

THE IMPACT OF DIFFERENT COLOUR NETWORKS ON YIELD AND QUALITY OF TOMATO

Vladimir Sabadoš*, Danijela Žunić

Agricultural extension services "Sombor", Serbia

Abstract

Extremely high temperatures have been adversely affecting most vegetable crops for years, primarily disrupting physiological processes, reducing yields and product quality, increasing the possibility of pests and diseases. In order to reduce the negative impact of extremely high temperatures, Agriculture Extension Service "Sombor" set up an experiment with the use of shading nets with different colors and varieties of consumer tomatoes Rio Grande and Kruna during the two years 2020 and 2021. In addition to the control variant, variants with other colors: green, blue, black and gray. The results of the experiment show that the application of shading nets affects the lushness, early maturity, yield quality, reduction of diseases, pests, protection from hail and increase yields. The experiment was set up in a drip system using black mulch foil. In this way of production, the advantages of shading nets are simple and mobile construction, as well as the possibility of use for many years. The disadvantages of shading nets are the significant investment in production during the first year. The application of this technology is recommended for the production of tomatoes on smaller areas because it contributes to stable and better production.

Keywords: high temperatures, tomato, vegetable production, yield

1. INTRODUCTION

In the second half of the last century, science and profession began with serious warnings that humankind on the earth's ball threatened climate change. From the middle of the last century, especially since 1970, there has been a trend of increasing the average global air temperature. High temperatures strongly affect the intensity of transpiration. Plants respond to stress by decreasing the intensity of breathing and synthesizing nutrients, as well as by increasing the reflection of radiation energy. Physiologically, injuries to plants and plant parts obtained from high temperatures depending on the intensity and length of exposure. Direct injuries lead to an imbalance of metabolism and changes that are present as membrane injuries, loss of fat, protein, and denaturation of nucleic acids (Ilić Z., et al., 2007). In order to protect the plants and yields of the pepper from the undesirable effect of high solar radiation, it is used to shade the crops by using colored networks. Nets in color represent an additional tool in the management of light quality.



Picture 1. The influence of high temperatures on yields of tomato (burns) on the field

2. MATERIALS AND METHODS

2.1. Methods

In order to enable the production of high - quality vegetables in vegetable production, the most modern technological solutions are applied. In order to contribute to the reduction of the negative impact of extremely high temperatures we used the shading nets in the trial field of Agriculture Extension Service "Sombor" (Serbia) as a special agrotechnical measure, characteristic for the production of tomato, which significantly contributes to the reduced negative effect of abiotic factors on the growth, quality and yield of tomato. At the end of the 1960s, shading net was used in Europe. The most famous factories were a location in England and Italy. Over time, this technology has found a way into other parts of the world. Nets, in addition to basic protective use, have the function of protection against birds, insects, and wind. The benefit of the color network includes an extension of harvest time, increased yields, improved quality and agro-economic performance of the yield (Shalom Y. and Gussakovsky E.E., 2004). Filtered sunlight through a photoselective net, shows the influence and quality improvement and yield (Oren - Shamir et al., 2001). In order to solve the problem in the field of Agriculture Extension Service "Sombor" (Serbia), its implemented trial experiment with different colors of the shading net: Blue, green, black and grey. An experimental trial was set in the period 2020 and 2021. The varieties of tomato that were represented for a period of 2 years are in Rio Grande and Kruna. Trials filed with the use of shading net is set in 3 repetition, in the "drop by drop" system with the application of a mulch foil. With each variant, a control plot was set up.

Variety Rio grande (picture 2) is strong-shaped, with an average weight of 150 grams, it is medium early variety of determinant tomato in the type of tomato plum. Suitable for manual and mechanized picking. Yields weigh about 80-100g, uniform shape, intense red color with few seeds. Ideal for cooking, mashing, juices and processing, but also for fresh use. Sowing is from spring from February to the end of April. If it is grown in a greenhouse throughout the year (if it is grown in a greenhouse, artificial pollination is necessary). Seeds are sown in warm pots or in compost containers. Compost for sowing is a mixture of peat substrate, sand and burnt manure. Seeds are covered with 1.5-2 cm compost. Warm beds or containers are covered with foil until the seeds start to germinate and then removed. It is plucked after 20 days of germination. Germination at temperatures above 15 °C, germinate in 4-20 days. Requires light and moderate humidity.



