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Cowpea inside Polyhouse with Varying Irrigation and Fertigation Levels

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Abstract:- The effect of different irrigation and fertigation levels for cowpea (NS 621) inside polyhouse was studied. Daily water requirement of the crop in open field was calculated using FAO CROPWAT software. Four different treatments were selected based on varying irrigation and fertigation levels. Daily irrigation with the estimated water requirement (2.2 l/plant/day) was found to be more effective. The results also showed that it was sufficient to apply fertilizers through fertigation once in four days.

Keywords: Fertigation, polyhouse, irrigation, greenhouse, Cowpea

I. INTRODUCTION

Availability of land for agriculture is decreasing day by day. More intensive and productive agricultural practices are needed to meet the food demands of the growing population. The productivity of a crop is influenced not only by its heredity, but also by the micro climate around it. Greenhouse farming has come up as one of the solutions for meeting these increasing demands.

Greenhouse technologies provide optimum conditions of light, temperature, humidity and carbon dioxide, and protect the plants from the adverse climatic conditions so as to achieve maximum yield and good quality produce. Water has also become scare and it has become difficult to meet its demand in agriculture. The yield and quality of crops is affected by water stress during critical growth periods

[1]. Drip irrigation along with fertigation helps in saving water and fertilizers and at the same time increases the quantity and quality of produce. When the water use efficiencies of different irrigation methods were compared it was found that the efficiency under flood irrigation was the lowest (1.06 q/ha/cm) and highest was recorded in drip irrigation (2.52 q/ha/cm) [5]. Fertigation provides nitrogen, phosphorous and potassium as well as essential trace elements (Mg, Fe, Zn, Cu, Mo, and Mn) directly to the active root zone. This minimizes the loss of expensive nutrients and helps in improving productivity and quality of farm produce. The present study was done to compare the effect of different irrigation and fertigation levels for cowpea (NS 621) inside greenhouse.

II. MATERIALS AND METHODS

The field experiment was conducted in the naturally ventilated polyhouse of Precision Farming Development Centre, Tavanur situated in the Instructional Farm of KCAET, Tavanur, Kerala Agricultural Univeristy, Kerala, India. The soil at the experimental site is sandy loam and the soil pH and EC inside the polyhouse at the time of planting was 5.22 and 55.38 deciseimen respectively. The experiment was laid out with 4 treatments, combination consisting of two irrigation levels and two fertigation levels. The trial was conducted during August to December, 2012.
Irrigation levels

I_1- daily irrigation, I_2- alternate day irrigation
Fertigation levels
F_1-alternate day fertigation, F_2-fertigation in four days

Table I: Treatment details

Treatment	Name	Description
T_1	I_1F_1	Daily irrigation and alternate day fertigation
T_2	I_1F_2	Daily irrigation and fertigation once in 4 days
T_3	I_2F_1	Alternate day irrigation and alternate day fertigation
T_4	I_2F_2	Alternate day irrigation and fertigation once in 4 days

A. Irrigation and Fertigation

Daily water requirement of the crop in open field was calculated using FAO CROPWAT software. Four different treatments were selected based in the varying irrigation and fertigation levels. The irrigation requirement was supplied to the crop either daily or on alternate days through inline drip system. Fertigation requirement estimated was also supplied on alternate days or once in four days. Recommended dose of fertilizer (20:30:10) was applied as per treatments fixed. Nitrogen, phosphorus and potassium are the major nutrients required for the growth. Among these, phosphorus was applied as basal application through *rajphos* (0-50-0). Nitrogen and potassium were applied in the form of urea (46-0-0) and sulphate of potash (0-0-50-17) respectively by venturi fertigation unit. Inline drippers at a spacing of 40cm having a discharge rate of 4 litres per hour were used for the study and each row of crop was give one lateral. Plant protection measures were adopted for incidence of pest and disease attacks using recommended dose of chemicals on time.

III. RESULTS AND DISCUSSION

The variations in temperature and humidity inside and outside the polyhouse were observed are represented graphically.

