

INVESTIGATION OF THE IMPACT OF BIOCHAR ON THE NECTARIFEROUS QUALITIES OF THE ZUCCHINI (*Cucurbita pepo* var. *giraumontia* Filov)

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Abstract

The aim of the study was to determine the influence of biochar, incorporated as a soil meliorant in the cultivation of zucchini, on the nectariferous qualities of their flowers. The experiment was carried out in 2017 on the experimental field of the University of Forestry – Sofia. In the spring cultivation of the soil were incorporated biochar and manure, and were developed different variants: 1) control - no biochar and manure; 2) only with manure – 4 t/ha⁻¹; 3) biochar - 500 kg/ha⁻¹; 4) manure + reduced amount of biochar (250 kg/ha⁻¹); 5) manure + optimal amount of biochar; 6) manure + increased amount of biochar (750 kg/ha⁻¹). For the purpose of the study it was followed: the development of the plants, the flowering duration, the number of flowers per plant and the amount of separate nectar and pollen. It was recorded the visit of bees on flowers of the studied plants. This determines the nectariferous potential of zucchini. The increase of nectar productivity by the flowers was observed in the variants with combination of biochar and manure.

Key words: bio char, *Cucurbita pepo* var. *giraumontia* Filov, honeybee, nectar productivity, zucchini.

INTRODUCTION

Some of the vegetable plants are of no importance to bees, and some of the more valuable honey plants. Grown throughout the country, as a separate area in mixed plantings which is why they are of interest to bees. These crops provide food for people and some of them are juicy fodder for domestic animals (Bizhev, 2003).

Cucurbita pepo is an one year dicotyledonous plant of the family Cucurbitaceae and constitute a separate variety group there to *ser. var. Giraumontia*. They come from Asia Minor. The valuable biological and economic qualities of courgettes have given rise, they are rapidly spreading to southern Europe and the Mediterranean. In our country they are grown in almost the whole country. The species from family Cucurbitaceae depend on the pollination of honeybees for fruit production. Representatives of this family have large yellow-colored colors, which emit a large amount of nectar and pollen and are visited very

well by bees. Female flowers produce large amounts of nectar, and males - mostly pollen and less nectar. They bloom for a long time and provide good grazing for bees.

Biochar not only enriches the soil with nutrients but also reduces acidity. It also creates more favorable conditions for the development of useful microflora and leads to increased yields. Inaccessible to the microorganisms compounds are embers of wood, which are carbonated materials, a product of incomplete combustion of different organic materials. The studies of Glaser et al. (2002) prove that charcoal is suitable for maintaining a high level of soil organic matter.

Biochar resulting from pyrolysis of plant materials are called bio-coal and are subject to research in some countries as a means of improving the structure and fertility of soils. This direction of their application dates back to at least 2500 years ago, as is the case for areas close to the Amazon river (Woods et al., 1999; Maris, 2006; Glaser, 2007).

Manure is characterized by its high content of macroelements, vitamins, growth regulators and useful microorganisms. Its use leads to an increase in yield and production quality. (Sreenivasatal., 2010; Natarjan, 2007).

The main objective is to study the impact of imported carbonated plant residues as a soil improver, on the nectariferous quality of the species *Cucurbita pepo var. giraumontia*. Determine the amount of individual pollen nectar from each variation.

MATERIALS AND METHODS

Studies were conducted in the learning experience of base "Hostile" of the University of Forestry - Sofia, in 2017. On alluvial meadow soil, an area of 150 m². The experiment was set by the standard method and circuit 100 x 60 x 50. After pretreatment of the soil are sized test Partselki. Biochar and manure were imported in March on the following scheme:

variant I - Control - cleansoil

variant II - Fertilizer 4 t/da = 140 kg

variant III - Biochar 500 kg/da = 23.5 kg

variant IV - Fertilizer 140 kg + Biochar 250 kg/da – 12 kg

variant V - Fertilizer 140 kg + Biochar 500 kg/da - 23.5 kg

variant VI - Fertilizer 140 kg + 2750 kg/da – 35 kg

variant VII – Fertilizer 4 t/da = 140 kg

Fenological and biometric measurements were performed on five plants of each variant in the phases - the beginning of flowering, the mass flowering and the end of flowering when the signs. We tested indicators by the method of Simidchiev 80: Start and duration of flowering; Flowering duration of a separate color; Number of colors on one plant; Amount nectar of 1 color for 12 h in mg; Percentage sugar content in the nectar; Quantity of pollen in mg;

RESULTS AND DISCUSSIONS

Despite the differences between experiments and control plants, it has to be noted that in the beginning of mass flowering the differences between the different variants are very small. At the beginning of blossom blossomed only female color, a few days later began flowering and onmalecolor.

