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STUDY ON THE INFLUENCE OF THE TYPE OF SUBSTRATE AND THE QUANTITY UPON THE TOMATO CROP

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Abstract

The research aims to present the influence of the type of substrate and the irrigation frequency upon the tomato crop. With this occasion the modern irrigation equipment will be tested too. The study was conducted in the research center Hortinvest in the frame of the University of Agronomic Sciences and Veterinary Medicine of Bucharest. The biological material used was the tomato hybrid 'Cindel'. In order to obtain reliable conclusions we provided the same quality parameters of irrigation water, using the same technology and culture in all experimental variants. The main goal of this research was to identify the best irrigation norms on culture in order to achieve a sustainable crop production with a precocious development. During the growing season we monitored vegetative growth and biometric measurements and determined the duration of each phenological phase, depending on the technique used. Objectives consist in establishing the percentage of early production to the total output depending on the culture substrate and to determine the early production on the variants grown on a substrate made of perlite and coir; determine the total production per plant, the allocation on quality ranks of the total production obtained with the perlite substrate and coir substrate.

Key words*: modern irrigation, substrate, tomato hybrid.*

INTRODUCTION

Tomatoes occupy a significant place in the crops within protected space, greenhouses or solariums. Under the conditions set out in our country, in the last few years, it can be established an increasing interest of some vegetable producers for the unconventional crop technologies that open new attractive prospects for the professional growers (Atanasiu, 2009).

Plant production in hydroponics and soilless culture is rapidly expanding throughout the world, raising a great interest in the scientific community (Raviv and Lieth, 2007).

Soilless crop has a series of advantages:

- The production grows with 20-25%, compared with the soil culture. On tomatoes there have been obtained productions of 40.5 kg/m2 in greenhouse in the first crop cycle;
- The early maturity of the tomato crop is within 10 days compared to the conventional crop;
- The steam or chemical disinfection of the soil is not necessary;
- The rotation of the crops is also not necessary;
- Because of the lower humidity of atmosphere, there are created less favourable conditions for the emergence of diseases;
- There is a better product quality (the tomatoes have more solid fruits that are rich in sugars and vitamin C);
- Complete automation conditions of the technological processes are created.

The temperature values during the vegetation and fructification period can largely influence the tomato crop (Drăghici and Dobrin, 2014). In recent years, the use of soilless culture has increased significantly throughout the world (Grillas et al, 2001). More than 60% of the vegetable greenhouses in the Netherlands are cultivated using rockwool media, but it is costly and difficult to dispose because it is not biodegradable and environmental friendly. Perlite which is less expensive than rockwool

has been used as soilless culture substrate around the world for successful production of vegetables, in the greenhouse (Asaduzzaman, and all. 2007).
The quality of the planting material can largely influence the crop (Drăghici, 2014), and also the fertigation and irrigation norm (Tüzel et al. 2008).
The consumption of nutrient solution in the case of hydroponic growing is an important technological and economic matter. It should be emphasized from the beginning the fact that all variants of crops within the hydroponic growing are characterized by low water consumption, which is very important for the expansion of horticultural production in where water resources are insufficient for the classical horticulture. In the long term, in the context of global warming, the matter of economic use of natural resources is becoming more important, especially in the case of water used for human consumption and irrigation.
The consumption of water (nutrient solution) for unconventional crops depends on the species, phenophase plant height and the surface of the appliance foliar, temperature, light, atmospheric humidity and soil. The nutrient solution flows from the place where it's prepared, from the bottom of the plants, throughout the drip irrigation system. The fitted nozzles of the drip irrigation systems have flow rates of 2/4 l /hour at a water pressure of 1 bar. The according flow rates are ensured by activating the irrigation system for a pre-set period of time. (Atanasiu, 2009).

MATERIALS AND METHODS

The experiments were executed in the greenhouses of the Research Centre Hortinvest, University of Agronomic Sciences and Veterinary Medicine of Bucharest, in the first crop cycle, year 2014. In the experiment we have used the Cyndel tomato hybrid (Figure 1). Variety description: extra-early hybrid with indeterminate growth, opened habits, airy, recommended for cultivation in protected crops or open fields.

Figure 1. The tomatoes hybrid CINDEL F1

The plant is vigorous, highly productive, produces uniform fruits of medium size, resistant to storage and transportation. Weight of a fruit: 120 - 130g. Fruit colour: dark red.
Cultivation method: direct seeding, seedling. We used two types of substrate: 1. mattresses filled with perlite with a grain size of 4 mm; 2. coir mattresses.
In the crop we applied specific care work in the greenhouse culture that consisted of: trellising, removing shoots shoot tipping, defoliation of basal leaves, inflorescence limit of the number of fruit, ensuring pollination using bumblebees. All growth factors were monitored.
The fertigations were made daily through the nutrient solution, the distribution of the solution became computerized. The nutrient solution was determined according to the recipe, based on the water analyses. The recipes were made according to the development stage of the plant – for the vegetative phase, the flowering and fruiting phase.
Throughout the whole period the pH was intended to be of 5.5-5.7, the electroconductivity of 2.8-3.0 mS/cm (depending on development stage) and the drainage was intended to be between 3.8 and 4.2 mS/cm. The amount of each nutrient solution for fertigation was of 50 ml/plant in the first 4 weeks, then 120 ml/plant. The number of watering was correlated with the growth of the plants. We have observed: the influence of crop substrate and of the irrigation on early and total crop, and also the standard quality of the crop.

