Int.J.Curr.Microbiol.App.Sci (2020) *9*(6): 542-548

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 6 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.906.070

Irrigation Management in Tomato with Coco Peat Media under Protected Cultivation

Rajni Lekhpal[1]*, R. Agrwal[1], P. Katre[2] and R. Singh[3]

[1]Department of Soil and Water Engineering, Faculty of Agricultural Engineering,
[2]Department of Agricultural Processing and Food Engineering,
[3]Department of Farm Machinery & Power Engineering, [4]Department of Vegetable Science,
COA, IGKV, Raipur, Chhattisgarh (492012), India

**Corresponding author*

Keywords

IW:CPE, Cocopeat, Irrigation requirement, Evapotranspiration

Article Info

Accepted:
15 May 2020
Available Online:
10 June 2020

A B S T R A C T

Water is one of the critical inputs for increasing productivity in any agricultural production system. Since agriculture consumes the maximum quantity of water in India, greater attention needs to be paid towards the adoption of improved water management technologies. Hence, the present study was taken up to work out the water requirement of tomato using climatological approach with coco peat media under protected cultivation This study was carried out to determine the irrigation requirement of tomato grown on Coco Peat under Protected Cultivation conditions at Research Farm of Center of Excellence on protected cultivation and precision farming under Polyhouse, College of Agriculture, IGKV, Raipur (C.G), during the Rabi season of 2016-17. The experiment was laid out in a Complete Random Design. The quality and yield response of tomato to drip irrigation was investigated. Six different irrigation levels (I_1 = 0.8 IW:CPE, I_2 = 0.9 IW:CPE, I_3 = 0.1 IW:CPE, I_4 = 1.1 IW:CPE, I_5 =1.2 IW:CPE, I_6 =1.3 IW:CPE) and one irrigation frequency were evaluated. The irrigation requirement of the tomato was analyzed for individual crop growth stages using climatological approach. The total seasonal water requirement comes to be 244.71 mm. The ET values for the initial stage, development stage, mid season stage and late season stage were determined as 52.38, 75.07, 72.27, 44.98 mm respectively.

Introduction

In everyday usage, a vegetable is any part of a plant that is consumed by humans as food as part of a savory meal. The exact definition of "vegetable" may vary simply because of the many parts of a plant consumed as food worldwide – roots, tubers, bulbs, corns, stems, leaf stems, leaf sheaths, leaves, buds, flowers, fruits and seeds. Vegetables play an important role in human nutrition. Vegetable like tomato is one of the most important and has the highest acreage of any vegetable crop in the world and also one of the most important protective food crops of India.

India is the second largest producer of tomato which is grown in 0.458 Mha area with 7.277 M mt production and 15.9 mt/ha productivity. Tomato is rich source of vitamins A, C,

potassium, minerals and fibers. Tomatoes are used in the preparation of soup, salad, pickles, ketchup, puree, sauces and also consumed as a vegetable in many other ways. Greenhouse technology is a breakthrough in the agricultural production technology that integrates market driven quality parameters with the production system profits. In the present scenario of perpetual demand of vegetables and shrinking land holding drastically, protected cultivation or Greenhouse technology is the best alternative for using land and other resources more efficiently. The Greenhouse tomato is a major vegetable crop that has achieved tremendous popularity over the last century. Tomatoes, aside from being tasty are very useful for our heath as they are a good source of Vitamins A and C. Cooked tomatoes and tomato products are the best source of lycopene, which is very powerful antioxidant and helpful in preventing the development of many form of cancer.

Coconut (*Cocus nucifera* L.) pith or coir, the mesocarp of the fruit, is a waste product of the coconut industry and has been proposed as a possible alternative to peat in growth media due to its suitable physical and chemical properties. Coir has a high water holding capacity and has been traditionally used to improve the physical and chemical properties of soils. When applied to agricultural soils coconut coir can improve moisture retention capacity, and increase available nutrient content, infiltration rate, total porosity, and hydraulic conductivity of that soil.

