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CONDUCE OF POLYFILM OF POLYHOUSE ON SOIL MOISTURE AFTER COMPOSITING FARM YARD MANURE

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Abstract– Protected cultivation is one of the most prominent methods practiced by most of the cultivators in North India especially to shield crops during adverse climatic conditions. Inside the polyhouse a microclimate is generated which protects the cultivars. An attempt was made to study the effect of polyfilm of polyhouse on the tomato yield when the seedbed was prepared by applying the farm yard manure by paddle operated farm yard manure applicator compared to broadcasting method (P_1 and P_2) in the crop research farm of Maya group of colleges, Dehradun. Two plots (O_1 and $O_{2)}$ were also prepared in the same way in open field condition. The analysis was made on the attributes such as air temperature, soil temperature, relative humidity and intensity of light in both situations, i.e. under protected cultivation and open field from mid October 2021 to mid march 2022. The results reveal air temperature was found to be 3-6ºC low in protected conditions but relative humidity was 12-14% higher. Soil temperature was 3-9 ºC was high in open field state but light intensity was low in polyhouse. The yield inside the polyhouses was obtained 48.7 t/h and 54.8 t/h compared to open field that was 31.6 t/h and 42.8 t/h.

INTRODUCTION

Adverse climate present in the North Indian states during extreme winter and summer season create a vigorous problem for cultivators of cucumber, capsicum, strawberry, orchids, tomato etc. as the unfavorable seasonal adversities create low productivity which affects the profit of farmers. Protected cultivation or polyhouses provide solution to this problem. Protected cultivation is a way to grow all expensive horticultural crops to enhance efficiency and intensify resource use. Studies also reveal that prolonged polyhouse cultivation conduced towards debilitation of physical, chemical and biological attributes which gradationally causes fecundity to diminution and hence reducing returns of cultivators as the created microenvironment in the polyhouse causes compaction, acidification, nutrient biomagnifications in soil profile (Lee and Widden, 1996). Microbial biomass, dehydogenase activity and basal respiration are remarkably disrupted by incessant protected cultivation. Also, the soil flora and fauna reduces (Lee *et al.*, 2010). Different soil borne pathogens aggrandize due to low intensity of light. During winters as temperature drops from 4-5 ^{o}C and amid of summers it rises 2-3 ^{o}C which causes consequential abatement of organic matter. Hence, it necessitates applying organic manure and residues of crop to enhance cost efficacy and conserves the quality of environment (Chen *et al.*, 2013). Likewise in winter polyhouse maintain proper temperature and air flow which and depreciate the exertion of friendly soil microorganism. Straightway or deviously it hampers the soil quality and gradually affects the crop growth.

In Uttarakhand, tomato is extensively cultivated in polyhouse in districts like Dehradun, Haldwani, and Haridwar. Therefore, the present study was carried out to investigate the growing repercussion at different conditions through microclimate alteration and their interaction of yield of tomato.

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MATERIALS AND METHOD

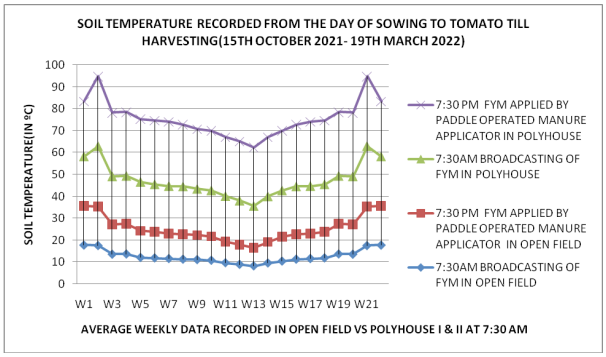
The experiment was administered in a covered polyhouse, facing north-east to south-west with 200µm thickness 700 gauges ultraviolet stabilized polythene sheet on a frame of steel pipes of 20′, 1.25′′ size along with an open field at the crop research farm of Maya Group of Colleges, Dehradun during the period of December 2021 to May 2022 with proper ventilation. Two parameters were taken into account in which two microclimate treatment were observed i.e. climate inside polyhouse and open field natural climate followed by a Completely Randomized Design with 5 replications. Two open field plot of size 2.5 *1.2 m^2 were chosen. The plots and blocks were disserved by 0.5 and 0.75 m respectively. Two polyhouses were taken of 200 m^2. Seedling of tomato cultivated at the nursery of Maya Group of Colleges was planted and regular drip irrigation was provided with proper fertigation. Appropriate crop protection measures were taken to protect crop from pest. Relative humidity, temperature and solar radiation were evaluated within the polyhouses and on open field plots at 7:30 AM and 2:30 PM respectively. For recording the solar radiation i.e. intensity of light, Lux meter was used. Soil Temperature was also recorded at a depth of 6.5 cm by Soil Thermometer. Relative humidity and Air temperature was measured by digital Hygrometer. Among the two plots, one plot was applied with paddled operated single roll farm yard manure applicator developed at MGC, Dehradun and the other plot was broadcasted by hand. Similarly, the polyhouses were also applied with the same methods. 15 kg of farm yard manure made in crop research farm of Maya group of colleges were applied respectively at each experimental plot. All the average of collected data was recorded on metrological weekly basis for all four plots. Finally the fruit yield was calculated.