Picture 2. Variety Rio grande in the experimental field of PSS "Sombor"

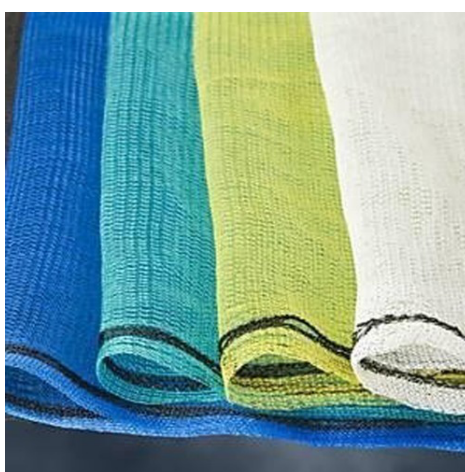
Variety Kruna (picture 3) is a low variety of pink yield. Yields weighing about 140 g are very firm and fleshy, with 2-3 chambers in cross section. The plant is weakly lush and can withstand higher densities, eg 80 x 40 cm. it can also be grown from direct sowing. The yields are resistant to cracking and diseases that occur in plants grown on the ground. It is recommended for field production in protected areas.



Picture 3. Variety Kruna on the experimental field of PSS “Sombor”

2.2. Materials

Manufacturers offer nets that range from 10 to 90%. Recommended vegetable density are nets that shine from 30 to 40%. They are most commonly produced from high-density polyethylene and can be used for more seasons. Shading nets are made of UV - resistant material and are suitable for use over several seasons, minimum two. Setting up nets is relatively simple. When installing the structure, it is necessary to lift the pillars over which the net is clinging and stretching. Nets are manufactured in different diameters of 1.20, 2.00, 3.60, 4.00, 6.00 and 7.50 mm depending on the purpose.



Picture 4. Different dimensions and colors of shading net

The nets are placed on wooden structures (picture 5). Tomato seedlings were produced in greenhouse production, i.e. the type of container seedlings in PSS "Sombor". During the entire vegetation, the protection parameters were monitored and adequate protection of tomato plants was performed.



Picture 5. Wooden structures on experimental field PSS “Sombor”

Nets can be found in different colors. Although it is said to be a shadow net, it at the same time reduces the amount of light, the intensity of UV rays and the temperature. Shading nets have additional functions such as making cold for domestic livestock and pets.

3. RESULTS AND DISCUSSION

3.1. Results in year 2020

During 2020, four nets were tested on the experimental field of PSS "Sombor": green, blue, gray and black. In addition to these variants, there was also a control variant.

The results show that the yield on the cultivar Rio grande on the variant with blue net showed a statistically significant difference, i.e. 77.7 t/ha compared to the control of 63.7 t/ha. Statistically significant difference of 14.0 t/ha. The second variant, which proved to be statistically significant, was 68.9 t/ha on the gray mesh variant, i.e. 8.8 t/ha higher than in the control. Other variants showed a lower contribution compared to the control.

