THE INFLUENCE OF THE MICROCLIMATE FROM POLYETHYLENE TUNNELS ON THE PRODUCTION OF CUCUMBERS IN THE PERIOD 2007-2009, AT HUSASĂU DE TINCA-BIHOR

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Abstract

In the present study there was examined the microclimate of two polyethylene tunnels of different sizes – S1 of smaller size and S2 the larger – containing the experimental culture of cucumbers of gherkins type. The microclimate in polyethylene tunnels was studied in the period of 2007-2009, the period in which polyethylene tunnel were occupied by the experimental culture: 1st of July to the 10th of October. The study of the microclimate evolution in the two polyethylene tunnels made in parallel with the one from outside. The result was that S2 polyethylene tunnel heats slower, but cools down more slowly, creating a more favourable microclimate for cucumber plants, compared with the S1 polyethylene tunnel. Air humidity has lower values up to 4% in the polyethylene tunnel S2, due to the opening of its large heads and abundant circulation of dry air from outside. The analysis of microclimate elements in the three experimental years showed more favourable conditions for growing cucumbers of gherkins type in 2008, compared with 2007 and 2009, the influence of these elements being found on the fruit production.

Key words: air temperature, microclimate, protected space, humidity, protected culture.

INTRODUCTION

The importance of climatic factors – mainly temperature, precipitation and wind regime – is emphasized by their powerful influence on growth and fructification of cucumber plants, both in open field and in protected areas. Heat is a factor of prime importance for obtaining high and quality yields. Plants growth under low temperatures (5°C), leading to delays in obtaining few and untypical fruits. Switching plants to 25°C brings the processes back to normal. The microclimate created in polyethylene tunnels directly influences the physiological processes of plants inside and thus the processes of growth, fruition and production (Mănescu, 1977).

MATERIAL AND METHODS

The experimental culture of cucumbers of *gherkins* type was placed in two polyethylene tunnels of different sizes, which influence more the temperature, namely:

- Polyethylene tunnel 1 (S1) with a length L = 50 m, width l = 5.5 m and height h = 2.5 m;

- Polyethylene tunnel 2 (S2) with a length L = 50 m, width l = 10 m and height h = 4 m.

The coating film was also of a different nature. Thus, we used in the polyethylene tunnel S1 a polyethylene film of type Kritifil and in the polyethylene tunnel S2 there was used a Luminal 4 film of Visqueen Company.

Solar radiations enter the polyethylene tunnels during the day, warming the soil and air. At night, the heat "escapes" through 3 mechanisms:

- infrared radiations (IR) with a large length of wave (7-14 microns) that are sent towards the atmosphere;
- circulation in the inside of the polyethylene tunnel towards the outside, because of the difference of air pressure;
- transmission through the film.

All these lead to a rapid decrease in temperature and sometimes lead to so-called "temperature inversion", when the temperature inside the polyethylene tunnel drops below the outside temperature.

For the cucumbers culture, air humidity is an important factor and the best of it is in the range of 80-90%. This parameter was measured at different intervals in the two polyethylene tunnels, throughout the culture.

The microclimate in polyethylene tunnels was studied in the period of 2007-2009, the period in which polyethylene tunnels were occupied by the experimental culture: 1st of July to the 10th of October. The study of the microclimate evolution in the two polyethylene tunnels made in parallel with the one from outside.

RESULTS AND DISCUSSIONS

Analyzing air temperatures in the two polyethylene tunnels, in 2007, we could observe a little difference: the polyethylene tunnel S1 temperatures are higher than those of S2 polyethylene tunnel. This is because in the smaller polyethylene tunnel (S1) the daily maximum is higher; the spread between maximum and minimum is higher.

The S2 larger polyethylene tunnel heats slower, but cools down more slowly, creating a more favourable microclimate for cucumber plants. Higher temperatures in the polyethylene tunnel S2 compared to polyethylene tunnel S1 are recorded in September 2007 and they exceeded by about 1ºC the temperatures from the smaller S1 polyethylene tunnel. The explanation consists of the nights were colder and polyethylene tunnels were completely closed at night, during this period.