RESULTS AND DISCUSSIONS

In the data presented in Figure 2 we can see that the variant grown on coconut substrate has obtained a smaller early production than the early production obtained on the perlite substrate, 26.04 % and 32.91% from the total production.

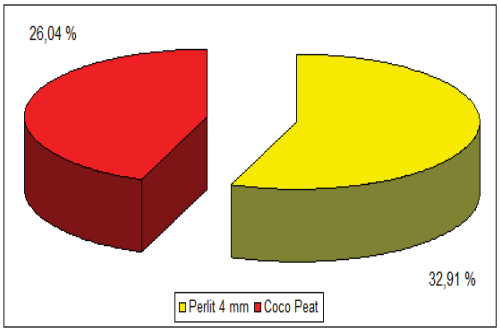

Figure 2. The percentage of early production to total output depending on the culture substrate

Early production was of 4.1 kg/m^2 on the variant planted with perlite and only 2.83 kg/m^2 on the variant grown on coir substrate (Figure 3).

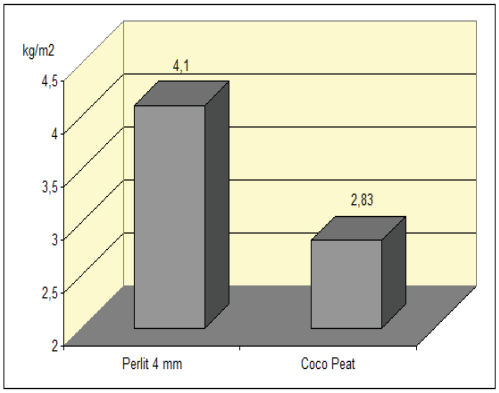

Figure 3. Early production established on the variants grown on a substrate made of perlite and coir

The total production was 12.46 kg/m^2 on the variant grown on perlite substrate and only 10.87 kg/m^2 on the variant grown on coir, Figure 4.

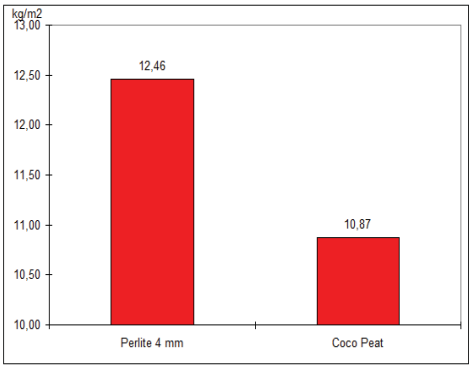

Figure 4. The total production obtained per plant

If we analyze the fruit percentage according to the quality standard, we notice that the highest percentage of fruit for the first quality category was registered in the variant grown on perlite, of 73.84% of total production. The percentage of under standard fruit was of only 12.84% (Figure 5).

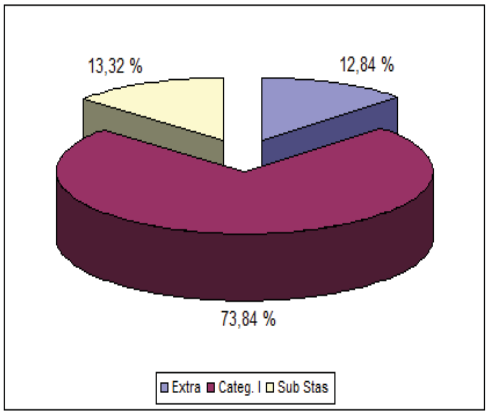

Figure 5. The allocation on quality ranks of the total production obtained with the perlite substrate

The highest percentage of fruit registered in the category Extra, of 20%, was also obtained in the variant cultivated on coir substrate. The fruit percentage under quality standard obtained was of 14%, being composed of split fruit, small or damaged fruit (Figure 6).

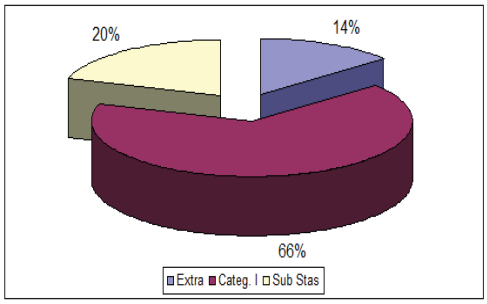

Figure 6. The allocation on quality ranks of the total production obtained with the coir substrate

CONCLUSIONS

The crop's substrate had an influence on the early production of tomatoes, having 4.1 kg/m^2 in the variant cultivated on perlite and only 2.83 kg/m^2 in the variant cultivated on coir substrate. Although the difference in the production between the two variants was of 1.59 kg/m^2, we appreciate that by achieving early production, revenues are higher in the case of the perlite culture.

The highest percentage of fruit in the first category was achieved in the variant grown on perlite substrate. This also indicates a certain uniformity of its production.

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