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Effect of drip irrigation and *jeevamrit* fertigation scheduling on soil and plant moisture status and crop growth in tomato under naturally ventilated polyhouse

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Abstract

The experiment was carried out during spring summer (2020) and autumn winter (2020-2021) on tomato (*Lycopersicum esculentum*) as test crop in a naturally ventilated polyhouse at CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The treatments comprised of two drip irrigation schedules (0.4 PE and 0.8 PE), five *jeevamrit* fertigation schedules (3 DF, 1 WF, 2 WF, 3 WF and 4 WF) and control. The eleven treatments *viz*., (a) 0.4PE3DF (b) 0.4PE1WF (c) 0.4PE2WF (d) 0.4PE3WF (e) 0.4PE4WF (f) 0.8PE3DF (g) 0.8PE1WF (h) 0.8PE2WF (i) 0.8PE3WF (j) 0.8PE4WF and (k) control (1.0PE and recommended doses were applied as basal (25 % RDF) and through fertigation (75 % RDF)). The result indicated that the drip irrigation applied @ 0.8 PE on daily basis was the most suitable treatment having higher soil moisture content, plant height, relative leaf water content and better crop growth leading to higher yield as compared to 0.4 PE. Among *jeevamrit* fertigation schedules, the relatively higher soil moisture content, relative leaf water content and better crop growth was recorded in 3DF as compared to other fertigation schedules.

Key words: Drip irrigation, *jeevamrit,* fertigation, tomato

Efficient use of water resources in the agricultural sector has been a great concern of water managers around the world since, agriculture being the largest consumer of water. Improper irrigation management practices not only waste expensive and scare water resources but also decrease crop yield quality, water use efficiency and economic return. Efficient use of available irrigation water is essential for increasing agricultural production per unit volume of water and per unit area of crop land for the ever increasing Indian population. The judicious use of the available water resources through more efficient methods of water application like drip irrigation under open and protected conditions becomes necessary to enhance the yield and water use efficiency. In drip irrigation, water is applied drop by drop on continuous basis through closed network of plastic pipes at frequent intervals near to the root zone for consumptive use of the crop. High-frequency water management by drip irrigation provides daily requirement of water to a portion of the root zone of each plant and sometimes maintains a high soil matric potential in the rhizosphere to reduce plant water stress (Nakayama and Bucks 1986). The added advantage of drip system is that water soluble fertilizers can also be applied through this system (fertigation). All these emphasize the need for water conservation and improvement in water use efficiency to achieve ‘more crop per drop’.

During the past years, farmers have shown steadily increasing interest in organic farming. More recently, as costs of chemicals and credit have increased and commodity prices have stagnated, thousands of conventional farmers have begun to search for ways to decrease input costs (Jaswal *et al*. 2022). The application of organic liquid formulations either through soil drenching or fertigation helps to achieve higher growth and development of the crops through improved physiological and biochemical processes of the plant, as their application results in rapid availability of macronutrients, micronutrients, growth regulators and other beneficial substances to the plants in addition to enhanced tolerance to biotic and abiotic stresses (Natarajan 2007; Palekar 2006 and Sreenivasa *et al*. 2010).

With the increasing population and improvement in the dietary habits, the consumption of vegetable has increased. Tomato (*Lycopersicum esculentum*) is one of the low-calorie vegetables and is excellent source of antioxidants, dietary fiber, minerals and vitamins. It is one of the important cash crops grown throughout the world and is the most widely used processed crop in several condiments. The optimum production of tomato requires intensive management practices that conserve and manage soil nutrients needed for maintaining soil and water quality and for sustaining tomato production. Water plays an important role in plant life and in determining the yield of tomato. Tomato plants are sensitive to water stress and show high correlation between evapo-transpiration (ET) and crop yield. Protected cultivation provides a better growing environment for plants, protects from rain, wind, high temperatures and minimizes the damage of insect pests and diseases thereby improving the quality and crop yield.

With this back ground, the present study was carried out to study the effect of drip irrigation and *jeevamrit* application schedules on soil and plant water and crop growth of tomato under protected environment.

Materials and Methods

The experiment was carried out from 2020 to 2021 in a naturally ventilated polyhouse at CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The experimental site is located in Palam Valley (320.6' N latitude, 760.3' E longitude) in Kangra district of Himachal Pradesh, at an elevation of 1290 m above mean sea level and represents Himachal Pradesh's mid hills sub humid agro climatic zone in the North Western Himalayas. According to Thornwaite's classification, the research farm is located in the Wet Temperate Zone (Aggarwal *et al*. 1978). The average air temperature ranges from 20°C in January to about 36 °C in May and June. The Temperatures in the soil can dip to as low as 2°C and frost is a typical occurrence. The relative humidity of this region ranges from 46 to 84 per cent.