RESULTS AND DISCUSSION

Soil Temperature

Germination of seed is greatly influenced by soil temperature. After application of farm yard manure to the seed bed of tomato crop it was irrigated effectively for proper functioning of root system and development of crop. It was noted in the 1st few weeks that there was a rise of soil temperature from 2-5 °C and during 11th week (6th to 13th March) a significant rise in temperature was observed. Under open field and protected conditions, (Kamal and Singh, 2011) it was depicted less soil temperature variation during early crop season as at initial stages crop needs less soil surface. But, yet the data recorded portray that there was less variation in soil temperature.

From mid February, 9th week onwards, soil temperature witnessed which shooted up from 4-11 °C inside the polyhouses whereas in open field 3-5 °C. In open field, at 7:30 AM soil temperature was traced to be between 2-3 °C but at 2:30 PM the recorded temperature was 8-9 °C respectively whereas in polyhouses there was a significant pattern confirmed which ranged from 15-21 °C inside the polyhouses at 2:00 PM. Thus, a conclusion could be drawn that during the month of March and April, the soil temperature in the polyhouse was significantly high in manure applied polyhouse with respect to manure applied field whereas in plots which were deprived of manure application were showing less temperature than the others.

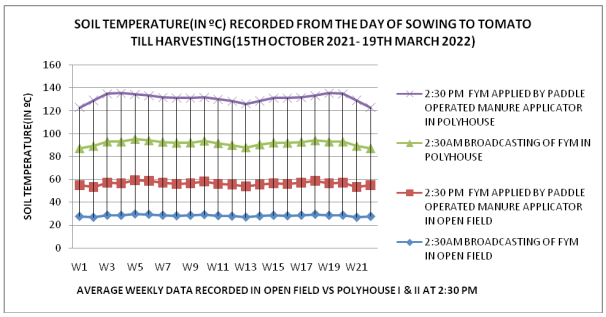


Average Weekly Soil Temperature Recorded in Open Field Vs Polyhouse I & II at 7:30 Am

Average Weekly Soil Temperature Recorded in Open Field vs Polyhouse I & II AT 2:30 PM

Intensity of solar Radiation (Light Intensity)

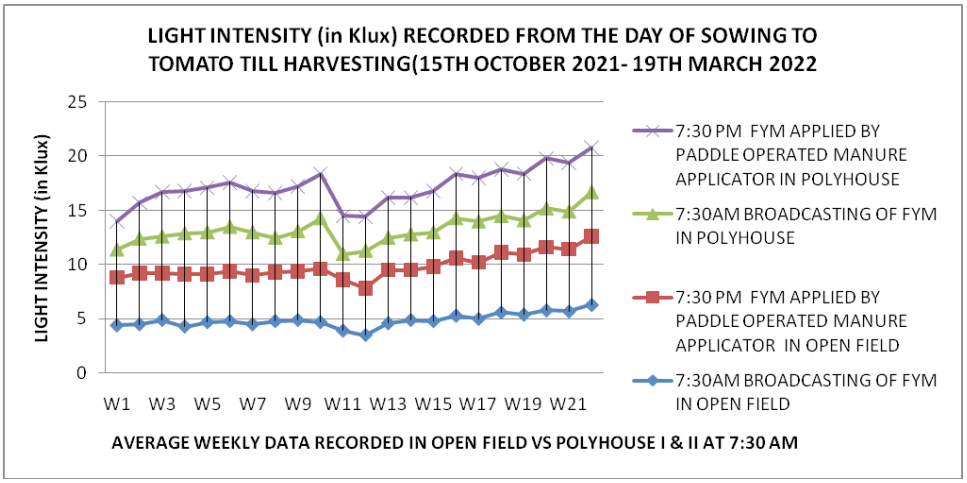
The color of fruit and leaves depends on intensity of light. The maturity of fruit is also light dependent.



