A COMPARATIVE ANALYSIS OF FERTILITY CHARACTERISTICS OF CHILLI PEPPERS GROWN UNDER ORGANIC AND CONVENTIONAL CONDITIONS

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Abstract: The paper examines the possibilities of growing Chilli Habanero peppers (Red Savina Seed) in a protected environment under organic and conventional conditions. The experiment was conducted on 30 plants in five iterations. In the course of the aforementioned experiment various agricultural techniques were applied in accordance with the principles of organic and conventional production. The branches of pepper stems have been reduced to two with the aim of decreasing the number of sprouts and thus increasing the number and quality of yield. The harvest was conducted successively in accordance with the physiological maturation of the yield. The following indicators have been observed: average yield mass (g), the number of fruits per plant, average yield per plant (g) and yield per m² (g). On the basis of the results obtained in the course of this research study one can deduce that organic production of chilli pepper in a protected environment produces very good results. However, by comparing the yield components in the conditions of organic and conventional growth the authors became aware of significant differences in favour of conventional production, which can be compensated by a higher nutritional value and a higher price on the market.

Key words: chilli pepper, organic production, protected environment, fertility characteristics.

1. INTRODUCTION

Peppers (*Capsicum annuum* L.) are annual, frost tender plants belonging to the family of nightshades (*Solanaceae*). They are primarily produced for nutritional purposes but their edible fruit is also grown to obtain different types of industrial products. Red spice pepper is known worldwide and it is produced by drying and grinding fresh red pepper *Capsicum annuum* L. and *Capsicum frutescens* L. Peppers are an excellent source of healthy ingredients such as flavonoids, carotenoids, phenols and capsaicin [3]. They can lack heat or have sweet or hot taste, depending on the variety, while most of them belong to the *longum* variety (*Capsicum annuum* L. var. *longum*). Their hot taste comes from alkaloids called capsaicinoids, i.e. capsaicin and dihydrocapsaicin, which are responsible for the heat in more than 90% of hot peppers [2]. Health effects of capsaicin are derived from its antioxidant properties and anti-inflammatory effects, even its anti-cancer function [1] [8]. Aside from their hot taste, the quality evaluation of peppers depends also on their colour (red). Red colour in peppers depends on the effects of ketoacrotene, capsanthin and capsorubin, or carotenoids. Capsaicin has a specific function, since it inhibits the growth of *Helicobacter pylori*, depending on the dosage, at concentrations greater than 10 mg/ml. However, it does not inhibit the growth of *Escherichia coli*, which means that the consumption of chilli pepper varieties has a strong protective effect against *Helicobacter pylori* [5].

In the past two decades the organic food market has been continually growing. Although the USA, the EU and Japan are currently the main constituents of the demand for organic food products, the wave of demand for these products has been sweeping over to other parts of the world. Such market trend poses a clear invitation to manufacturers to respond with an

adequate offer to the current consumer demands. Aside from a conventional manner of production, in recent years we bear witness to the development of an organic production of peppers. Organic production is a method which, on the basis of elementary understanding of the processes in a grown plant and its relationship to the environment, resorts to the methods which do not endanger the environment.

2. WORKING MATERIALS AND METHODS

The paper examines the possibilities of organic production of the chilli Habanero variety, as well as its comparison to the conventional production in a protected environment. The authors have monitored 30 plants per either production methods.

2.1. Organic production

The sowing of seeds for the purposes of seedling production was performed into plastic containers with 230 holes in the period between 15th and 20th of January, 2017. The substrate Pindstrup with 60% of white and 40% of black peat was used. In the period between the sowing and transplanting (approximately 30 days) no additional supplement was used. The transplant of seedlings into the 7x7cm cups was performed at the end of February. Upon transplanting, the seedlings were fertilized with organic bio-fertilizer and the Slavol growth stimulator. The transplant of plants to their permanent location in the greenhouse was performed from 15th to 20th of April. Organic fertilized (ITALPOLINA 4:4:4) was used in the process of preparing the soil for planting. The planting density was 45 cm between the rows and 35 cm between plants in a row.

After the planting, predators of the genus *Swirskii* were inserted to control harmful insects. *Ambylesius swirskii* - a predatory mite originating from the eastern part of the Mediterranean feeds on various types of mites and insects, and is commonly used in biological control against greenhouse whiteflies and thrips. It is often used in greenhouse against silverleaf whitefly (*Bemisia tabaci*), greenhouse whitefly (*Trialeurodes vaporariorum*), larvae of the Californian thrips (*Frankliniella occidentalis*) and red spider mite (*Tetranychus urticae*, *T. cinnabarinus*).

The placement of bags with this predator was done in the zone of twigs, close to the flowers, 3 bags per 1m². During vegetation, the plants were treated with Extrasol (*Bacillus subtilis*), which has a microbiological and fungicidal effect. Weed control was done by weeding and hoeing. During the months of July and August, green aphids appeared, and their suppression was done with a solution of capsaicin. The solution was obtained by immersing 250g of the fruits in one litre of 96% medicinal alcohol and left in a dark place for 14 days in order to extract the capsaicin from the fruit into the alcohol. It is necessary to mix this solution three times a day every day for a better capsaicin extraction.

