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EFFECT OF GREEN AND WHITE SHADENET HOUSE ON BIOMETRIC CHARACTERISTICS OF SPINACH

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ABSTRACT

A field trial was conducted at Department of Farm Structures Engineering, CAET, Dr. Panjabrao Deshmukh Agricultural University, Akola during 2015 to see the effect of green and white shade nets (50%) on yield of spinach. Shadenet house are the framed or inflated partial or full controlled environmental conditions to get optimum growth and productivity. Due to climate change farmers are facing a lot of problems in their traditional farming so for diversification, cultivation of high value short duration crops in shadenet house is the best solution for farmers. Adoption of shadenet house technologies will be helpful for the judicious use of water and gaining economic advantages. The leafy vegetables like spinach is selected for the study in green and white shadenet house for this study. The average temperature inside the green shadenet house was observed 2-3°C less than white shadenet 4-5°C less in open field. The average relative humidity inside the green shadenet house was about 5-6 % more than white shadenet. The plant height was observed in green shadenet house 15.9 cm and 14.6 cm in white shadenet *et al.*

INTRODUCTION

India is the second largest producer of vegetable crops in the world. However, its vegetable production is much less than the requirement if balanced diet is provided to every individual. There are different ways and means to achieve this target, e.g., bringing additional area under vegetable crops using hybrid seeds, use of improved agro-techniques, and another potential approach is perfection and promotion of protected cultivation of vegetables. Agriculture in India has changed significantly in recent years. For instance, the area under rice in India has declined by 1.09 million ha during 2000-2007 (Directorate of Economics and Statistics, 2007), while the area under vegetables has increased by 1.07 million ha during 2002-2006 (National Horticultural Board, 2006). A similar trend is occurring in several Indian states, including Punjab. The area under vegetables increased to 152,100 ha in 2005-2006 from 54,612 ha in 1990-91 (National Horticultural Board, 2006; Punjab Government, 2009). Growing vegetable demand could be achieved through bringing additional area under cultivation crops, using hybrid crops, and adoption of improved agro-techniques. The vegetable extensively grown in Andhra Pradesh, Karnataka, Madhya Pradesh, Odisha and Gujarat. Protected cultivation of vegetables could be used to improve yield quantity and quality (Singh *et al.*, 1999; Ganesan, 2004; Shahak *et al.*). Protected cultivation has the potential to reduce biotic and abiotic stresses. A shade net house can modify environmental conditions with reduced labour.

Protected agriculture has expanded now days to help improve agricultural productivity. The shade net houses commonly used as protected cultivation are designed for temperate or moderately warm regions. These design need to be upgraded with climate control to overcome overheating in summer and overcooling in winter when used in warm, arid regions. The greenhouse climate is dictated by the soil inside the greenhouse, which constitutes the major thermal mass the 'greenhouse' effect itself, which can be controlled mainly by ventilation in most greenhouses; the crop's transpiration, which has a dominant effect on temperature and vapor-pressure deficit. Structures commonly used in the region are small (low and small volume) and have inappropriate roof-slopes (reducing light transmission); taller structures with appropriate roofs would improve light transmission, ventilation, inertia against external climatic variations, and drainage of condensation. (Nangare *et al.*, 2015) Some studies under different types of shade net house have been carried out for growing of nursery as well as for production of some important medicinal plants etc. in hilly regions of India. Net house structure, provides totally or partially controlled environmental condition suitable for better stone germination and subsequent seedling growth. Therefore, the present study was undertaken to evaluate effect of various growing medias on mango cultivars in regard with their growth parameters. (Parasana *et al.*, 2013). The abiotic factors such as mean temperature, sunshine hours and wind velocity showed a significant positive correlation with the mite pest whereas a negative correlation was established with relative humidity and rainfall. (Kumar D. *et al.*, 2014) But scanty information is available on such type of wooden framed structure, which may be utilized for

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round year cultivation of spinach in semi-arid region. The Vegetable crops have very high market value (Zaragoza: 2004). It can give better financial benefits to the farmers, if better quality of crop is taken. By considering the climatic factor and requirement of crop, the greenhouse technology is most suitable and practicable technology for getting better quality and quantity produce. It is most practical way of achieving the goal of protected cultivation. The whole idea of greenhouse technology is optimization all the inputs like nutrition, pesticides application, irrigation and light. Spinach is extensively used all over the world. It is only agricultural product which adds pungency to the daily used dishes. Spinach is an important cash crop of India and is grown both for home market and for export. The lack of information is available regarding the cultivation of spinach in different colors shadenet house therefore the goal of this study is to study the effect of environmental parameters on biometric characteristics in shadenet house.