The experiment was conducted in a naturally ventilated polyhouse during spring summer (2020) and autumn winter (2020-2021) on tomato (*Lycopersicum esculentum*) as test crop. The 30 strips of 1m^2 were prepared having 6 pits each for installing dripper lines and transplanting of tomato. The recommended manures dose of 250 kg/ha *ghanjeevamrit* and 250 kg/ha of FYM was applied in each strips before transplanting. The surface inline drip lines were fixed on crop strips. The root of tomato seedlings were treated with *beejamrit* for 30 minutes before transplanting. The tomato hybrid (Palam Tomato Hybrid-1) was transplanted on 27th April, 2020 (crop I) and 8th November, 2020 (crop II) on strips adjacent to the drippers. These strips were treated through fertigation (10 % solution of *jeevamrit*) at different frequencies as per the treatments starting from 3rd and 2nd week of transplanting to 10 days before the final harvest of crop I and crop II, respectively. In adjoining polyhouse 3 strips were prepared for control and the recommended doses (150:120:55; N: P2O5:K2O kg/ha) were applied as basal (25 % RDF) and through fertigation (75 % RDF) at weekly intervals starting from 3rd week of transplanting to 15 days before the final harvest in all the treatments. The treatments comprised of two drip irrigation schedules (40 % of Pan Evaporation = 0.4 PE and 80 % of Pan Evaporation = 0.8 PE), five *jeevamrit* fertigation schedules viz., (3 days interval of fertigation = 3 DF, 1 week interval of fertigation = 1 WF, 2 weeks interval of fertigation = 2 WF, 3 weeks interval of fertigation = 3 WF and 4 weeks interval of fertigation = 4 WF) and control. The eleven treatment combinations *viz*., (a) 0.4PE3DF (b) 0.4PE1WF (c) 0.4PE2WF (d) 0.4PE3WF (e) 0.4PE4WF (f) 0.8PE3DF (g) 0.8PE1WF (h) 0.8PE2WF (i) 0.8PE3WF (j) 0.8PE4WF and (k) control (1.0PE).

The irrigation requirements were calculated using evaporation data recorded daily at meteorological observatory located around 300 m away from experimental field. The daily evaporation data recorded from April to September 2010 to 2020 (ten year) for crop I and November to March 2010 to 2020 (ten year) for crop II were averaged and irrigation requirement was calculated by multiplying the averaged values with corresponding PE values.

The changes in soil water content at dripper and between the dripper during the both crop period at 0-7.5, 7.5-15 and15-30 cm depths were determined by thermo gravimetric method at 15 days intervals after transplanting. Volumetric water content (Θ) for different depths was calculated by multiplying the water content (w/w basis) with pre-determined bulk density for that depth (Hillel 1982).

The relative leaf water content (RLWC) was determined at monthly intervals during 7.00 AM, 10.00 AM, 2.00 PM and 5.00 PM. RLWC was computed from the fresh weight, turgid weight and oven dry weight according to the method given by Weatherly (1950) as

$$\text{RLWC}=\frac{\text{Fresh weight - Oven dry weight}}{\text{Fully turgid weight - Oven dry weight}}\times 100$$

The plant height was calculated from base of the plant to the tip of the growing point at flowering.

The data were analysed using standard statistical techniques described by Cochran and Cox (1963).

Results and Discussion

Soil moisture content

The soil moisture content (Θ) determined at 0-0.075, 0.075-0.15 and 0.15-0.30 m soil depths at 60 DAT during the growth period of crop I and crop II are given in table 1 and 2.

At dripper, among different irrigation scheduling, significantly higher values of soil moisture content were recorded in 0.8 PE (28.28, 29.76 & 30.94 % by

Table 1. Effect of drip irrigation and *jeevamrit* application schedules on soil water content (% by volume) at 60 days after transplanting of tomato in Crop I (April-Sep 2020)