Table1. Phenological indicators for zucchini related to the determination of the honey productivity

Variant	I	II	III	IV	V	VI	VII
Initial flowering (days)	08 June	08 June	08 June	08 June	08 June	08 June	08 June
Mass tsaf. (Days)	28 June	28 June	28 June	28 June	28 June	28 June	28 June
End of flowering (days)	10 July	10 July	10 July	10 July	10 July	10 July	10 July

Table 2. Flowering duration for *Cucurbita pepo var. giraumontia*

Variant	I	II	III	IV	V	VI	VII
Flowering time. per plant (days)	33 days	33 days	33 days	33 days	33 days	33 days	33 days
Initial flowering (days)	2 ♀	2 ♀	2 ♀	2 ♀	2 ♀	2 ♀	2 ♀
Mass tsaf. (days)	7 ♀, 6 ♂	7 ♀, 6 ♂	7 ♀, 6 ♂	7 ♀, 6 ♂	7 ♀, 6 ♂	7 ♀, 6 ♂	7 ♀, 6 ♂
Duration of tsaf. one color (days)	4 days	4 days	4 days	4 days	4 days	4 days	4 days

♀ - female color, ♂-malecolor

Table 3. Quantity of nectar and sugar content in colors of *Cucurbita pepo var. giraumontia*

Variant	Amount of nectar of 1 color in (ml)		Sugars in the nectar, (%)		Amount of pollen,(mg)
	♀-color	♂-color	♀-color	♂-color	♂-color
I	75.5	70.5	29.9	31.5	0.15
II	76.9	72.6	30	32.9	0.2
III	78.6	73.1	31.6	32.7	0.14
IV	89.5	72.8	30.5	32.6	0.2
V	89.9	73.2	37.2	35.1	0.22
VI	89.4	73	30.9	31.8	0.23
VII	76.9	72.5	30	32.9	0.2

From female flowers, a greater amount of nectar was released in all assay variants from 75.5 mg to 89.9 mg. Because of the species specificity of *Cucurbita pepo var. giraumontia*, we recorded lower nectar values in male flowers from 70.5 to 73.2 mg. Sugar content in nectar is relatively high from 29.9% to 37.2% with a maximum of 40% sugar content. Highest values are reported for V variant. Our results are close to those of Massimo 1993, 2001.

The obtained results show that the biochar introduced into the soil has a positive effect on

the color of the zucchini (Table 1, Table 2). For variants VI, V and VI the colors produce higher amounts of nectar and pollen (Table 3).

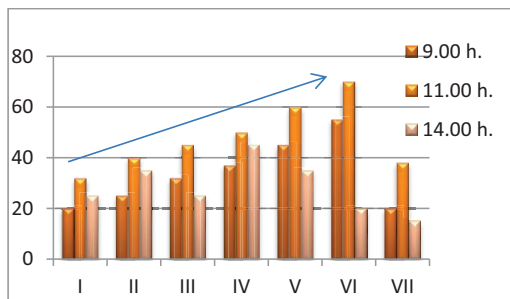


Figure 1. Visiting the bees by the colors of *Cucurbita pepo* var. *girumontia*.

Figure 1 shows that bees began to visit flowers in 9:00 hours. Mass visit was reported with increasing temperature and solar radiation for 11 hours and then decline before closing color. The highest number of bees was recorded for option VI. The inputs of biochar and manure in the soil in this variant have a favorable effect on the quantities of nectar and pollen which have been shown, as evidenced by the higher values shown in Figure 1.

CONCLUSIONS

The results of this study show that the colors of *Cucurbita pepo* var. *girumontia* produce an abundance of nectar and pollen that are available in quantities sufficient to maintain bee families in large plantations. Through proper farming practices create the most favorable conditions for plant growth, and indirectly to improve separation of the nectar.

The increase in nectar production by the colors is observed in the bio-manure and manure variants.

In conclusion, it can be concluded that the introduction of these soil improvers is reflected positive on all tested signs.

ACKNOWLEDGEMENTS

This research work was carried out with the support of: Project №158 / 2017 Investigation of the influence of biochar on soil fertility and agricultural crop development.

Project BG05M2OP001-2.009-0034 "Support for the Development of Scientific Capacity at the University of Forestry".

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