MATERIALS AND METHODS

The study of environmental parameters such as temperature, relative humidity, light intensity, concentration of CO₂ and biometric characteristics of vegetable crop "spinach" inside the green and white shadenet house were studied. The frame structure was covered with 50 per cent green and white shade net. In addition to this the frame was covered with polyethylene sheet upto height of 1 m from ground level. This modification was made to enhance formation of CO₂ blanket at a height of 1 m. So, as to increase the growth of plant inside shadenet house and the ventilation was provided to shadenet house for lowering the temperature. The selection of crop to be raised in different colour shadenet house was made on the basis of physical size of the structure and economics of crop production. The soil bed was prepared manually with width 90 cm and 1130 cm length and 20 cm height of pathway 100 cm, was left along midway of shadenet house.

The variety of spinach such as "All Green" was selected for cultivation. Sowing was done by manually broadcasting method. Daily inside and outside temperature, relative humidity and Light intensity measurement at 8:00, 12:00 and 16:00 hours was carried out with the help of digital thermo hygrometer and by Lux meter respectively. The biometric characteristics of crop inside the shadenet house were recorded after two days interval. The height of plants was measured with the help of scale and the number of leaves and branches was counted manually. The CO₂ concentration of crop inside shadenet house and outside was recorded after 2 days interval by CO₂ analyser. The obtained yield was measured by digital weighing balance.

RESULTS AND DISCUSSION

The environmental parameters such as temperature, relative humidity, light intensity and CO₂ concentration are the major factor which is responsible for plant growth and the care should be taken that they should be within comfortable zone of plant for satisfactory results.

Temperature

Temperature plays a vital role in vegetative growth, the temperature was recorded at 8.00 am, 12.00 am 4.00 pm from 20 Dec. to 8 Feb.2015.(Figure 1).The temperature in shadenet house crop was in the range of 7°C to 21°C during the night time. The temperature of outside condition was more i.e. 4°C to 5°C than shadenet house. Due to trapping of short wave radiation in shadenet house under partially closed condition's the temperature in shadenet house is less than outside condition, this is one of the reasons for getting maximum yield in shadenet house.

From graph the temperature outside the shadenet was more as compared to the temperature inside the green and white shadenet house. It was found that the temperature inside the green shadenet house is very less as compared to outside and white shadenet house. So the green shadenet house controls the temperature better as compared to other.

Relative humidity

The relative humidity should be within the comfortable zone of plant to achieve satisfactory result. The high humidity reduces transpiration thus reducing water loss. Humidity directly affects the growth of plant in shadenet house. The absolute humidity of inside air rises with sun because the stomata opening increases transpiration and will affect the plant growth. For most of the crops, the range of relative humidity is between 5 % to 80%.From the figure 2, it reveals that the

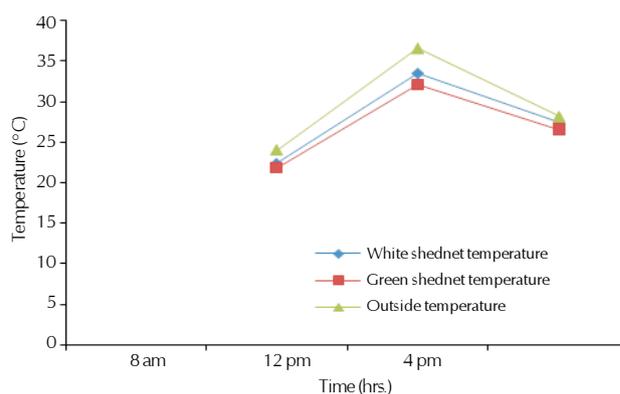


Figure 1: Average temperature with respect to time in period 20.12.2014 to 08.02.2015

Table 1: Average Temperature, Relative Humidity and Light intensity at different time and different location in white Shadenet, green and outside from

Time	White Temp(°C)	RH (%)	LI(Lux)	Green Temp(°C)	RH (%)	LI(Lux)	Outside Temp(°C)	RH (%)	LI(Lux)
8.00	22.4	47	16465	21.9	45	15853	24.1	45	25004
12.00	33.5	36	46025	32.1	36	42536	36.6	34	59304
4.00	27.4	46	15657	26.6	42	14983	28.2	42	10356

