Journal of Agrometeorology 8(2) : 226 - 229 (Dec. 2006)

Performance evaluation of ventilation and fan-pad system in semi-controlled polyhouse during monsoon season

P. B. KALE, A. A. DEOGIRIKAR and S. M. PATIL
Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS)-India-444 104

ABSTRACT

An experiment was conducted during hot weather season at Akola (Maharashtra State) to evaluate the effect of ventilation with and without operating fan-pad system of the modified Quonset north light truss type greenhouse. Environmental parameters were recorded near the fan, centre of the greenhouse and near the pad. These were compared with the readings recorded outside the greenhouse. Temperature dropped by 2.5 to 6.6 ° C and relative humidity increased by 5 to 10 % on operating fan-pad system for 10 min. inside the greenhouse when ventilators were kept closed. Similarly, when ventilators were kept open, temperature drop of 2.3 to 5.6 ° C and relative humidity increase of 7 to 11 % was recorded on operating fan-pad system for 10 min. Air temperature and relative humidity inside the greenhouse was observed to be always higher than that outside the greenhouse.

Key words : Polyhouse, ventilation, fan-pad system.

Ventilation of polyhouse is a very important aspect. For greenhouse crop cultivation, it is necessary to use fan-pad system or open the ventilators as and when the ambient temperature rise is very high. Sometimes, it becomes difficult to work inside the greenhouse even when the ventilators are kept open. In such situations, crop growth also gets hampered (Feuilloley, 1990). In order to provide comfortable working environment and favourable crop environment for proper crop growth inside greenhouse, forced or fan-pad ventilation becomes necessary. Forced ventilation of $1 m^3/min/m^2$ of greenhouse floor area is recommended for the greenhouse having 2.5 m ceiling height, without shade net. This airflow rate at the first stage is of the order of 8-10% of full flow, 60% at middle stage and 100% at the final stage (Robert and Mears, 1984).

Using an evaporative cooling pad with the forced ventilation system, the temperature inside greenhouse can be ameliorated. Also this cooling pad can help to increase relative humidity inside the greenhouse that can help substantially to reduce thermal stress of plants under high temperature conditions, particularly, in relatively dry climate. Even in humid climate also, evaporative cooling can provide significant reduction in plant stress during mid day when sunlight is the most intense (Mears, 1997). Considering the above facts

and to exploit the possibility of commercial use of greenhouse technology, in hot and dry climate of Vidarbha region of Maharashtra State, efforts were made to maintain favourable microclimate inside polyhouse using fan – pad system, during present study.

MATERIALS AND METHODS

An experiment was conducted at Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) during the hot weather season i.e. 20th June to 3rd July i.e. in a north roof truss modified Quonset type greenhouse. During 20th to 26th June 2001, the ridge ventilators were kept closed and from 27th June to 3rd July 2001, the ridge ventilators were kept open to evaluate the effect of ventilation with and without operating the fan–pad system. The weather parameters viz., ambient temperature, relative humidity and light intensity were measured at 0.5 m height above the ground surface, near the fan, at centre and near the pad. The observations were recorded at 8.00, 11.00, 14.00 and 17.00 hrs IST. The fan pad system was operated for only 10 minutes at above timings and again the temperature and relative humidity were measured. Standard thermometer and mechanical hygrometer were used to record the observations. Means of the observations were computed and used for comparing with the readings recorded outside the greenhouse. A lux meter was used to record the light intensity.

RESULTS AND DISCUSSION

Weather parameters during closed ventilators

This experiment was conducted during 20th to 26th June, 2001. The ridge ventilators were kept open throughout the experiment. Air temperature and relative humidity were recorded at 8.00, 19.00, 14.00 and 17.00 hrs, everyday, inside and outside the greenhouse. The fan pad system was operated for 10 min. after taking the readings and these parameters were again recorded. The readings were averaged for comparison (Table 1). The maximum temperature and relative humidity difference of 6.6° C and 10 % was recorded between before and after operating the fan pad system at 14.00 hrs. Temperature was reduced while relative humidity was increased. This difference was the minimum i.e. 2.5° C and there was no change in relative humidity at 8.00 hrs. Due to closed ventilators and the evaporative cooling system, the relative humidity inside the greenhouse was observed to be consistently higher than that existing outside, the mean being 9 %. Whereas, after operating fan pad system inside the greenhouse, on an average, the difference between inside and outside relative humidity was about 15 %. Because of shade net inside the greenhouse, at ceiling height, the light intensity was consistently lower inside the greenhouse, compared to outside.

