May, 22, to June, 19, and had nine harvests as well. The largest market yield was harvested from untreated plots. The lowest yield was harvested from plot treated with Synergin® (Tab. V). The total market yield found in two years was of the highest value from untreated plots, without application of either Synergin® or Lignohumat B (Tab. III). Fruit quality classification of 'Honeoye' and 'Symphony' cultivars is shown in Fig. 7 and 8.

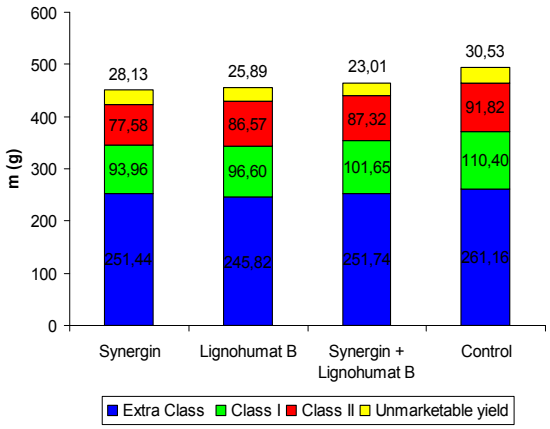
The differences in vitamin C content for different variants were not statistically significant in one year. Though the application of both products increased vitamin C content in fruits. In 2008, the vitamin C content ranged for 'Honeoye' cultivar within the interval (269.15–1 164.71 mg.kg^{-1}) and 'Symphony' (344.90–1 024.83 mg.kg^{-1}). In 2009, measured for 'Honeoye' (302.91–639.69 mg.kg^{-1}) and 'Symphony' (274.39–752.89 mg.kg^{-1}). Similar figures were reported by Voca *et al.* (2009), the vitamin C content in strawberries ranged from 407.3 to 466.8 mg.kg^{-1}. Similarly, Kumar *et al.* (2010), indicates the contents of vitamin C in strawberries 631.2 mg.kg^{-1}.

The highest value of refraction in 2008 for 'Honeoye' cultivar had fruits treated with Synergin®. The lowest was measured for control. The average value of this early cultivar in 2008 was 10.17 °Brix. 'Symphony' cultivar also had the lowest value of the refraction when treated with both preparations, but the highest after application of Synergin®. The average value of this late cultivar was 10.75 °Brix. Statistically significant difference was found neither between treatments nor between cultivars.

The harvest in 2009 of 'Honeoye' cultivar had the highest values of refraction, after the joint application of both products and the lowest for untreated control. The average value of this cultivar was 8.53 °Brix. 'Symphony' cultivar had the highest refraction value when treated with Lignohumat B and the lowest one for the combination of both products. The mean refraction in a given year was 8.95 °Brix.



7: *Fruit quality classification of 'Honeoye' cultivar in 2009 [g.plant^{-1}]*



8: *Fruit quality classification of 'Symphony' cultivar in 2009 [g.plant^{-1}]*

CONCLUSION

From obtained results it is evident that the auxiliary plant preparations Synergin® and Lignohumat B had not significant effects on yield and quality of strawberry in our experiments. They did not confirm the information from manufacturers of Lignohumat B and Synergin®, who state that the agent application increases yield and quality production.

'Symphony' cultivar is more suitable for organic production than 'Honeoye'. It was more vital, more profitable, and more drought resistant. Fruits are firm and well-transportable, whereas 'Honeoye' fruits are pressed and softened. The aroma was stronger and there is no diminution in the fruit as in the case of early varieties. The excessive rainfall caused fruits cracking of 'Honeoye' cultivar. Both varieties were very resistant to strawberry grey rot (*Botryotinia fuckeliana*). Both were reported only a weak presence of white spots on strawberry leaves (*Mycosphaerella fragariae*). The disadvantage of 'Honeoye' cultivar is a great susceptibility to root diseases (*Phytophtora fragariae, Phytophtora cactorum, Verticillium albo-atrum*, etc.). This cultivar requires structural soils that must not be heavy and waterlogged. Inappropriate land is the one that tired after strawberries. The advantage is early ripening, depending on the weather. In spring 2009 the first crop was already on May, 13. If all the conditions for cultivation of 'Honeoye' cultivar are followed both cultivars can be recommended to organic production.

In the first year of trial in 2007, the average yield of the 'Honeoye' cultivar was 50.54 g. per plant and in the first year of planting in 2008 it was 47.71 g. per plant. The yield of 'Symphony' cultivar in 2007 was 67.54 g. per plant and in 2008 it was 48.03 g. per plant. Odstrčilová (2010) found in the comparative cultivar experiment, that the yield of 'Honeoye' cultivar in the first year after planting on average was 40.4 g. per plant. For 'Symphony' cultivar it was 45.21 g. per plant.

In the second year of trial in 2008, the average yield of the 'Honeoye' cultivar was 245.62 g. per plant and in 2009 it was 381.3 g. per plant. The yield of 'Symphony' cultivar in 2008 was 358.82 g. per plant and in 2009 it was 390.02 g. per plant. Boček *et al.* (2010) found that the second year yield of 'Honeoye' cultivar was 348.7 g. per plant and for 'Symphony' cultivar it was 492.4 g. per plant.

