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Lettuce quality in greenhouse with different technological levels

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Abstract

Technologies for protected lettuce (Lactuca sativa) crop have been gaining ground in scientific studies, in search of alternatives which increases productivity, quality and loss reduction in the production of the most consumed leafy vegetable in Brazil. Greenhouses provides to crops controlled conditions of temperature and relative humidity, to held within the optimal ranges for plant development and ensuring thermal comfort. This research work assesses the influence of greenhouses with different technology levels (natural ventilation, red shade net and evaporative cooling system) on lettuce grown and quality attributes. The study was held at FEAGRI/UNICAMP, conducting a 45-days growth cycle of green and ruby 'mimosa' lettuce seedlings in pots with pine bark substrate drip-irrigated with nutrient solution. At the end of the cycle, plants were assessed in terms of their physical and physico-chemicals atributtes and chlorophyll and anthocyanin contents. Red shade net intensifies red spectral band and promotes high rates of vegetative and radicular growth. Leafy vegetable growing in greenhouses with shade net enhances bioactive compounds and pigments synthesis, in addition to thermal comfort conditions, increases anthocyanins content. Better quality atributtes are achieved in thermal comfort provided by using evaporative cooling system for vegetable crop in greenhouses.

Key words:

Anthocyanin, evaporative cooling, red shade net.

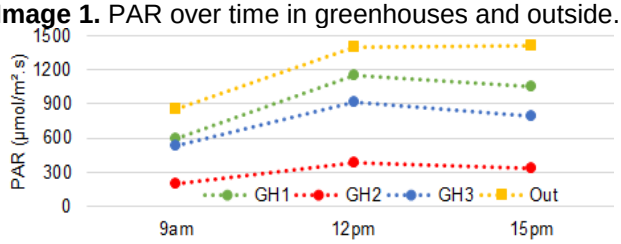
Introduction

A strong imbalance between population growth and world food demand has been required to reduce food losses and wastage. Protected crop promotes benefits, increasing productivity, availability and quality in food growing in greenhouses, providing to crops controlled conditions of temperature and relative humidity, to held within the optimal ranges for plant development and ensuring thermal comfort. However, cooling is essential to achieve these conditions in tropical and subtropical regions, especially in the summer, although the most part of greenhouses in Brazil are still at low technological and climate control levels. This research work assesses the influence of greenhouses (GH) with different technology levels (natural ventilation (GH1), red shade net (GH2) and evaporative cooling system (GH3)) on lettuce (*Lactuca sativa*) grown and quality attributes, conducting a 45-days growth cycle of green and ruby 'mimosa' lettuce seedlings in pots with pine bark substrate drip-irrigated with nutrient solution. At the end of the cycle, plants were assessed in terms of their fresh and dry mass, plant length, number of leaves, moisture content, pH, soluble solids, total titratable acidity, color parameters and chlorophyll and anthocyanin contents.

Results and Discussion

High PAR (Photosynthetically Active Radiation) values were noticed at 12pm in GH1, GH3 and GH2, in decreasing order, as shown in Image 1.

Image 1. PAR over time in greenhouses and outside.



There was a 28% drop of PAR by 5-years use plastic cover (GH3) compared to new plastic cover (GH1). By comparing GH1 to GH2, PAR decreased 68% due red shade net in GH2.

Chart 1. Average temperature (Tair) and relative humidity (RUair) of the air over time in greenhouses.

Time	Tair (°C)			RUair (%)		
	GH1	GH2	GH3	GH1	GH2	GH3
9am	29	29	15	65	63	79
12pm	37	38	31	45	42	62
15pm	41	40	33	35	37	58

T averages were higher in GH1 than GH2 and GH3, respectively, due natural ventilation (GH1, GH2) versus evaporative cooling (GH3), while RU were inversely proportional. Lettuce in GH2 presented the highest mass (106.7g green; 82.4g ruby) and length (26.0cm green; 25.1cm ruby) due red spectral band intensification by red shade net, which stimulates vegetative growth. Anthocyanin content was higher in ruby lettuces than in green ones, since this pigment is responsible for ruby color. The highest anthocyanin content was achieved in GH3 ruby lettuces (1.15mg.100g^{-1}), since them are increased under thermal comfort and good quality and quantity of incident radiation. There were no substantial differences in chlorophyll content and physico-chemical attributes for different environments and lettuce varieties.

Conclusions

Longer usage time of plastic cover entails transmissivity decrease of solar radiation in greenhouse. Red shade net intensifies red spectral band and improves vegetative growth. Leafy vegetable growing in greenhouses with shade net enhances bioactive compounds and pigments synthesis, in addition to thermal comfort conditions, increases anthocyanin content. Lettuce quality attributes are influenced by T and UR and better results are achieved in thermal comfort conditions provided by using evaporative cooling system for vegetable crop in greenhouses.

Acknowledgement