Table 2: Biometric characteristics of Spinach

Sr. No.	Date	Height of white shadenet	Height of green shadenet	No. of Leaves in white shadenet	No.ofLeaves in green shadenet
1	20/12/2014	2.3	2.7	2	2
2	22/12/2014	2.5	2.9	2	2
3	24/12/2014	2.7	3.1	2	2
4	26/12/2014	3	3.3	3	2
5	28/12/2014	3.3	3.8	3	3
6	30/12/2014	3.5	4.1	3	3
7	01/01/2015	3.9	4.6	4	4
8	03/01/2015	4.3	4.9	4	4
9	05/01/2015	4.8	5.4	5	4
10	07/01/2015	5	5.9	5	5
11	09/01/2015	5.4	6.3	5	5
12	12/01/2015	5.8	6.5	6	6
13	14/01/2015	6	6.9	6	6
14	16/01/2015	6.2	7.5	7	6
15	18/01/2015	6.4	7.9	7	7
16	20/01/2015	6.7	8.3	8	7
17	22/01/2015	6.9	8.8	8	8
18	24/01/2014	7.2	9.1	9	9
19	27/01/2014	7.6	9.6	10	9
20	29/01/2015	8.3	10.5	10	10
21	31/01/2015	9.1	11.2	12	12
22	02/02/2015	10.2	13.6	12	12
23	04/02/2015	12.5	13.9	12	14
24	06/02/2015	13.9	14.5	13	14
25	08/02/2015	14.6	15.9	13	16

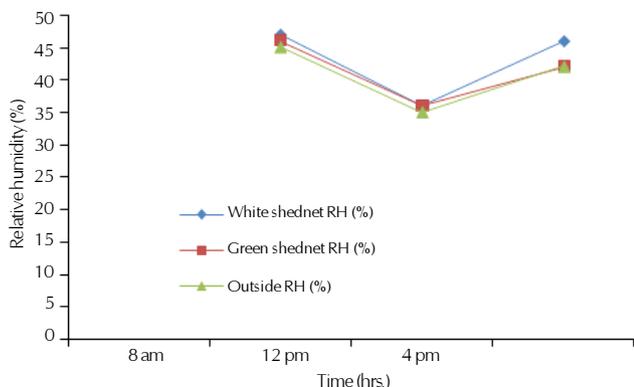


Figure 2: Average relative humidity with respect to time in 20.12.2014 to 08.02.2015

average relative humidity in green shadenet house was 5-6 % more as compare to the white net and outside.

Nimje *et al.* (2007) has also found similar result in high humidity for better yield due to their beneficial effect on flowering and fruiting also on parthanocarpic development of fruits. He had been found that fruit yield of sweet pepper inside poly house 2.27 times more than that of outside cultivation.

The relative humidity in green and white shadenet decrease from morning to evening. But the relative humidity is more in green shadenet house as compared to white shadenet house and outside the shadenet house. The relative humidity is very less outside the shadenet house as compare to inside the shadenet house. The relative humidity was found outside the shadenet house at afternoon is less as compared to morning and evening. So the relative humidity is maintained in the shadenet house.

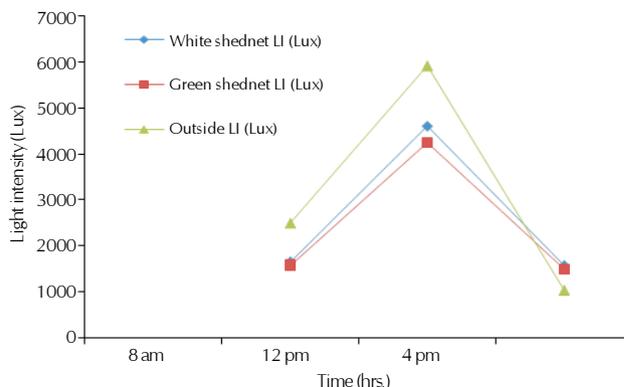


Figure 3: Average light intensity with respect to time in 20.12.2014 to 08.02.2015

Light intensity

The light intensity plays an important role in process photosynthesis of specific environmental condition. During the study, light intensity was recorded at 8.00am, 12.00pm, 4.00 pm. Table 3 reveals the 50% light intensity less in shadenet house as compare to the open field condition. Hanan (1978) has reported that radiation affect the flowering, photosynthesis, plant temperature, evapotranspiration and water loss. If the light intensity is diminished, photosynthesis slows down and hence the growth higher than optimal light intensities are provided growth again slow down because injury to the chloroplasts.

The light intensity was found more in white shadenet as well as in open field as compare to the green shadenet house . The solar rays enters inside the shadenet house is less as compared to outside. So we get a favorable environment for crop inside

inside the shadenet house. The light intensity is less in morning and evening time and it is more at afternoon.

Biometric characteristics

The height plays an important role for observing the growth of vegetables in shadenet house. The height of vegetables was measured in two days interval in both in green and white shadenet.

The height and number of leaves were more in green shadenet as compare to the white shadenet due to favorable microclimate was achieved in green shade net.

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