30-40% of light intensity gets reduced in polyhouses as compared to open field as incident solar radiation gets absorbed inside the polyhouses due to greater impact of roof of polyhouse in contrast to open field. The open field gets abundant of radiation with respect to polyhouse.

As per the data documentation evaluated on weekly basis, solar radiation at 7:30 AM was 1.9- 8.3 Klux in polyhouses and in open field was 3-12 Klux. At 2:30 PM 20 Klux to 45.6 Klux was the light intensity under polyhouses likewise in open field condition it was 28 Klux - 52 Klux. This alluded that plants which are grown inside the polyhouses or in protected cultivation receives less solar radiation. This results in less evapo-transpiration of plants inside the polyhouses. Overall it depends on the roof material and color of roof.

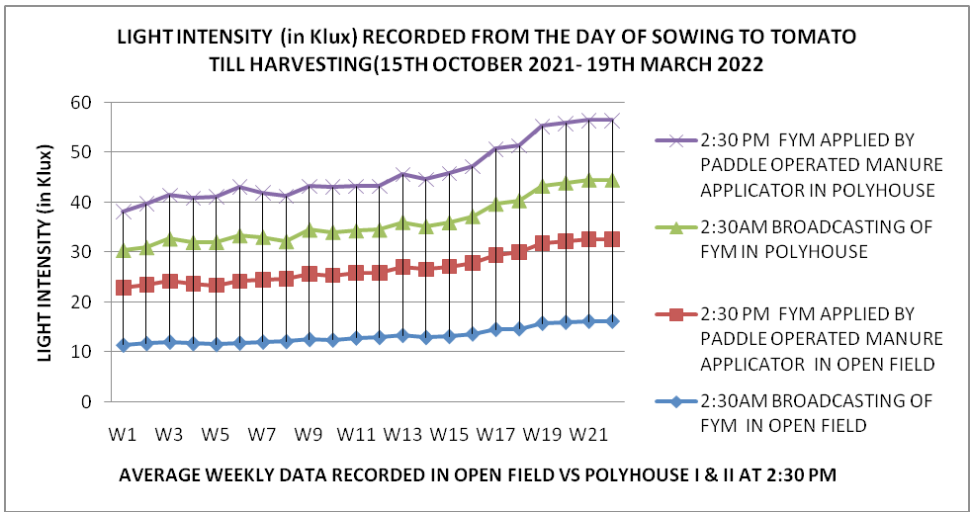
Average Weekly Light Intensity Recorded in Open Field Vs Polyhouse I & II At 7:30 Am



Average Weekly Light Intensity Recorded in Open Field vs Polyhouse I & II at 2:30 Pm

Air Temperature

Air temperature was found comparatively low in open field in contrast to polyhouse. It was distinguish to be higher in polyhouse ranging from 3-10 °C higher as comparison to open field. At 7:30 AM, the temperature difference was of about 7 °C whereas at 2:30 PM it rose to 12 °C. The growing stage of crop has no effect on air temperature. On weekly basis it varied from 24 °C to 33 °C in polyhouse while at open field it was 17 °C to 27 °C, respectively. Same consequences were found by Nimje and Shyam (1993). Air temperature was found to be gradually increased due to green house effect in polyhouse with an optimum level of 27 °C to 29 °C during the cooler months of plantation.



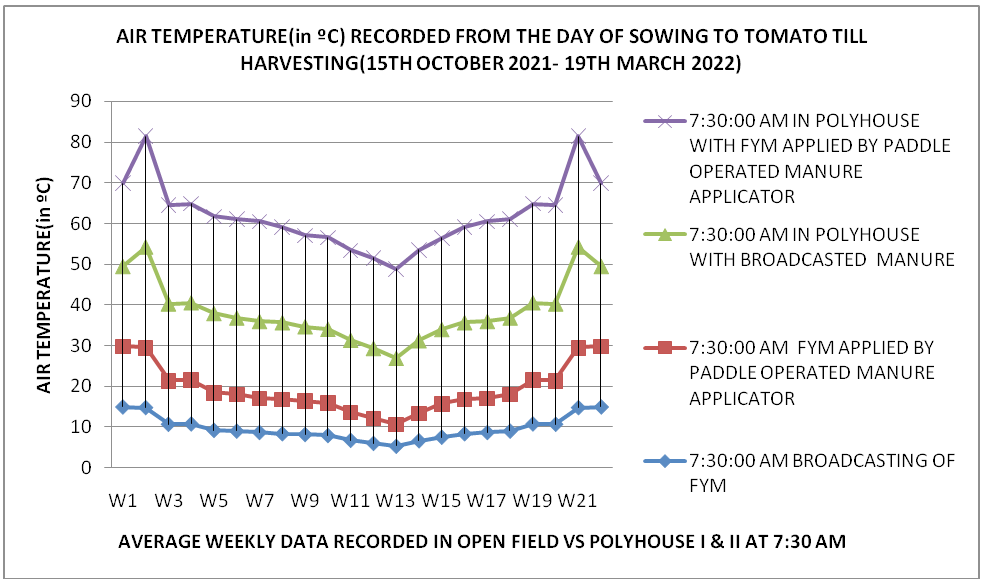
During hotter months the indoor temperature ascend than best possible levels, hence good ventilation is a must to maintain the amiable state for proper budding of tomato crop and give good yield.