At dripper	Drp irrigation (D)	*Jeevamrit* application (F)								
		3DF	1WF	2WF	3WF	4WF	Mean	CD (5%)		
					0-0.075 m					
	0.4 PE	28.65	28.14	27.51	27.11	26.66	27.61	**D**	**F**	**D×F**
	0.8 PE	29.43	28.71	28.37	27.73	27.15	28.28	0.34	0.54	NS
	Mean	29.04	28.43	27.94	27.42	26.91				
	Control	29.82	**CD (5%)**							
	Others	27.95	0.56							
					0.075-0.15 m					
	0.4 PE	30.12	29.74	29.31	28.75	28.28	29.24	0.15	0.24	NS
	0.8 PE	30.66	30.19	29.80	29.36	28.77	29.76			
	Mean	30.39	29.96	29.56	29.06	28.52				
	Control	31.05	**CD(5%)**							
	Others	29.50	0.25							
					0.15-0.30 m					
	0.4 PE	31.16	30.78	30.43	30.12	29.74	30.45	0.18	0.28	NS
	0.8 PE	31.73	31.24	30.92	30.62	30.19	30.94			
	Mean	31.44	31.01	30.68	30.37	29.97				
	Control	32.22	**CD(5%)**							
	Others	30.69	0.30							
Between dripper	**Drip irrigation (D)**	*Jeevamrit* fertigation(F)								
		3DF	1WF	2WF	3WF	4WF	Mean	CD (5%)		
	0-0.075 m									
	0.4 PE	28.08	27.47	26.83	26.34	26.07	26.96	**D**	**F**	**D×F**
	0.8 PE	28.72	28.17	27.57	27.16	26.29	27.58	0.35	0.56	NS
	Mean	28.40	27.82	27.20	26.75	26.18				
	Control	29.43	**CD(5%)**							
	Others	27.27	0.59							
					0.075- 0.15 m					
	0.4 PE	29.47	28.90	28.52	28.18	27.53	28.52	0.41	0.64	NS
	0.8 PE	29.92	29.69	29.41	28.71	28.19	29.18			
	Mean	29.70	29.30	28.96	28.44	27.86				
	Control	30.26	**CD(5%)**							
	Others	28.85	0.67							
					0.15 -0.30 m					
	0.4 PE	30.47	30.24	29.70	29.44	29.18	29.81	0.36	0.57	NS
	0.8 PE	30.87	30.72	30.43	29.80	29.44	30.25			
	Mean	30.67	30.48	30.07	29.62	29.31				
	Control	31.62	**CD(5%)**							
	Others	30.03	0.60							

Table 2. Effect of drip irrigation and *jeevamrit* application schedule on soil water content (% by volume) at 60 days after transplanting of tomato in Crop II (Nov 2020-March 2021)

At dripper	Drp irrigation (D)	*Jeevamrit* application (F)								
		3DF	1WF	2WF	3WF	4WF	Mean	CD (5%)		
					0-0.075 m					
	0.4 PE	28.59	28.09	27.10	26.39	25.67	27.17	D	F	D×F
	0.8 PE	29.36	28.90	28.47	27.62	26.77	28.22	0.34	0.53	NS
	Mean	28.97	28.49	27.79	27.01	26.22				
	Control	29.83	CD(5%)							
	Others	27.70	0.56							
					0.075- 0.15 m					
	0.4 PE	29.15	28.14	27.18	26.56	25.82	27.37	0.66	1.04	NS
	0.8 PE	29.42	29.19	28.52	27.81	26.95	28.38			
	Mean	29.28	28.66	27.85	27.18	26.39				
	Control	30.17	CD(5%)							
	Others	27.87	1.10							
					0.15 -0.30 m					
	0.4 PE	30.70	29.60	28.60	28.03	27.17	28.82	0.42	0.67	NS
	0.8 PE	31.47	30.92	30.74	29.36	28.53	30.20			
	Mean	31.08	30.26	29.67	28.70	27.85				
	Control	31.72	CD(5%)							
	Others	29.51	0.70							
Between dripper	Drip irrigation (D)	*Jeevamrit* fertigation (F)								
		3DF	1WF	2WF	3WF	4WF	Mean	CD (5%)		
					0-0.075 m					
	0.4 PE	28.23	27.39	26.27	26.37	25.01	26.66	D	F	D×F
	0.8 PE	28.62	28.43	27.75	27.05	26.05	27.58	0.31	0.48	NS
	Mean	28.43	27.91	27.01	26.71	25.53				
	Control	29.42	CD(5%)							
	Others	27.12	0.51							
					0.075- 0.15 m					
	0.4 PE	28.58	27.45	26.42	26.04	25.04	26.71	0.28	0.44	0.62
	0.8 PE	28.83	28.61	28.14	27.24	26.25	27.82			
	Mean	28.71	28.03	27.28	26.64	25.65				
	Control	29.74	CD(5%)							
	Others	27.26	0.46							
					0.15 -0.30 m					
	0.4 PE	29.92	29.20	28.16	27.25	26.79	28.26	0.30	0.48	NS
	0.8 PE	30.81	30.42	30.32	28.63	28.08	29.65			
	Mean	30.36	29.81	29.24	27.94	27.44				
	Control	30.89	CD(5%)							
	Others	28.96	0.50							

