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THE INFLUENCE OF SOME COVER MATERIALS ON THE CHLOROPHYLL AND ANTHOCYANIN CONTENT OF SWEET PEPPER PROTECTED CROPS

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INTRODUCTION

Extreme phenomena (sunburn, hail, heavy rains, etc.) make it increasingly difficult to grow pepper plants in the open field. As a result, the pepper crop areas protected with polyethylene or textile materials is continuously increasing in Romania. In Europe, the largest area is occupied by crops protected with polyethylene and shading textiles (Ombódi et al.).

The textile industry is characterized by the diversity of raw materials which are used for the production of shading textiles. They are organic and inorganic (Dierickx and Van Den Berghe, 2004). Additives and pigments added during textile manufacturing are resistant to sunlight and weather (Mansfield, 2005).

Textile structures are used to protect pepper crops from extreme phenomena due to changes in climatic conditions (Ajmeri, 2016; Ferrándiz, 2017; Pooja, 2019). The cultivation in protected areas covered with agrotextiles provides good protection against some extreme weather events such as hail (Gruda et al., 2019; Olle and Bender, 2010; Pooja, 2019). The use of agrotextiles contributes to better plant development (Ferrándiz et all. 2017), protects crops against weed growth and prevents insect attacks, all without affecting the interaction between air and water.

The properties of textil material depend on the fibers used for their production, type and conditions of manufacture (Ajmeri, 2016; Mondal, 2008). Textiles must withstand solar radiation and various atmospheric temperatures and must be effective against climate change and wind, and create a microclimate between soil and agrotextil to balance temperature and humidity.

The netex must be biodegradable to avoid the pollution of soil and the environment (Ajmeri, 2016; Böttjer et al., 2019).

The type of cover materials at protected pepper crops influences the chlorophyll content of pepper plants (Ombódi et al. 2015).

This study aimed to contribute at the knowledge on the effect of different materials (polyethylene, glass, and shading nets) on the chlorophyll and anthocyanin content of pepper cultivated in protected area.

MATERIAL AND METHODS

The experiments were carried out at the Vegetable Research - Development Station Bacau in protected and open field crops of pepper – Dariana Bac variety (Table 1).

Table 1. Study of chlorophyll and anthocyanin content of pepper in open field and protected crops

No. Variants	Crop conditions
V1	Laboratory conditions, at the sun
V2	Laboratory conditions, in shade
V3	Greenhouse crop at the sun
V4	Greenhouse crop in shade screen
V5	Shaded screen plants with green textiles at the sun
V6	Shaded screen plants with green textiles in shade
V7	Plants in shading screen conditions with black textiles at the sun
V8	Plants in shading screen conditions with black textiles in shade
V9	Plants in field conditions, at the sun (control)
V10	Plants in field conditions, in shade

The study of chlorophyll content was performed with OPTI-SCIENCES CCM 200 plus chlorophyll meter by optical absorbance in two different wavebands (653 nm and 931 nm). The measurement was performed at 3 samples from each variant. The limits of variation and the average of the chlorophyll content for each variant were established.

The estimation of anthocyanin content of sweet pepper was performed with OPTI-SCIENCES ACM 200 plus anthocyanin meter by optical absorbance in two different wavebands (530 nm and 931 nm). OPTI-SCIENCES ACM 200plus is designed to measure anthocyanin content and compensate for leaf thickness.

The measurement was performed at 3 samples from each variant. The limits of variation and the average of the anthocyanin content for each variant were established.

The maximum day temperature was 18-32°C with peaks up to 40°C.

The obtained results will be used in future researches in organic and conventional agricultural systems in open field and protected area in order to decrease incidence of extreme phenomena conditions in sweet pepper crops.

RESULTS AND DISCUSSIONS

The study of optical absorption in the 653 nm and 931 nm wavelengths (close to infrared) showed different values of chlorophyll content (CCI) indices, depending on climatic conditions and pepper coating materials (Table 2) .

Table 2. Study of the influence of some cover materials on chlorophyll content index (CCI) at sweet pepper plants

No. var.	Specification	Limits of variation	Coments
1.	Laboratory conditions, at the sun	7,7 – 10,6	Plants need artificial lighting
2.	Laboratory conditions, in shade	7,7- 11,0	Plants need artificial lighting
3.	Greenhouse crop at the sun	8,4-11,0	-
4.	Greenhouse crop in shade screen	8,2-11,2	-
5.	Shaded screen plants with green textiles at the sun	10,4-11,2	-
6	Shaded screen plants with green textiles in shade	10,5-11,3	-
7	Plants in shading screen conditions with black textiles at the sun	10,3-10,7	-
8	Plants in shading screen conditions with black textiles in shade	9,8-10,8	-
9	Plants in field conditions, at the sun (control)	7,4 – 11,9	Pepper plants need shade
10	Plants in field conditions, in shade	8,2 – 11,2	-

Analyzing the presented data, it is observed that pepper plants in laboratory conditions, in the sun or in the shade, require artificial lighting, because the chlorophyll content decrease at 9.6-9.7 CCI. It is observed that the highest chlorophyll content had the pepper plants covered with green textiles (variants 5 and 6), 10.8 CCI, at the sun or in the shade (fig 1). On the 2nd place was the variant 7 - Plants in shading conditions with black textiles, in the sun with 10.5 CCI. It is followed by V8 Plants in shading conditions with black textiles, in the shade with 10.3 CCI. Plants in greenhouse conditions, in the sun and in the shade had the same chlorophyll content, 10.0 CCI.