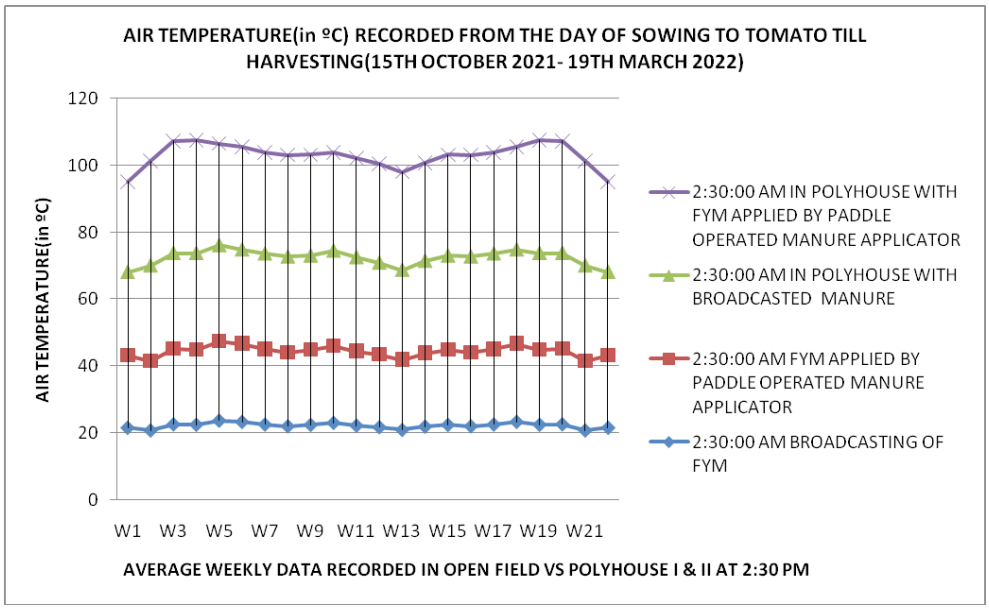
Average Weekly Air Temperature Recorded in Open Field vs Polyhouse I & II At 7:30 Am

Average Weekly Air Temperature Recorded in Open Field vs Polyhouse I & II at 2:30 Pm

Relative Humidity

The development of area of leaf and stomatal conductance get affected by humidity which interferes the photosynthesis and dry matter production (Jolliet, 1994). Hence, relative humidity was recorded at 7:30 AM and 2:30 PM. These readings showed reverse trend with respect to air temperature under protected and open field. At 2:30 PM the relative humidity was low and at 7:30 AM it was higher within the polyhouse with respect to open field. Relative Humidity was 3-8% lower than that of open field during winter that is between mid December to mid February but was higher in 1st week of March upto 5%. Relative Humidity was lower in polyhouse as compared to open field which could lead to yield loss (Holder and Cockskull, 1990) overall the relative humidity was 3-7% in open field as compared to polyhouse during winter months but in summer months it was higher by 11%.





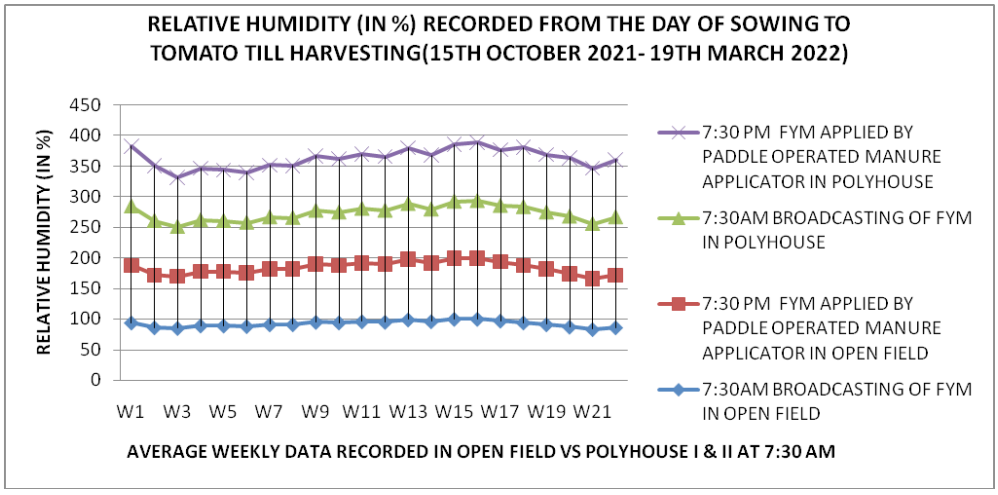
Average Weekly Relative Humidity Recorded in Open Field Vs Polyhouse I & II at 7:30 Am