In trial No. 1, the average yield for the two years 2007 and 2008 for the 'Honeoye' cultivar was 24.69 $t.ha^{-1}$ and for 'Symphony' 35.48 $t.ha^{-1}$. One plant of 'Honeoye' cultivar had an average yield of 296.16 g for the two years and 'Symphony' had 426.36 g. In trial No. 2 the average yield for the two years 2008–2009 for the 'Honeoye' cultivar was 35.91 $t.ha^{-1}$ and for 'Symphony' cultivar it was 36.5 $t.ha^{-1}$. On average for two years, the yield of one plant of 'Honeoye' cultivar was 429.27 g. and for 'Symphony' cultivar it was 439.02 g.

SUMMARY

The influence of auxiliary plant preparations such as Lignohumat B and Synergin® on the yield, quality of production and internal fruit quality of strawberries was investigated. The content in vitamin C and soluble solids was evaluated. The suitability of 'Honeoye' and 'Symphony' cultivars for the organic cultivation in the Czech Republic was also verified.

The trials were carried out in 2007–2009 on the plots of the Faculty of Horticulture, the Mendeleu. The conventional frigo plants were used, as organic plants is not yet certified in Czech Republic. The strawberries were planted in black non-woven film with drip irrigation pulled under. The method used was completely randomized blocks in split plots with 4 modalities of treatment in 4 replications of the 25 plants. A total of 1600 plants were planted. Lignohumat B was applied according to the manufacturer's instructions: soaking the root system, watering after planting, spraying on the leaves two weeks before flowering and after flowering in 1% concentration. Synergin® was applied before flowering by means of foliar sprayer and two weeks after flowering. Biostimulant Synergin® was applied before flowering by means of foliar sprayer and two weeks after flowering. Harvests were carried out in three to four-day intervals. Harvested fruits were classified into quality classes and weighed. The measurement with hand-held refractometer RR1 was made simultaneously. Vitamin C content was determined right after the harvest by means of HPLC.

Both cultivars were very resistant to grey rot of strawberries (*Botryotinia fuckeliana*). Both cultivars reported only a weak presence of white strawberry leaf spot diseases (*Mycosphaerella fragariae*). The 'Honeoye' cultivar was sensitive to the complex of soil pathogens, and there were significant plant outages. The excessive rainfall caused the fruit splitting. At the beginning of the harvest the 'Honeoye' cultivar had big fruits that then quickly became tiny. The 'Symphony' cultivar was more vital, more drought stress resistant. It had higher yields, which is typical for late cultivars. Strawberry aroma was pronounced. Fruits were firm and well-transportable, whereas the fruits of 'Honeoye' cultivar became pressed and soft. If all the conditions for cultivation of 'Honeoye' cultivar are followed this cultivar can be recommended for organic production. In trial No. 1 (2007–2008), the average yield for two years for 'Honeoye' cultivar was 24.69 $t.ha^{-1}$ and for 'Symphony' it was 35.48 $t.ha^{-1}$. The average yield per one plant for two years for 'Honeoye' cultivar was 296.16 g. per plant and for 'Symphony' it was 426.36 g. per plant. In trial No. 2 (2008–2009) the average yield for two years for 'Honeoye' cultivar was 35.91 $t.ha^{-1}$ and for 'Symphony' it was 36.5 $t.ha^{-1}$. The average yield per one plant for two years for 'Honeoye' cultivar was 429.27 g and for 'Symphony' it was 439.02 g.

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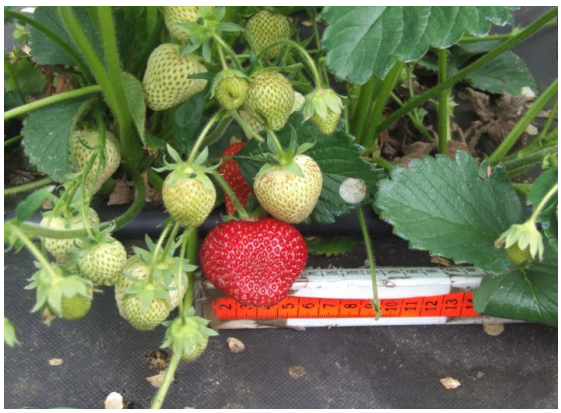
ANNEX

Photo of the trials No. 1 and No. 2

9: *Photo 1: Frigo plantings of 'Symphony*

10: *Photo 2: Trials No.1 and No.2 during flowering*



11: *Photo 3: Trial No.1, 'Honeoye' the second year of fruiting*

12: *Pfoto 4: Trial No. 2, 'Symphony' the first year of fruiting*

13: *Photo 5: 'Honeoye' cultivar treated with Lignohumat B*

14: *Photo 6: 'Symphony' cultivar treated with Lignohumat B*

Address

Ing. Šárka Kremláčková, doc. Dr. Ing. Petr Salaš, Ing. Stanislav Boček, Ph.D., Ústav šlechtění a množení zahradnických rostlin, Zahradnická fakulta v Lednici, Mendelova univerzita Brno, Zemědělská 1, 613 00 Brno, Česká republika, e-mail: patockovasarka@seznam.cz