volume) and (28.22, 28.38 & 30.20 % by volume) than 0.4 PE (27.61, 29.24 & 30.45 % by volume) and (27.17, 27.37 & 28.82 % by volume) under crop I and crop II at all three depths, respectively. Similarly, for crop I, among different fertigation scheduling, significantly higher values of soil moisture content were recorded in 3DF (29.04, 30.39 & 31.44 % by volume) as compared to other treatments. However for crop II, among different fertigation scheduling, the higher values of soil moisture content were recorded in 3DF (28.97 & 29.28 % by volume) at 0-0.075 & 0.075-0.15 m soil depths. However, soil moisture content in 3DF was statistically at par with 1WF (28.49 & 28.66 % by volume) at those depths, respectively. However, significantly higher value of soil moisture content was recorded in 3DF (31.08 % by volume) at 0.15-0.30 m soil depth as compared to other treatments. The interaction between irrigation scheduling and fertigation scheduling on soil moisture content was non-significant at all three depths for both the crops. In control vs others comparison, significantly higher values of soil moisture content were recorded in control (29.82, 31.05 & 32.22 % by volume) and (29.83, 30.17 & 31.72 % by volume) than others (27.95, 29.50 & 30.69 % by volume) and (27.70, 27.87 & 29.51 % by volume) under crop I and crop II at all three depths, respectively.

Between dripper, among different irrigation scheduling, significantly higher values of soil moisture content were recorded in 0.8 PE (27.58, 29.18 & 30.25 % by volume) and (27.58, 27.82 & 29.65 % by volume) than 0.4 PE (26.96, 28.52 & 29.81 % by volume) and (26.66, 26.71 & 28.26 % by volume) for crop I and crop II at all three depths, respectively. Under crop I, among different fertigation scheduling significantly higher value of soil moisture content was recorded in 3DF (28.40 % by volume) at 0- 0.075 m soil depths compared to other treatments. However, at 0.075-0.15 m and 0.15- 0.30 m soil depths the higher values of soil moisture content were recorded in 3DF (29.70 & 30.67 % by volume), respectively. However, soil moisture content in 3DF was statistically at par with 1WF (29.30 & 30.48 % by volume) at those soil depths, respectively. Similarly, for crop II, among different fertigation scheduling significantly higher values of soil moisture content were recorded in 3DF (28.32, 28.64 & 30.07 % by volume) at all three depths as compared to other treatments. The interaction between irrigation scheduling and fertigation scheduling on soil moisture content was non-significant at all three depths for both the crops. In control vs others comparison, significantly higher values of soil moisture content were recorded in control (29.43, 30.26 & 31.62 % by volume) and (29.42, 29.74 & 30.89 % by volume) than others (27.27, 28.85 & 30.03 % by volume) and (27.12, 27.26 & 28.96 % by volume) for crop I and crop II at all three depths, respectively. The higher moisture content in 0.8PE over 0.4PE might be due to higher application rate of water. Similar result was reported by Ponnuswamy and Santi (1998). Also, the higher root concentration in surface layer extracted more amount of water which led to lower soil moisture content in surface layers than the sub surface soil layer. According to Ponnuswamy and Santi (1998), more water penetrated into the deeper layers in drip system of irrigation and the crop utilized the water very effectively. Similar result was reported by Kassem (2008). The increase in moisture content in 3DF might be due to reduction of soil bulk density, increased soil porosity, soil aggregation, aggregate size and high-water retention properties which might have contributed to maintain the soil physical structure and resulted in better soil moisture retention as compared to rest of the treatments. Similar results were reported by Pillai (2012) and Mellek *et al*. (2010). The higher moisture content in control over others might be due to higher application rate of water (1.0 PE) compared to 0.4 PE and 0.8 PE irrigation level.

Relative leaf water content

The relative leaf water content (RLWC) determined at 60 DAT during the growth period of crop I and crop II are given in table 3 and 4. Among different irrigation scheduling, significantly higher values of RLWC were recorded in 0.8 PE (85.14, 84.75, 82.26 & 84.20 %) and (87.96, 86.78, 84.66 & 87.48 %) than 0.4 PE (82.63, 82.12, 80.97 & 82.28 %) and (85.95, 84.77, 82.77 & 85.55 %) at 07. 00 AM, 10.00 AM, 02.00 PM and 5.00 PM, under crop I and crop II respectively. Similarly, under crop I, among different fertigation scheduling, the higher value of RLWC was recorded in 3DF (84.40 %) at 02.00 PM. However, RLWC in 3DF was statistically at par with 1WF (83.30 %) at that time. However, significantly