In soiless culture, drip irrigation is used to deliver water to crops. Irrigation is an important factor for tomato production in Mediterranean climates where the growing season coincides with a period of high evaporative demand. The amount of irrigation applied and its timing through the crop cycle influence both yield and fruit quality. However, the yield and quality of marketable fruits are dependent upon local agronomic and environmental conditions.

Materials and Methods

Description of study area

The experiment was conducted in controlled condition of the naturally ventillated polyhouse during rabi season in the year 2016-17 at the research farm of the center of excellence on protected cultivation and precision farming under polyhouse, College of Agriculture, Raipur (C.G.). The experiment was laid out in a random block design with 3 replications. The details of treatment taken for present study are given below.

The irrigation system consists of mains, Disc filter, sub mains, inline laterals and other accessories required for drip irrigation. Drippers at 2.4 litres per hour capacity were in the inline dripper at a spacing of 30 cm for drip irrigation treatments. Amount of irrigation water applied to drip treatments were based on daily pan evaporation readings. The water requirement of the crop was calculated based on the following equation.

$$\text{Irrigation requirement (liters per day per plant)} = \frac{A \times B \times C \times D}{E}$$

Where, A = Evaporation rate in mm/day,
B = Crop coefficient,
C = Canopy factor,
D = Spacing between two inline laterals in meters,
E = Efficiency of irrigation system (0.9 for drip system).

The irrigation requirement was estimated for the growing season of Tomato i.e. from August to January. The daily time of operation of the system was also worked out.

Results and Discussion

Irrigation requirement for tomato

Tomato seeds were sown on 29th July 2016 & transplanting was done on 17th August 2016. The amount of water applied during this period was accounted for the total irrigation requirement of the crop. The water applied for each stage is presented in the following table:

Table.A Irrigation Requirement for Tomato under Protected Cultivation

Particulars	Initial stage	Development stage	Mid-season stage	Late season stage	Total
ET (mm/day)	1.05	3.3	3.6	2.4	10.35
Kc	0.6	1.15	1.18	0.8	3.73
Duration days	30	40	45	30	145
ET (mm)	52.38	75.07	72.27	44.98	244.71

In protected cultivation, irrigation requirement of tomato with drip irrigation in coco peat media under protected cultivation is 244.71 mm during the whole crop period. In open field condition, irrigation requirement of tomato with drip irrigation in soil is 400-600 mm.

Agronomical measures

Plant height (cm)

The effect of irrigation was analyzed and results are presented in table no:-1.

It was observed that during crop growth, development & maturity stage, interaction effect of irrigation significantly influenced height of tomato plant. In descending order the results showed tha the plant height of 4.45m, 2.56m, 0.78m were recorded at 30 DAT, 60DAT, 120 DAT respectively in treatment I_1 followed by a plant height 3.99m, 2.30m 0.67m which were recorded at 30DAT,60 DAT,120 DAT in treatment I_2, I_3, I_4, I_5, I_6 respectively. In view of the crop stage at 120DAT, 60DAT, 30DAT the lowest plant height is 2.87m, 1.96m, 0.41m.

No of leaves

The effect of irrigation and fertigation levels was analysed and results are presented in Table:-2. It was observed that during crop growth, development and maturity stage, interaction effects of irrigation significantly influenced number of leaves per plant. In descending order, the results showed that the maximum number of leaves per plant 277.73, 184.47,100.93 were recorded at 190 DAT, 120 DAT, 90 DAT respectively in treatment combination I_1, followed by the maximum number of leaves per plant of 260.33, 165.07, 86.4 which were recorded at 190 DAT, 120 DAT, 90DAT in treatment combination I_2, I_3, I_4, I_5, I_6 respectively. From Table and Figure in terms of number of leaves per plant, treatment combination I_1 was superior over the rest of the treatment combinations throughout the growing period.