Weather parameters during opened ventilators

The second experiment was conducted during 27th June to 3rd July 2001, when the ridge ventilators were kept open.

Table 1 : Weather parameters before and after operating fan-pad system. under closed ventilators

Time (hrs)	Inside the greenhouse							Outside the greenhouse							Light intensity diff. (lux)
	Temperature (°C)			Relative humidity (%)			Light intensity (lux)	Temperature (°C)			Relative humidity (%)			Light intensity (lux)	
	Before	After	Diff.	Before	After	Diff.		Before	After	Diff.	Before	After	Diff.		
8.00	31.7	29.2	-2.5	66	71	5	13028	27.3	27.5	0.2	57	57	0	21157	8129
11.00	37.2	32.4	-4.8	58	66	8	19242	30.5	30.4	-0.1	50	54	4	28242	9000
14.00	41.3	34.7	-6.6	51	61	10	19371	32.8	33.2	0.4	44	44	0	30142	10771
17.00	38.6	32.3	-6.3	57	67	10	11757	32.4	32.8	0.4	46	51	5	19585	7828

Table 2 : Weather parameters before and after operating fan-pad system under opened ventilators

Time (hrs)	Inside the greenhouse							Outside the greenhouse							Light intensity diff. (lux)
	Temperature (°C)			Relative humidity (%)			Light intensity (lux)	Temperature (°C)			Relative humidity (%)			Light intensity (lux)	
	Before	After	Diff.	Before	After	Diff.		Before	After	Diff.	Before	After	Diff.		
8.00	31.0	28.7	-2.3	66	73	7	11300	25.2	26.2	1.0	56	56	0	18271	6971
11.00	36.0	31.8	-4.2	61	69	8	14050	28.8	29.2	0.4	50	53	3	22628	8578
14.00	40.2	34.6	-5.6	53	64	11	13242	29.8	30.7	0.9	46	47	1	22557	9315
17.00	37.7	33.8	-3.9	55	64	9	11985	30.8	31.7	0.9	47	49	2	21185	9200

The readings were recorded similar to the previous experiment. In this condition, the temperature difference between inside and outside greenhouse was less as compared to the previous experiment. Temperature inside the greenhouse was always higher than that existed outside. The maximum temperature and relative humidity difference between inside and outside greenhouse was higher than that outside. The maximum temperature and relative humidity difference to the tune of 5.6 ° C and 11 %, respectively was recorded at 14.00 hrs before and after operating fan pad system. In this experiment also temperature was reduced while relative humidity increased inside greenhouse, after operating the fan pad system. These differences were minimum at 8.00 hrs. The mean increase in relative humidity throughout the day was 9 % and temperature reduction was 4° C. The average temperature and relative humidity difference between inside and outside greenhouse was 7.5 ° C and 9 %, respectively and both these parameters were higher inside the greenhouse. After operating the fan pad system this differences increased to 2.7 ° C and 21 %, respectively.

Under both the conditions i.e. ventilators kept closed and ventilators opened, the inside temperature was reduced and relative humidity was increased after operating the fan – pad system. When the ventilators were opened, the temperature difference was lower than the condition when the ventilators were closed. This is attributed to the intermixing of inside microclimate with the external environment. Since it was the start of the rainy season, after operating the fan pad system, temperature inside the greenhouse was closer to that outside the greenhouse but it was never lower than outside temperature. However, during hot summer season, the temperature inside the greenhouse may drop considerably as compared to outside temperature.

CONCLUSION

There was considerable difference in temperature and relative humidity inside and outside greenhousem, under both the conditions i.e. the ventilators kept closed or opened.

REFERENCES

Feuilloley P. 1990. Optional static ventilation in greenhouse. The use of plastics in agriculture. Proceedings of National seminar held during 26th Feb to 2nd March, 1990 at New Delhi, India.

Mears D. R., 1997: Multispan low to medium cost greenhouse facilities design – applications. Proceedings of International seminar on "Protected cultivation in India" held during December 18 – 19, 1997 at Banglore, India.

Robert W. J. and D. R. Mears 1984. Heating and ventilating greenhouses. Extension publication, NJAES, New Brunswick.