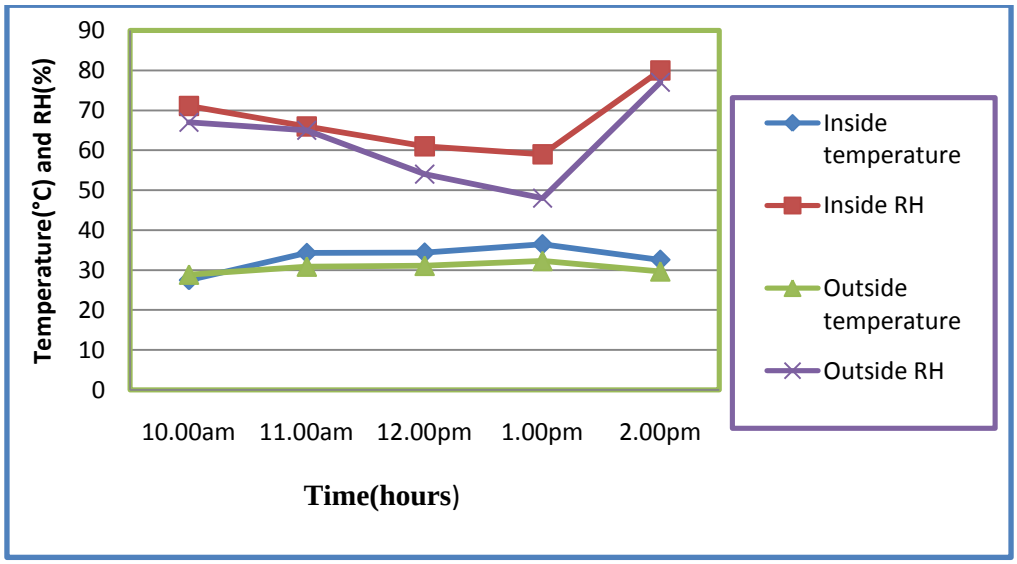

Fig.1 Temperature and Relative humidity variation inside and outside the polyhouse

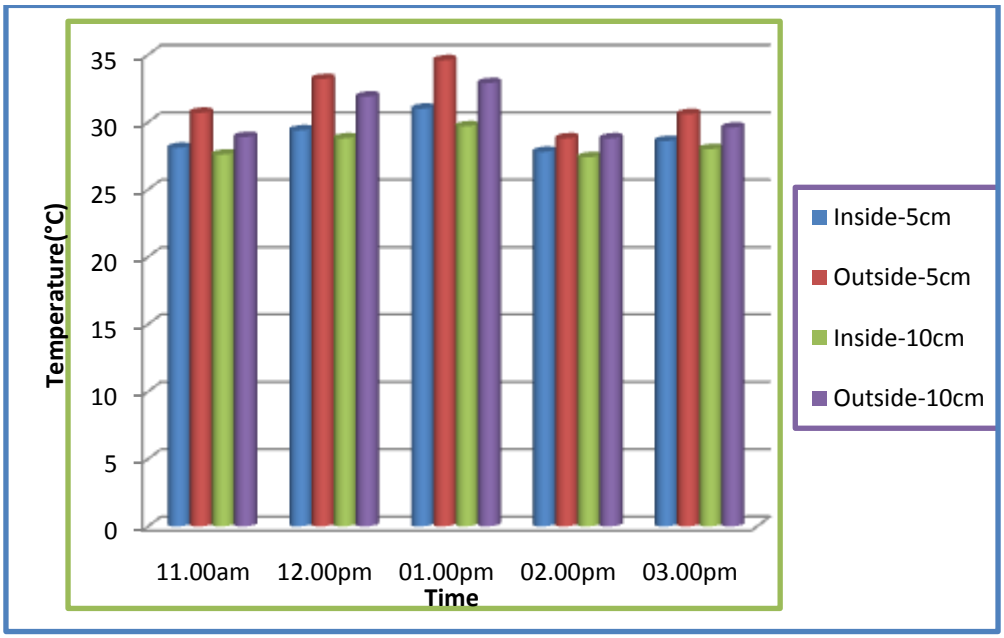

Fig.2 Soil temperature variation inside and outside polyhouse at different depths

The performance of cowpea under different irrigation and fertigation levels inside polyhouse was studied.