Fruit diameter

The effect of irrigation levels and fertigation on average diameter of the tomato was analysed and results are presented in Table :-3.

Table.1 Plant height (m) at different days after transplanting in tomatoes grown under control conditions

Treatment	30DAT	60DAT	120DAT
I_1	0.782	2.563	4.457
I_2	0.674	2.303	3.993
I_3	0.623	1.972	3.438
I_4	0.407	1.964	2.874
I_5	0.585	2.255	3.44
I_6	0.69	2.34	3.133
C.D.	0.106	0.34	0.885
SE(m)	0.034	0.109	0.284

Table.2 Effect of different irrigation methods on no of leaf

Treatment	90DAT	120DAT	190DAT
I_1	100.933	184.467	277.733
I_2	66.8	98.867	250.667
I_3	86.4	132.467	319.333
I_4	58.067	91.133	204.267
I_5	60.333	117.47	226.6
I_6	70.267	165.07	260.333
C.D.	17.27	43.61	56.091
SE(m)	5.543	13.999	18.004

Table.3 Effect of different irrigation methods on no of fruit set and fruit diameter

Treatment	Fruit set	Fruit dia (cm)
I_1	42.01	5.433
I_2	41.56	4.767
I_3	40.36	5.2
I_4	40.22	5.167
I_5	40.05	5.333
I_6	41.28	4.867
C.D.	4.824	0.407
SE(m)	1.548	0.131

Table.4 Yield per hectare, water use efficiency influenced by different irrigation level

Treatment	Yield (tha^{-1})	Cummulative Use of Water, mm	WUE(tha^{-1} cm^{-1})
I_1	58.57	5.32	11.01
I_2	44.27	5.437	8.14
I_3	42.123	5.477	7.69
I_4	53.603	5.623	9.53
I_5	50.687	5.67	8.94
I_6	54.297	5.71	9.51
C.D.	0.42	0.026	0.218
SE(m)	0.135	0.009	0.07

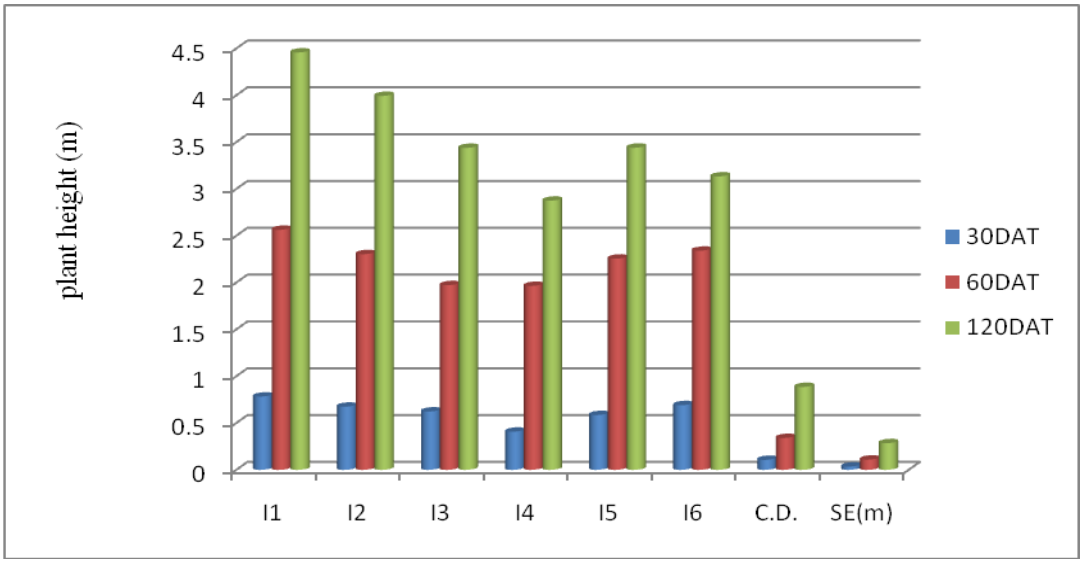

Fig.1 Effect of different irrigation methods on plant height of tomato at various growth stages