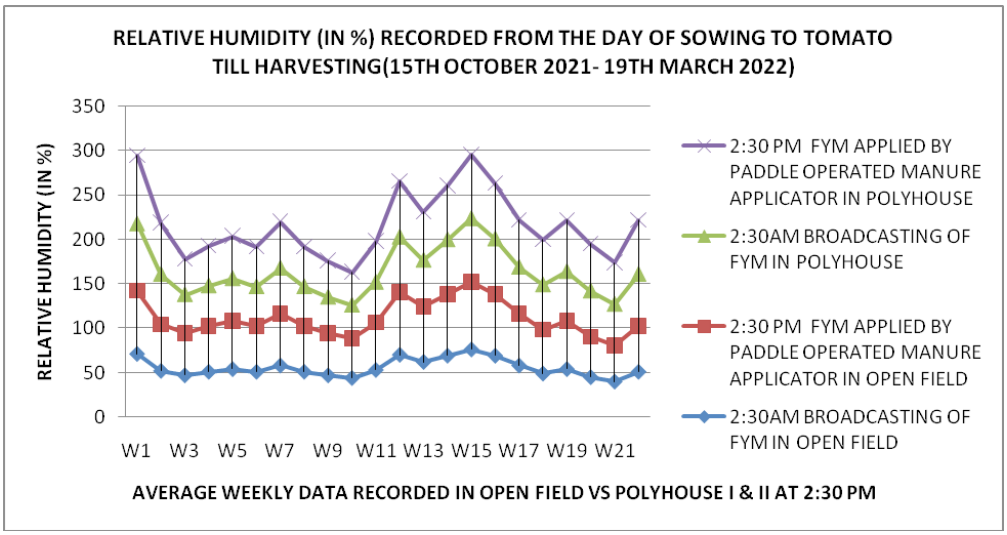
Average Weekly Relative Humidity Recorded in Open Field Vs Polyhouse I & II at 2:30 Pm

Effect of all factors on crop Yield

Light intensity effects the growth of crop along with air temperature, Soil temperature and relative humidity. The average weight of fruit in the polyhouse broadcasted with FYM was found to be 53.2 g/fruit, when number of fruit per plot on an average was 276. The fruit yield was found in this case to be 48.7 t/h, on the contrary the open field was calculated obtained much less that is 145 fruits/plot with fruits much smaller in size (50.3 g/fruit) and fruit yield was 31.6 t/h. The open field and polyhouse which was applied farm yard manure with paddle operated FYM applicator was found to be 306 and 192 fruits per plot respectively, when weight of fruit was 59.6 and 55.2 n g/fruit in that order where as fruit yield was 54.8t/h and 42.8 t/h correspondingly. The yield in polyhouse was 70% higher in case of polyhouse which was applied farm yard manure with paddle operated FYM applicator in comparison with other plots. This might have been the result of uniform application of farm yard manure with paddle operated FYM applicator and the polyhouse created a better microclimate than other plots. Above all none of the flowers got disturbed in polyhouse and more vigor and healthy plants were obtained for best productivity of tomato buds and fruits.

Treatment/ Stages	No. of Fruits/plot	Fruit Weight (g/fruit)	Fruit Yield (t h^{-1})
PolyhouseP_1P_2	276306	53.259.6	48.754.8
Open FieldO_1O_2	145192	50.355.2	31.642.8
S.Em ±	0.873	1	0.998
C D at 5%	S	S	S





CONCLUSION

In hilly state like Uttarakhand where temperature falls significantly during winter and rise during summers. Low cost polyhouses were made up by locally available materials making it very suitable. Because of the seasonal constraints, growth of tomato like crops s possible with help of polyhouse and the farmers get double yield as compared to open field. Time to time application of farm yard manure with paddle operated FYM applicator helps in proper and optimized treatment of soil temperature and microclimate is controlled which benefits the cultivators with good market price.

Conflict of Interest: None

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