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DRIP IRRIGATION SCHEDULING IN TOMATO (*Lycopersicon esculantum* MILL.)

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ABSTRACT: A field experiment was conducted during the year 2001-02, 2002-03 and 2003-04 at Sabajpura farm, LWEERP, Patna on drip irrigation scheduling in tomato. The experiment was conducted in split plot design with irrigation water equivalent to 100, 80 and 60% ET (Evapo Transpiration) in main plots and water as per daily, alternate days and once in three days schedule in sub-plots. Observations regarding yield (q/ha) and water use efficiency (q/ha^{-cm}) was undertaken. This parameter showed better response at 80%ET when plant received irrigation once in three days except for water use efficiency. Yield of tomato per hectare was maximum at irrigation 80% ET (838.5, 967.72, 895.52q/ha, respectively in three consecutive years) and was significantly higher than 100 % Evapo-Transpiration treatment except second year of observations. Irrigation once in three days gave maximum yield (824.10, 940.23 and 904.76q/ha respectively in three consecutive years). Water use efficiency was significantly higher under 80 % ET (96.71q/ha^{-cm}) during the first year. In the 60% ET treatment irrigation once in three days gave maximum water use efficiency (73.07 and 74.18q/ha^{-cm} during first and third year) except second year where maximum water use efficiency (99.23q/ha^{-cm}) under daily irrigation schedule was observed.

Keywords : *Drip irrigation, evapo-transpiration, water use efficiency, tomato.*

Tomato is a major solanaceous crop next to potato considered as remunerative vegetable crop in India. It is a rich source of minerals, vitamins and organic acids, used as raw in salad, fetch greater demand in processing industry for making ketchup, sauce and puree. Drip irrigation, a boon to today's era of high-tech agriculture, needs to be exploited to its fullest extent. The system has proved its superiority over other conventional methods of irrigation, especially in fruit and vegetable crops owing to precise and direct application of water in the root zone. It is necessary for the vegetable crops grower to know how much water and when it should be applied to a particular crop for enhancing its productivity and can fetch good amount by increasing its marketability. Since, drip irrigation saves 30-40% fertilizer/chemical with enhanced quality of produce and yield as compared to surface irrigation and also helpful in reducing labour cost, salt concentration in the root zone and disease incidence. Therefore, an effort has been laid out keeping all these in view to study the water requirement and irrigation scheduling on tomato with the objective to find out the optimum schedule of irrigation for maximum tomato yield and water use efficiency.

MATERIALS AND METHODS

A field experiment was conducted at ICAR Research Complex for Eastern Region, Patna during 2001-02, 2002-03 and 2003-04 on tomato. The tomato seed S-41 (Gotya, a Mahyco hybrid) was sown in nursery during first week of September and transplanted at the spacing of 60x60cm in the first week of October. The experiment was laid out in split plot design with three replications. The treatments as the main plot factors were irrigation level at 100% (I_1), 80% (I_2) and 60% (I_3) ET (Evapo-transpiration) while as the sub-plot factors were scheduling at daily (S_1), once in two days (S_2) and once in three days (S_3). The drip irrigation systems were consisted of 2lph capacity with online drippers. One lateral for one row of crop with one dripper per plant was adopted in each plot. Each sub-plot consisted of ten rows and ninety plants. The daily irrigation was applied in drip treatments at 1kg/cm^2 pressure. The daily pan evaporation was used to compute the daily water requirement of the crop through drip systems. The effective rainfall was computed by considering the pan evaporation and precipitation received during irrigation intervals. Tomatoes were harvested several times and data were added to estimate the fruit yield and water use efficiency during experimentation and analyzed using

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statistical methods as suggested by Panse and Sukhatme (10).

RESULTS AND DISCUSSION

Effect of irrigation scheduling on yield

The data presented in Table 1 indicated that yield (q/ha) registered in treatment with irrigation at 80% ET scheduling at once in three days. However, significantly maximum water use efficiency was obtained in the treatment with irrigation at 60% ET scheduling at once in three days during first and third year of experimentation while irrigation schedule did not differed significantly during second year. Yield of tomato per hectare was maximum at irrigation at 80% ET significantly higher than 100 % ET might be due to more translocation of photosynthates from leaf to berry, proper staking, more leaf area and of less water application scheduling with once in three days. Maximum yield with irrigation scheduling at once in three days was observed. The possibility of increased yield of tomato due to the increased photosynthesis, maximum individual fruit weight, the production of more number of functional leaves resulting the formation of highest photosynthates, less disease incidence and minimal physiological disorder leads to enhancement of more yields. The increased yield under drip irrigation might have resulted due to better water utilization (Mani frinato, 8), higher uptake of nutrients (Bafna *et al.,* 1), irrigation interval of 3 days (Gvozden *et al.,* 4) and excellent soil-water-air relationship with higher oxygen concentration in the root zone (Gornat *et al.,* 3). These findings are corroborate with the result that drip irrigation scheduled at every third day frequency with irrigation level 79% ET resulted maximum yield of tomato and increased yield up to 27% (Dalvi *et al.,* 2). Prabhakar *et al.* (11) revealed that micro irrigation systems produced 17-29% higher yield. Malik and Kumar (7) also observed maximum green pod yield of pea (*Pisum sativum* L.) when irrigation through drips were applied at 75% of pan evaporation. Narda and Lubana (8) revealed that tomatoes under sub surface drip irrigation system in general performed best in terms of growth dynamics and yield.

Effect of irrigation scheduling on water use efficiency

The data pertaining to water use efficiency (Table 1) showed that field water use efficiency in different irrigation treatments ranged from 53.45 to 96.71, 75.35 to 119.75 and 55.80 to 71.25q/ha^{-cm} during the three consecutive year of experimentation. It was 96.71 and 74.18q/ha^{-cm} with irrigation 80% scheduling at once in three days, where the production potential was (838.50q/ha) as compared to 100% with daily irrigation scheduling (792.00q/ha) during first year while, irrigation 60% scheduling at once in three days, where the production potential was (895.52q/ha) as compared to 100% with daily irrigation scheduling (850.40q/ha) during third year. But the difference between them was non-significant during the second year of trial. The higher water use efficiency might be due to the lower rate of water loss through evaporation from soil surface under drip irrigation. Hao *et al.* (5) observed that irrigation frequency significantly increased the water use efficiency (WUE) and irrigation water use efficiency (IWUE). Irrigation schedule with 45% MAD of availability soil water resulted maximum water use efficiency in cauliflower (Kashyap, 6)

CONCLUSION

The results obtained from the experimentation concluded that drip system is very effective and

Table 1: Effect of drip irrigation scheduling on tomato yield and water use efficiency.

Treatments	Yield (q/ha)			WUE (q/ha^{-cm})		
	2001-02	2002-03	2003-04	2001-02	2002-03	2003-04
Main plots						
100% ET	792.00	920.84	850.40	53.45	75.35	55.80
80% ET	838.50	967.72	895.52	96.71	98.94	71.48
60% ET	804.90	879.00	839.00	91.97	119.75	85.52
C.D. (P=0.05)	30.59	NS	8.41	3.40	10.01	0.77
Sub-Plots						
Daily	787.50	926.14	853.47	79.19	99.23	70.86
2 days	823.80	901.19	826.70	71.86	95.83	67.76
3 days	824.10	940.23	904.76	73.07	98.99	74.18
C.D. (P = 0.05)	19.81	NS	8.34	1.59	NS	0.71

efficient method of irrigation for raising tomato crop and the scheduling of irrigation once in three days at 80% ET through drip systems was suitable for higher productivity of tomato fruit.

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