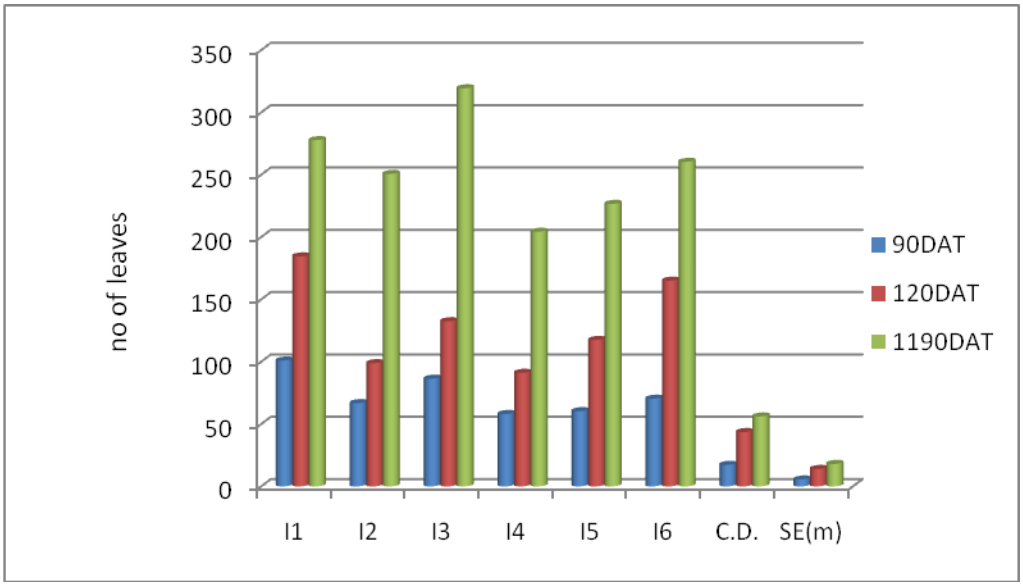

Fig.2 Effect of different irrigation methods on number of leaves

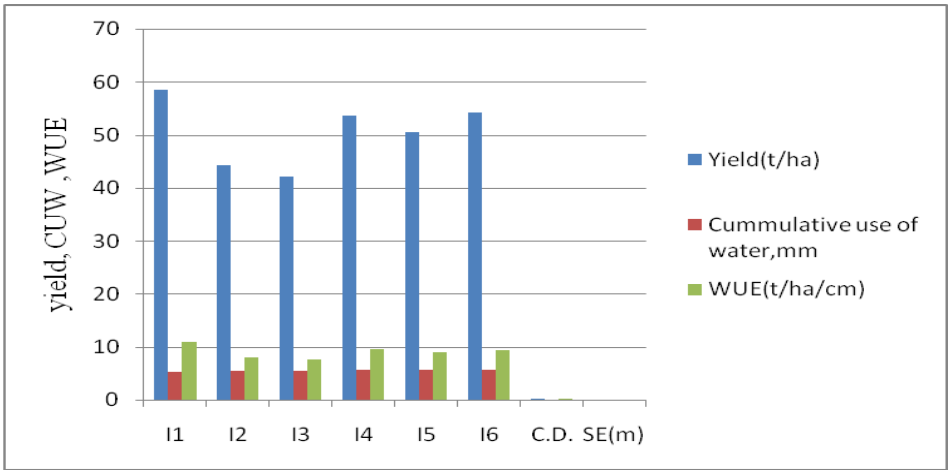

Fig.3 Water Use Efficiency of tomato under protected cultivation

It was observed that interaction effects of irrigation and ferigation affected the average diameter of the curd. In descending order, the results showed that the maximum average diameter of the tomato 5.433cm was recorded in treatment combination I_1, followed by an average curd diameter of 5.333cm which was recorded in treatment combination I_4. From Table 4.15 and Fig.4.13, in terms of fruit diameter, treatment combination I_1 was superior over the rest of the treatment combinations.