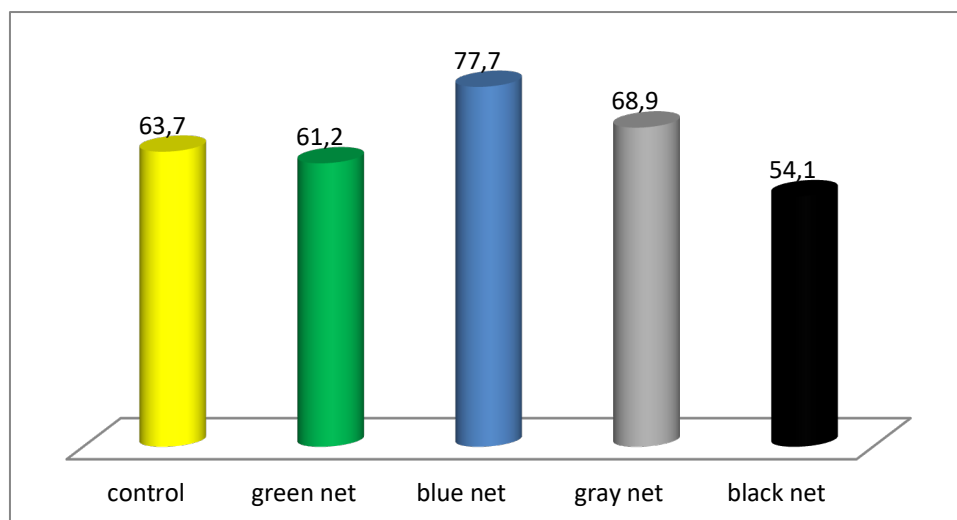


Fig. 1. Graphical presentation of the yield (t/ha) results of the experiment with the application of nets of varieties Rio grande

In the cultivar Kruna, the variant with black net 86.2 t/ha showed a statistically significant difference in relation to the control 78.1 t/ha. The statistical difference is 8.10 t/h. Other variants showed lower yields compared to the control.

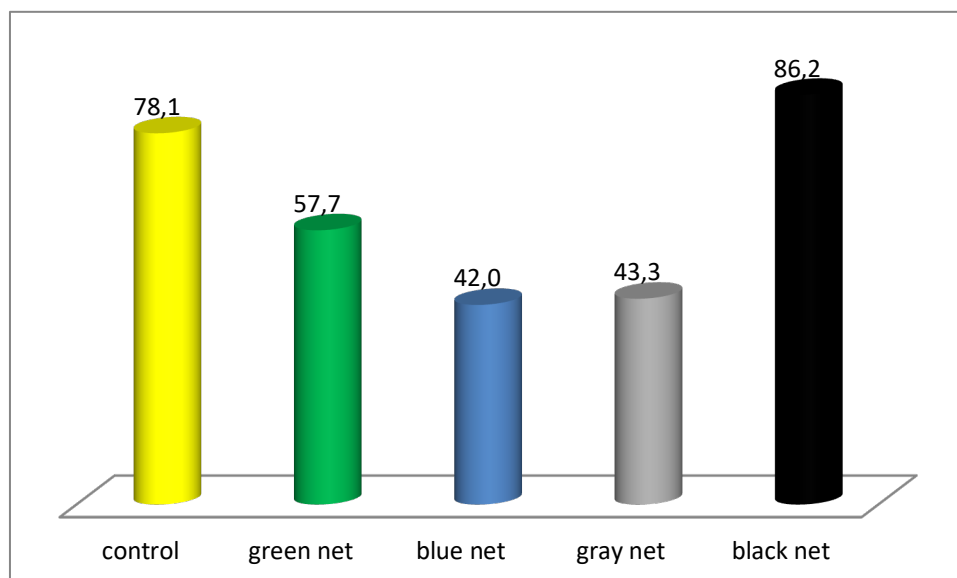


Fig. 2. Graphical presentation of the yield (t/ha) results of the experiment with the application of nets of varieties Kruna

In the cultivar Rio grande on morphological characteristics, the weight of the yield on the variant with black net showed a greater difference of 130.1 grams per yield compared to the control 121.9 grams, while the variety Kruna also on the variant with black net 166.8 grams showed higher weight compared to a control of 146.8 grams. Also, in the variant with black net we had an increase in dry matter in the cultivar Rio grande 4.1 in relation to the control, while in the cultivar Kruna also in the variant with black net we had an increase of 3.2 in relation to the control 2.8.