In the analyzed period, the highest average air temperatures were recorded between 22 and 27 July 2007, in the first polyethylene tunnel reaching 33.4°C, respectively 28.9ºC in the polyethylene tunnel S2 (fig. 1).

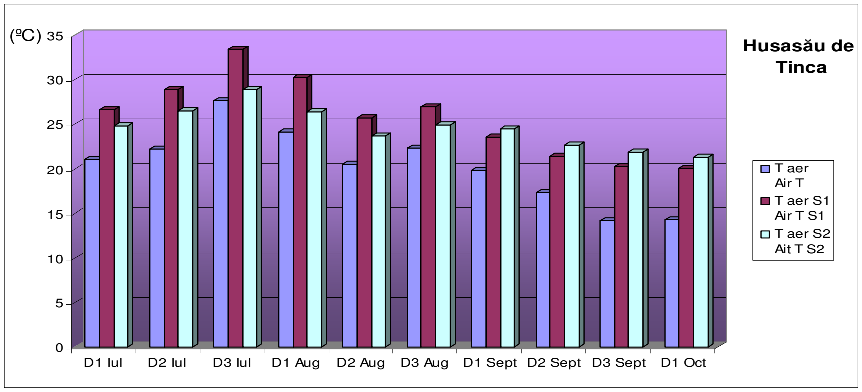

Fig. 1. Air temperature outside the polyethylene tunnels and air temperature in the polyethylene tunnels S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September and 1st decade of October 2007.

The relative air humidity in 2007 was of 71.2-88.7 % in the polyethylene tunnel S1 and 69.5-86.9 % in the polyethylene tunnel S2. Lower values of relative air humidity were recorded throughout the July and first decade of August, due on the one hand, high temperatures of this year, and on the other hand, low volume of plants (fig. 2).

Comparative data from the two polyethylene tunnels indicate lower air humidity values up to 4% in the larger polyethylene tunnel S2, due mainly to the opening of its large heads and abundant circulation of dry air from outside; or it knows that the summer of 2007 was hot and dry.

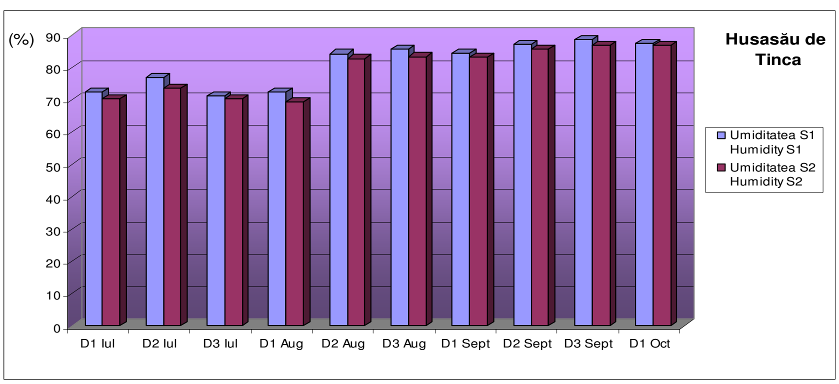

Fig. 2. Air humidity in the polyethylene tunnels S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September and 1st decade of October 2007.

Analysing on the whole the year 2008, in terms of climate, it is found that this year had an average annual temperature (11.1ºC) lower than that of 2007 (12.6ºC), the last one being the warmest year of the period occupied by the experimental culture. The year 2007 had a thermic deviation from the multiannual average of +2.4ºC and a total of 10 warm months, compared with 2008 and 2009, which accumulated a total of 7 warm months each of them. The year 2008 was a warm year, and 2009 a hot one, in terms of their deviations from the multiannual average.

In 2008, temperatures in the two polyethylene tunnels had favourable values for growth and development of cucumber plants, except the second half of September, when the temperatures dropped more, being associated with an increased cloudiness. The temperature values in the two polyethylene tunnels have evolved similarly to those in 2007. Thus, in the S1 polyethylene tunnel the highest average temperature was 28.8ºC, and the lowest average temperature was 17.1ºC, compared to 2007 when the highest average temperature was 33.4ºC and the lowest of 20.3ºC. In the polyethylene tunnel S2 the highest average value was 27.9ºC and the lowest 19.5°C, compared to 2007 when the highest average temperature was 28.9ºC and the lowest 21.9°C.