Water use efficiency (tha^{-1}cm^{-1} of water)

Water use efficiency (WUE) is the ratio between crop yield (q ha^{-1}) and total depth of water (cm) applied to the crop. It is apparent from the Table 4 that the water use efficiency recorded was significantly influenced by different irrigation levels. Significantly maximum water use efficiency was found under the treatments I_1 (11.01 t/ha/cm) and it was followed by I_2 (8.14t/ha/cm), I_3 (27.69 t/ha/cm), I_4 (9.53 t/ha/cm) and I_5 (8.94 t/ha/cm),I_6 (9.51 t/ha/cm) respectively.

References

Alagha S.A and Sangodoyin A.Y., 2013 Irrigation water scheduling for tomato under soilless.

Barikara U, Santhana Bosu S., K.P. Rema and Murumkar A.R.,2013**.** Drip irrigation with fertigation in soil-less media for tomato under controlled cultivation. Journal of Applied Horticulture, 15(3): 195-197

Butler JD, Oebker NF. 2006. Hydroponics as a Hobby— Growing Plants Without Soil. Circular 844. Information Office, College of Agriculture, University of Illinois, Urbana, IL 61801

Chen XM, Cai HJ, Li HX, Wang J, Du WJ (2007). Calculation of crop evapotranspiration in greenhouse. Ying Yong Sheng Tai Xue Bao. Feb;18(2):31721.

Fernandes, C., Cora, J.E. and Araujo, J.A.C.d., 2003. Reference evapotranspiration estimation inside greenhouses.s Scientia Agricola, 60 (3): 591-594

Harmato, Saloke, V.M., Babel, M.S. and Tantau, H.J., 2004. Water requirement of drip irrigated tomatoes grown in tropical environmental. Agricultural Water Management (71): 225-242.

Kadam, J. R. and Magar S.S. 1989. Economic aspects of drip irrigation in tomato (Lycopersicom Esculentum, mill), Journal of Indian Water Resources Society, Vol. 12 (1-2): 79-80.

Mahajan.G and Singh K.G.(2006). Response

of Greenhouse tomato to irrigation and fertigation Agricultural Water Management Volume 84, Issues 1–2, 16 July 2006, Pages 202–206

Nagaraj, D. M., Nemichandrappa, M., Ayyanagowdar, M. S., Srinivasareddy, G. V. And Patil, M. G. 2015 Growth and Yield of Bell Pepper (*Capsicum Annuum* Var.*Grossum*) in Soilless Media under Shade House. 10(3): 1391-1394

Orgaz, F.M.D.,Fernandez, S., Bonanchela, M.G. and Fereres, E., 2005. Evapotranspiration of horticultural crops in unheated plastic green house. Agricultural Water Management, 72:81-96.

Sahu, R. K. and Rao, V. N. (2005). Faculty of Agricultural Engineering IGKV Raipur, *Journal of Drainage and irrigation water management*, 118-135

Vinković T., D. Iljkić, Parađiković Nada 2007. Growing tomatoes on a substrate from coconut shells. Acta Agriculturae Serbica, vol. 12, no. 23, p. 55-60.

Vinkovic T., D. Iljkic, Nada Paradjikovic, 2007 Tomato Cultivation on Coconut Husks Substrate. Acta Agriculturae Serbica, Vol. XII, 23 (2007) 55-60.

How to cite this article:

Rajni Lekhpal, R. Agrwal, P. Katre and Singh. R. 2020. Irrigation Management in Tomato with Coco peat Media under Protected Cultivation. *Int.J.Curr.Microbiol.App.Sci.* 9(06): 542-548. doi: https://doi.org/10.20546/ijcmas.2020.906.070