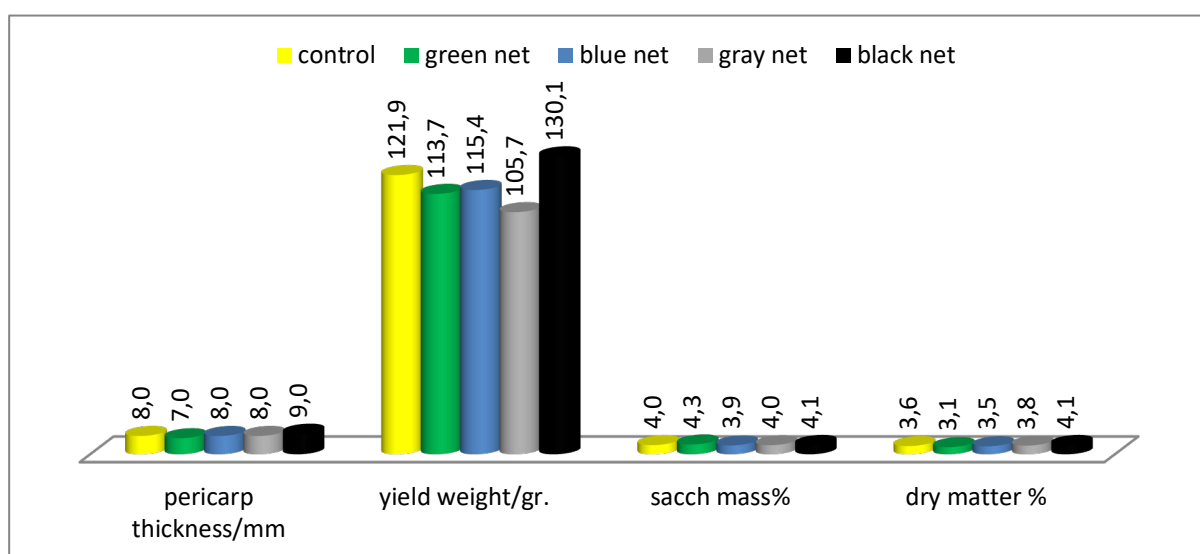


Fig. 3. Graphical presentation of the results of morphological parameters of experiments with the application of networks on varieties Rio grande