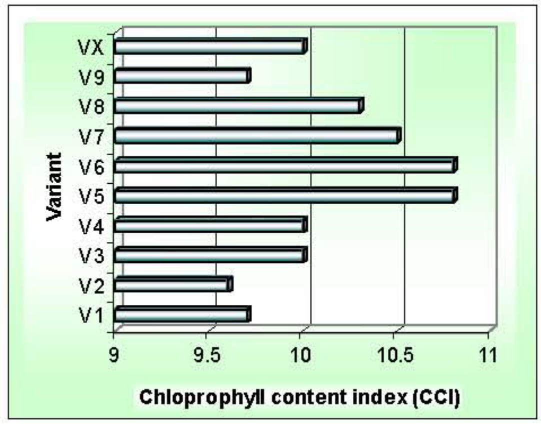

Fig. 1. Chlorophyll content index (CCI) at cover variants of sweet pepper plants

The study of the optical absorption in the 530 nm and 931 nm wavelengths revealed different values of the anthocyanin content indices (ACI), related to the climatic conditions and the cover materials of the pepper crops (table 3).

Table 3. Study of the influence of some cover materials on content indices (ACI), at sweet pepper crops

No. var.	Specification	Limits of variation	Coments
1.	Laboratory conditions, at the sun	3,5-4,1	Plants need artificial lighting
2.	Laboratory conditions, in shade	3,5-3,9	Plants need artificial lighting
3.	Greenhouse crop at the sun	3,8-4,1	-
4.	Greenhouse crop in shade screen	3,7-4,2	-
5.	Shaded screen plants with green textiles at the sun	4,1-4,5	-
6	Shaded screen plants with green textiles in shade	4,2-4,4	-
7	Plants in shading screen conditions with black textiles at the sun	4,3-4,5	-
8	Plants in shading screen conditions with black textiles in shade	4,2-4,6	-
9	Plants in field conditions, at the sun (control)	3,7-4,1	Pepper plants need shade
10	Plants in field conditions, in shade	3,8-4,4	-

It is observed that pepper plants in laboratory conditions, in the sun or in the shade, require artificial lighting, because the anthocyanin content being the lowest 3.7-3.8 ACI.

The highest anthocyanin content was found in pepper plants covered with black textiles (variants 7 and 8), 4.4 ACI, both in the sun and in the shade. On the 2nd place were the variants 5 and 6 ith 4.1 - 4.5 ACI. Plants in shading conditions with green textiles, in the sun and in the shade had 4.3 ACI (fig. 2). Control variants 9 and 10 (Plants in field conditions, in sun and shade - control) had 10.1 anthocyanin content index.

In greenhouse conditions, in the sun and in the shade, the pepper plants had a content of 4.0 ACI (fig. 2).

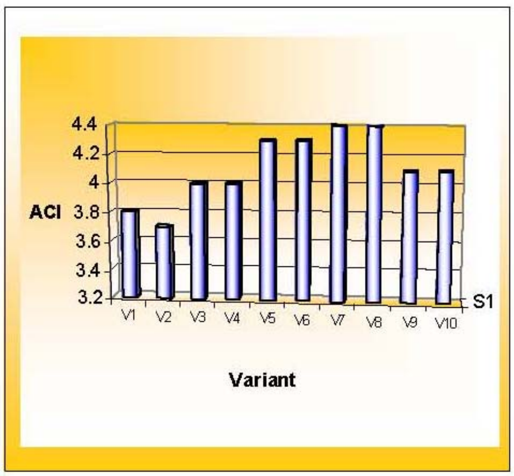

Fig. 2. Variation of the anthocyanin index (ACI) in pepper plants in greenhouse conditions

CONCLUSIONS

The study of optical absorption in the 653 nm and 931 nm wavelengths (close to infrared) showed different values of chlorophyll content (CCI) indices, depending on climatic conditions and pepper coating materials.

Pepper plants in laboratory conditions, in the sun or in the shade, require artificial lighting, because the chlorophyll content decrease at 9.6-9.7 CCI. The highest chlorophyll content had the pepper plants covered with green textiles (variants 5 and 6), 10.8 CCI, at the sun or in the shade. On the 2nd place was the variant 7 - Plants in shading conditions with black textiles, in the sun with 10.5 CCI. It followed by V8 Plants in shading conditions with black textiles, in the shade with 10.3 CCI. Plants in greenhouse conditions, in the sun and in the shade had the same chlorophyll content, 10.0 CCI.

The study of the optical absorption in the 530 nm and 931 nm wavelengths revealed different values of the anthocyanin content indices (ACI), related to the climatic conditions and the cover materials of the pepper crops

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In greenhouse conditions, in the sun and in the shade, the pepper plants had a content of 4.0 ACI.

ABSTRACT

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The study of the optical absorption in the 530 nm and 931 nm wavelengths revealed different values of the anthocyanin content indices (ACI), related to the climatic conditions and the cover materials of the pepper crops.

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In greenhouse conditions, in the sun and in the shade, the pepper plants had a content of 4.0 ACI.

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