The peppers stems were limited to two branches, which reduced the number of sprouts, thereby increasing the yield and quality of fruits. The harvest was carried out successively in accordance with the maturation rate of the fruit, in physiological maturity, ie, when the fruits were red. The experiment was set in 5 iterations of 6 plants. The following indicators were monitored: the weight of fruit, the number of fruits per plant, yield per plant, fertility and yield per m².

2.2. Conventional production

The sowing of seeds for the purposes of seedling production was performed in plastic containers at the same time and in the same manner as with the organic production. After the sowing process, the containers were filled with fungicide Funomil in the amount of 10g

per 10l of water in order to prevent Phytium-induced root rot (*Phytium* sp.), as well as the Fusarium-induced wilting (*Fusarium* sp.). The transplant of breeds into 7x7cm cups was performed at the end of February. After the transplant, the plants were fertilized with organic and biostimulative fertilizer Humi Start 4: 12: 5, with a high percentage of phosphorus, humic, fulvo and amino acids enhanced by the substrate of algae and microelements. This ensured a better rooting and prevented the emergence of stress to low and high temperatures. After 5 days, the plants were fertilized again with the fungicide Signum in the amount of 8g/10 l of water.

The final transplant of seedlings to the greenhouse was carried out in the period between 15th and 20th of April. During the preparation of the soil for transplant, a high quality complex mineral fertilizer was applied (YARA MILA 13:13:21) with micro-elements in a chelate form in the amount of 500kg/ha. The planting was done at a distance of 45cm between rows and 35cm between plants in a row. During the vegetation, standard measures of crop protection were applied.

3. RESULTS AND DISCUSSION

The results of the examined properties in the organic production of chilli peppers of the Habanero variety are shown in Table 1. The highest weight of the fruit was 26.6g and the lowest was 16.7g, which is 19.7g on average. The largest number of fruit per plant was 60, and the smallest 49, which amounts to 55 fruits on average. The average yield per plant was 1062.7 g, the lowest yield per plant being 866.3 g, and the highest 1257.3 g. Regarding the yield per m², one can observe that the highest yield was 7544,0 g, and the smallest 5197,9 g, which is 6376,1 g on average.

Table 1. The results of examined properties of the organic production of the Habanero chilli peppers

Iterations	Weight of the fruit (g)	Number of fruits per plant	Yield per plant (g)	Yield per m ² (g)
1	21,2	56	1185,0	7109,8
2	25,7	49	1257,3	7544,0
3	17,8	60	1069,8	6418,8
4	16,7	52	866,3	5197,9
5	17,0	55	935,0	5610,0
Average	19,7	55	1062,7	6376,1
LSD 005	3,532		175,326	
001	4,743		210,517	

Table 2 shows the results of examined properties in the matter of the conventional production of the Habanero chilli peppers. In addition to the conventional production method, an ecological production of peppers has also been developing in recent years [6]. The largest weight of the fruit was 30.1g, and the smallest 18.2g, which is 24.1g on average. The determined masses of fruits are significantly higher than those indicated by other researchers [7]. The highest number of fruit per plant was 70, and the smallest 53, which is 61 fruit on average. The average yield per plant was 1475.7g, whereby the lowest yield per plant was 965.7g, and the highest 1710.5g. As for yield per m², one can observe that the highest yield was 10263,0 g, and the smallest 5794,0.

Table 2. The results of examined properties of the conventional production of the Habanero chilli peppers

Iterations	Weight of the fruit (g)	Number of fruits per plant	Yield per plant (g)	Yield per m ² (g)
1	30,1	56	1686,7	10120,3
2	26,3	60	1580,4	9482,4
3	25,5	67	1710,5	10263,0
4	20,5	70	1435,0	8610,0
5	18,2	53	965,6	5794,0
Average	24,1	61	1475,6	8854,0
LSD 005	4,211		288,768	
001	5,123		331,253	

Table 3 shows comparative results of investigated properties in both conventional and organic production. In the matter of conventional production, a higher average fruit weight of 4.4g was obtained. Likewise, in the case of conventional production there was a higher number of fruits per plant by 6. As for the average yield per plant, conventional production was expected to achieve a higher yield per plant by 413.0g, while the difference in yield per m² was 2480.8g in favour of conventional production.

Table 3. Comparative results of investigated properties in conventional and organic production

Method of production	Average fruit weight (g)	Number of fruits per plant	Average yield per plant (g)	Average yield per m ² (g)
Conventional production	24,1	61	1475,7	8854,0
Organic production	19,7	55	1062,7	6373,1
Differences	4,4	6	413,0	2480,9

4. CONCLUSION

On the basis of the results obtained in this study, it can be concluded that a successful organic production of chilli peppers of the Habanero variety in a protected area is possible. In conventional production, the peppers of the Habanero variety reached a higher mass of fruit by 4.4g. The number of fruits per plant was also higher by 6 fruits in conventional production. A higher yield per plant by 413,0g was achieved in conventional production. The difference in yield per m² was in favour of the conventional production by 2480.9g. All of these results indicate better fertility characteristics in cultivation under conventional production conditions, which was expected due to the high level of agro-technology and applied protection. However, taking into account the nutritional value and the higher price of organic products, which rarely goes beyond 30%, organic production of chili peppers, regardless of the lower productivity, becomes justified.

5. REFERENCES

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