Table 2. Yield data of cowpea inside polyhouse

	R1	R2	R3	R4	R5	Total	Average
T1	4184	4084	3276	3444	3636	18624	3724
T2	3492	3900	5988	3084	3228	19692	3938
T3	2844	1848	1956	2184	2976	11808	2361
T4	3186	2754	1992	1848	3096	12876	2575
Total	13706	12586	13212	10560	12936	63000	
Avg	3426.5	3146.5	3303	2640	3234		
	Source	**Df**	**SS**	**MS**	**F-ratio**	**Tab-value**	**Remarks**
	Blocks	4	1468112	367028	0.59	3.26	NS
	Treatment	3	9519696	3173232	5.14	3.49	*
	Error	12	7411456	617621			
	Total	19	18399260		**CD=1083.05**		

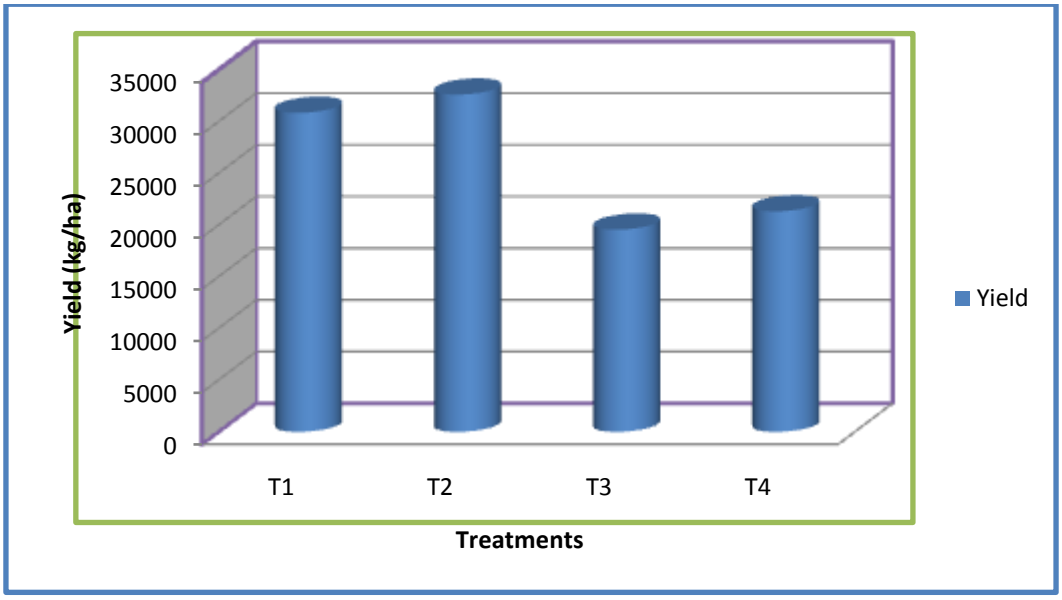

Fig.3 Comparison of yield obtained from different treatments

The four treatments showed significant difference in the case of average yield (kg/ha). The maximum yield was observed for the treatment T2 (32632 kg/ha) which is irrigated daily and fertigation done once in four days. The minimum yield was observed in the case of treatment T3 (19428 kg/ha) having alternate day irrigation and alternate day fertigation. With respect to average yield, the different levels of irrigation showed significant difference.

Reference [3] indicates that the use of drip irrigation saves water and gives better plant (capsicum) yield and quality as it reduces the humidity build up inside greenhouse after irrigation due to precise application of water to the root zone of the crop.

A similar experiment in tomato showed that an average daily irrigation rate of 0.5 l/plant/day was found to be the optimum amount of water for maximizing the tomato yield [2]. The application of irrigation at lower amount (deficit irrigation) of the water requirement gave lower yield. But increasing the irrigation water over a certain level (over irrigation) did not increase the tomato yield above maximum yield. So, the irrigation should be given as precise as possible to the plant close to the optimum. The optimum amount of irrigation was very close to the crop evapotranspiration which was calculated from the dynamic microclimate inside the greenhouse during the experiment. In an experiment on fertigation in tomato, the highest fruit yield was obtained with application of recommended dose of fertilizers comprising of polyfeed (19:19:19), MAP (12:60:0) and urea through fertigation [4]. The yield was 22-27% higher compared to that obtained from the crop through soil application.

IV. CONCLUSION

The statistical analysis of the yield data showed that the treatment with daily irrigation and fertigation once in four days was the best. The growth and yield parameters observed showed that daily irrigation with the estimated water requirement (2.2 l/plant/day) was more effective. The results also showed that it was sufficient to apply fertilizers through fertigation once in four days.

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