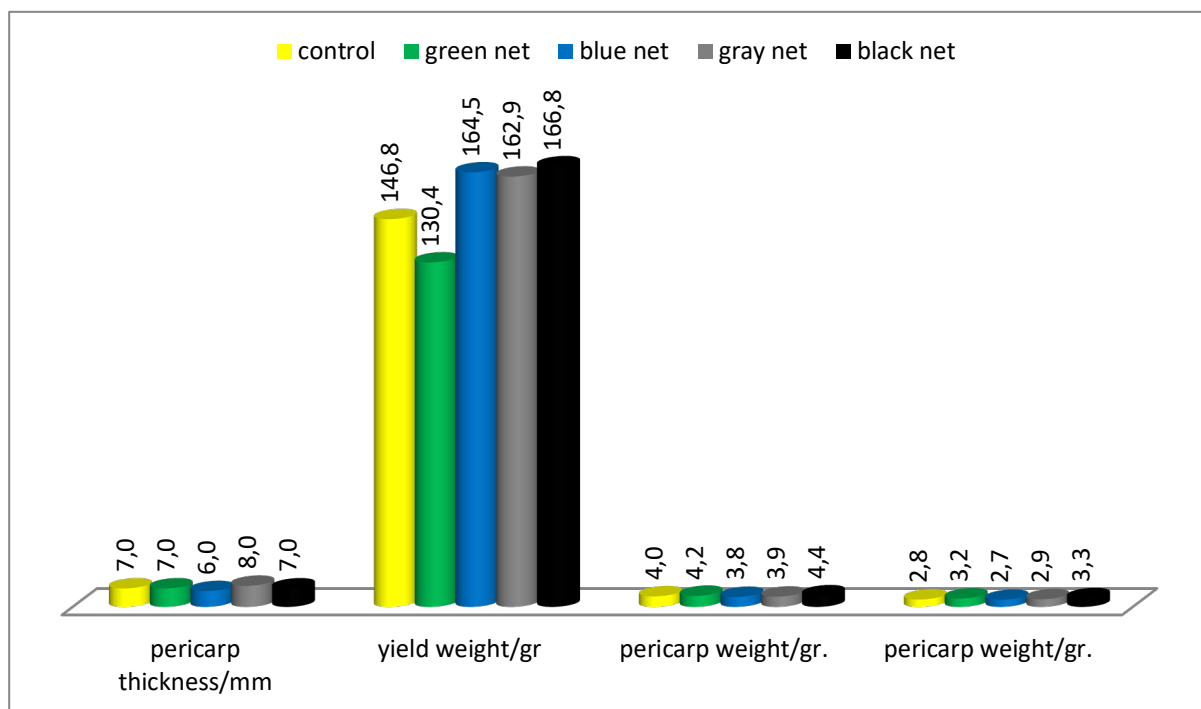


Fig. 4. Graphical presentation of the results of morphological parameters of experiments with the application of networks on varieties Kruna

In 2020, the variant with a black net proved to be the best, both due to the increase in yield and the morphological characteristics that were monitored during the vegetation and post-harvest parameters. Also, the percentage of damage on the control of both varieties and all variants showed a statistically significant difference in relation to the control.



Picture 6. Nets in 2020 years in the experimental field

3.2. Results in year 2021

During 2021, in the Rio Grande variety, we had a statistically significant increase of 88.3 t/ha in the gray net variant compared to the control of 74.2 t/ha. Also, on the variant with black net 81.3 t/ha, a significant increase compared to the control.

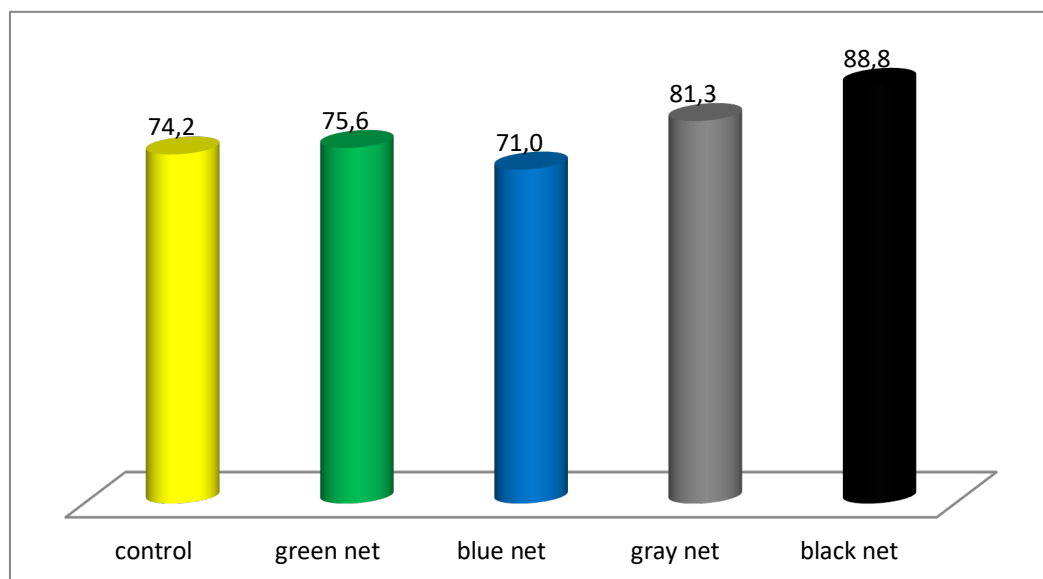


Fig. 5. Graphical presentation of the yield (t/ha) results of the experiment with the application of nets of varieties Rio grande

There was no statistically significant increase in the variety Kruna in 2021.