Comparing the temperature values of the two experimental years in the two polyethylene tunnels it can be seen that in the polyethylene tunnel S1 there were recorded somewhat higher values than in the second polyethylene tunnel, except the last two decades of September, when in the polyethylene tunnel S2 the average values raised up to 2.4ºC in 2008 (fig. 3). This shows, once again, that the more favourable temperatures were recorded in the larger S2 polyethylene tunnel.

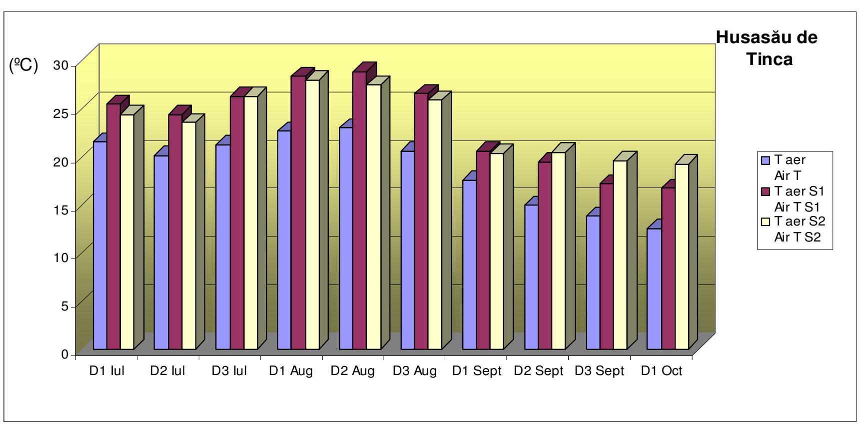

Fig. 3. Air temperature outside the polyethylene tunnels and air temperature in polyethylene tunnel S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September and 1st decade of October 2008.

In the figure 4 we see that, in 2008, the relative air humidity recorded valuesbetween 68.3 to 80.4 %, values that were somewhat higher in smaller S1 polyethylene tunnel. The highest values of air humidity were recorded in both solariums, in September.

Thus, in S1 polyethylene tunnel the highest value of air humidity was recorded between September 21 to 26, reaching 80.4 %, at the same spell, in the polyethylene tunnel S2 the humidity being 79.6 %.

The lowest humidity value was 70.3 % in the polyethylene tunnel S1, being produced between August 10 to 15, 68.3% respectively in the polyethylene tunnel S2, registered in the same spell.

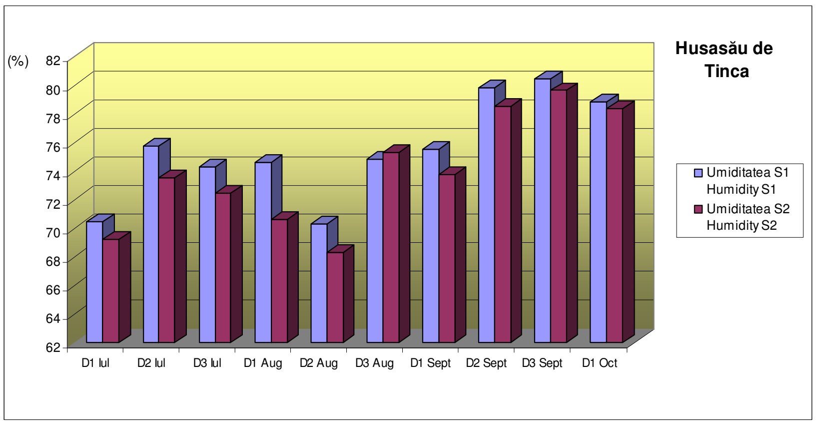

Fig. 4. Air humidity in the polyethylene tunnels S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September and 1st decade of October 2008.

As noted above, the experimental year 2009 was a hot year, with slight increases in air temperature outside and inside of the polyethylene tunnels, compared with 2008. The average annual temperature of 2009 was 11.6ºC. This year, temperatures recorded values of between 17.8 to 29.2ºC in the smaller polyethylene tunnel S1, respectively 19.7 to 28.4ºC in the polyethylene tunnel S2. The temperatures in the two polyethylene tunnels have also evolved in 2009, similar to those of the years 2007 and 2008, when the daily ventilation was maintained at temperature favourable for the development of plants (fig. 5).