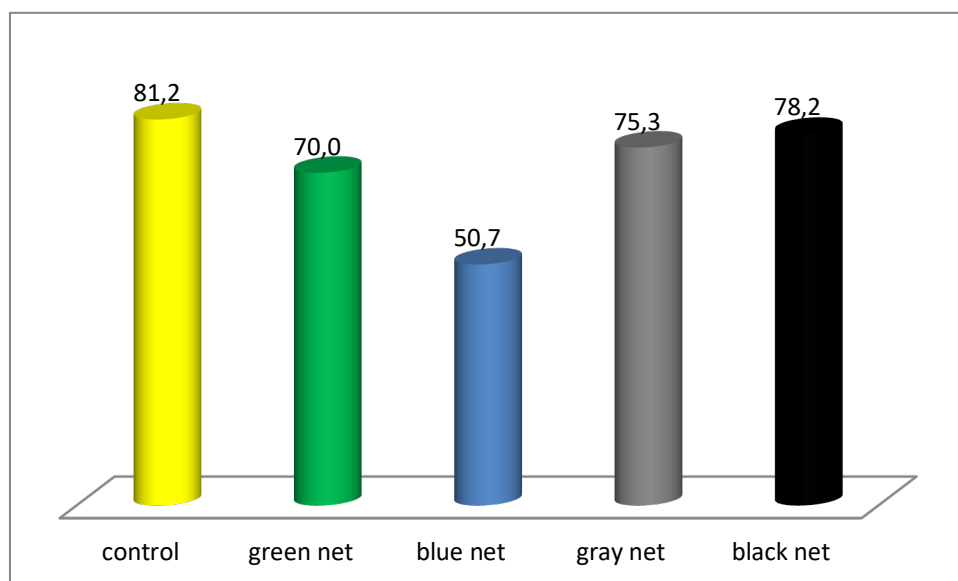


Fig. 6. Graphical presentation of the yield (t/ha) results of the experiment with the application of nets of varieties Rio grande

What has certainly been noted is a drastic reduction in yield damage from insects, sunburn, etc. under the net in any variant. What turned out to be interesting was the very large difference in the cultivar Rio grande in the individual measured yield weight on the variant with a black net of 97.6 grams compared to the control of 81.1 grams. Also in 2021, in the Rio Grande variety, the sugar content increased by 0.8-1.0% in all variants, and the dry matter content was 5.4 higher in the black net variant compared to the control. 5.0. In the variety Kruna in 2021, the weight of the yield was statistically significant 147.4 grams compared to the control of 133.6 grams. Also, on the variant with the green network, we had an increase in sugar content of 4.7% compared to the control of 4.0%.

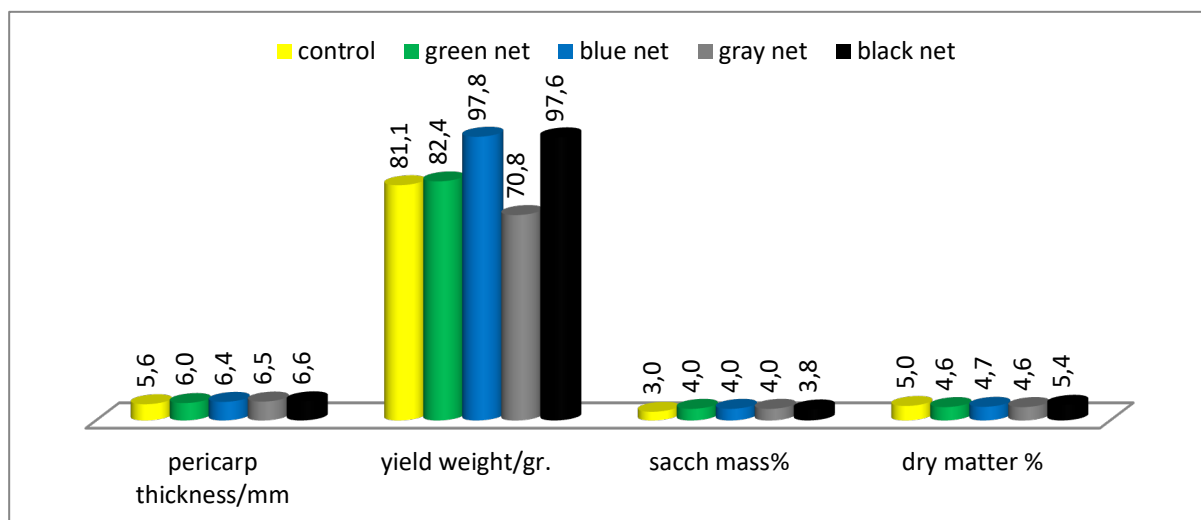


Fig. 7. Graphical presentation of the results of morphological parameters of experiments with the application of networks on varieties Rio grande

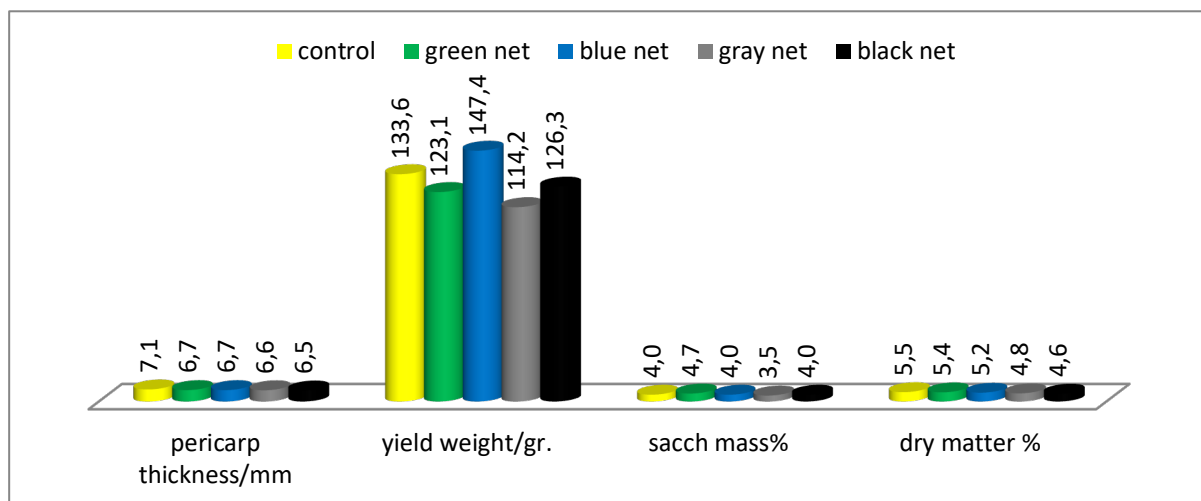


Fig. 8. Graphical presentation of the results of morphological parameters of experiments with the application of networks on varieties Kruna



Picture 7. Nets in 2021 years in the experimental field

Variants with black, blue and gray net, depending on the variety, proved to be the best. On average, we had the best yields on the varieties with black net, while during both years of testing and both variants we had a significant reduction in yield damage compared to the control. Based on these results, we can certainly propose to agricultural producers the use of nets to protect crops as well as to increase yields, reduce yield damage, protect against UV radiation, protect against insects and improve yield quality. We will certainly continue our research in the future in the experimental fields of PSS "Sombor".

4. CONCLUSIONS

Due to climate change, it will be necessary to slowly start finding adequate solutions for vegetable production. Extreme temperatures certainly adversely affect vegetable production itself and adversely affect physiological processes. This can be one of the protection measures on areas under vegetable production. The application of this technology is also recommended for the production of paprika on smaller areas, but it is also interesting for the production of blue eggplant. The advantages of the color grid include prolonging the harvest time (early and late ripening), increasing the yield, improving the quality and the overall agro-economic effect of the yield. (Shahak Y. and Gussakovsky E.E., 2004). In addition, the importance of network applications is also reflected in the protection of plants from hail and insects.

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