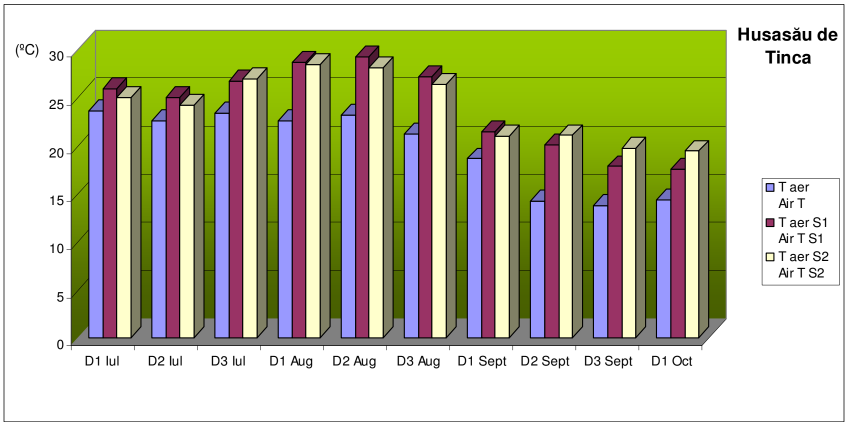

Fig. 5. Air temperature outside the polyethylene tunnels and air temperature in polyethylene tunnel S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September and 1st decade of October 2009.

Regarding the air humidity in the two polyethylene tunnels it is noted that the recorded values between 69.8 to 81.6 % are very close to the requirements of cucumbers to this important factor for growth and fructification (fig. 6).

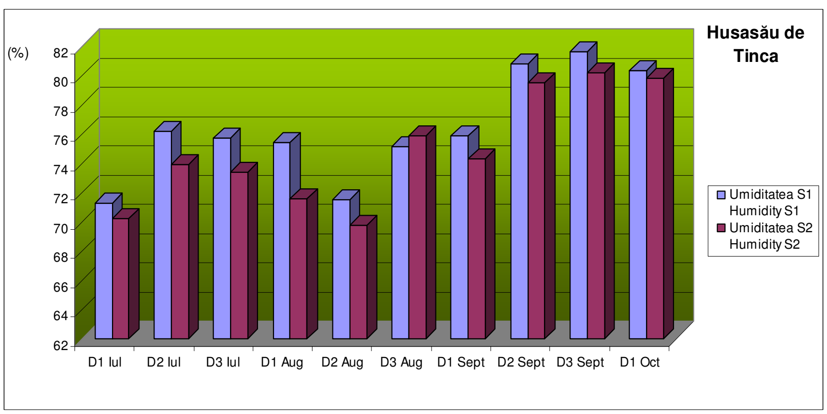

Fig. 6. Air humidity in the polyethylene tunnels S1 and S2 at Husasău de Tinca, in the 3 decades of the period July-September an 1st decade of October 2009.

CONCLUSIONS

1. The year 2007 was the warmest year of the analyzed period, especially the last decade of July. The year 2008 – the period occupied by experimental culture – was a warm year, although in the second decade of September the temperatures dropped more, being associated with a high cloudiness. It was, however, the coldest year of the analyzed period. The year 2009 was similar, in terms of heat to 2008, but it was considered a hot year.

2. Analyzing the evolution of temperature in the larger polyethylene tunnel S2, we see that it heats slower, but cools down more slowly, creating a more favourable microclimate for cucumber plants, compared with the smaller S1 polyethylene tunnel.

3. Comparative data from the two polyethylene tunnels indicate lower air humidity values up to 4% in the larger polyethylene tunnel S2, due mainly to the opening of its large heads and abundant circulation of dry air from outside.

4. Analyzing the overall the microclimate elements in polyethylene tunnels in the three experimental years, there can be noted much more favourable conditions for growing cucumbers of *gherkins* type in 2008, compared with 2007 and 2009, the influence of these elements being found directly on the fruit production.

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