Table 3. Effect of drip irrigation and *jeevamrit* application schedules on RLWC (%) at 60 days after transplanting of tomato in crop I (April-Sep 2020)

Drip irrigation (D)	*Jeevamrit* fertigation (F)								
	3DF	1WF	2WF	3WF	4WF	Mean	CD (5%)		
				7.00 AM					
0.4 PE	85.99	84.15	82.05	80.77	80.18	82.63	**D**	**F**	**D×F**
0.8 PE	88.60	87.41	85.12	83.19	81.36	85.14	0.48	0.77	NS
Mean	87.29	85.78	83.59	81.98	80.77				
Control	89.39	**CD(5%)**							
Others	83.88	0.80							
				10.00 AM					
0.4 PE	85.40	83.71	81.54	80.19	79.75	82.12	0.35	0.56	0.79
0.8 PE	88.13	86.91	84.80	82.80	81.09	84.75			
Mean	86.77	85.31	83.17	81.49	80.42				
Control	88.81	**CD(5%)**							
Others	83.43	0.58							
				2.00 PM					
0.4 PE	83.31	82.35	80.45	79.48	79.27	80.97	0.75	1.18	NS
0.8 PE	85.49	84.26	82.63	80.51	78.44	82.26			
Mean	84.40	83.30	81.54	79.99	78.85				
Control	85.99	**CD(5%)**							
Others	81.62	1.24							
				5.00 PM					
0.4 PE	85.22	83.63	82.13	80.68	79.72	82.28	0.52	0.83	NS
0.8 PE	86.80	86.16	83.87	82.95	81.24	84.20			
Mean	86.01	84.89	83.00	81.82	80.48				
Control	87.86	**CD(5%)**							
Others	83.24	0.86							

higher values of RLWC were recorded in 3DF (87.29, 86.77 & 86.01 %) at 07. 00 AM, 10. 00 AM and 05.00 PM, respectively as compared to other treatments. However under crop II, among different fertigation scheduling, significantly higher values of RLWC were recorded in 3DF (88.64, 87.47, 85.46 & 88.29 %) at all those respective times as compared to other treatments. Under crop II, the interaction between irrigation scheduling and fertigation scheduling on RLWC was non-significant at 07.00 AM, 02.00 PM and 05.00 PM. However, at 10.00 AM significantly higher value of RLWC was recorded in 0.8PE3DF (88.13 %) as compared to other treatment combinations. Similarly, for crop II, the interaction between irrigation scheduling and fertigation scheduling on RLWC was non-significant at all those respective time periods. In control vs others comparison, significantly higher values of RLWC were recorded in control (89.39, 88.81, 85.99 & 87.86 %) and (90.34, 89.18, 87.30 & 89.79 %) than others (83.88, 83.43, 81.62, 83.24 %) and (86.96, 85.78, 83.72 & 86.51 %) under crop I and crop II, at 07. 00 AM, 10.00 AM, 02.00 PM and 5.00 PM, respectively. The results showed that RLWC was lower in 0.4 PE in comparison to 0.8 PE due to less quantum of water application leading to proportional decrease in the quantity of available water in the soil. Kirnak *et al.* (2010) reported that water stress resulted in reduced vegetative growth, leaf relative water content and leaf chlorophyll content. Similar results were also reported

Table 4. Effect of drip irrigation and *jeevamrit* application schedules on RLWC (%) at 60 days after transplanting of tomato in Crop II (Nov 2020-March 2021)

Drip irrigation (D)	***Jeevamrit* fertigation (F)**								
	3DF	**1WF**	**2WF**	**3WF**	**4WF**	**Mean**	**CD (5%)**		
				7.00 AM					
0.4 PE	88.01	86.85	86.32	84.41	84.15	85.95	**D**	**F**	**D×F**
0.8 PE	89.26	89.24	88.33	86.85	86.13	87.96	0.36	0.57	NS
Mean	88.64	88.05	87.33	85.63	85.14				
Control	90.34	**CD(5%)**							
Others	86.96	0.60							
				10.00 AM					
0.4 PE	86.84	85.67	85.16	83.23	82.96	84.77	0.34	0.53	NS
0.8 PE	88.09	88.07	87.15	85.65	84.96	86.78			
Mean	87.47	86.87	86.16	84.44	83.96				
Control	89.18	**CD(5%)**							
Others	85.78	0.56							
				2.00 PM					
0.4 PE	84.74	83.66	83.16	81.30	81.01	82.77	0.29	0.46	NS
0.8 PE	86.18	86.06	85.32	83.39	82.36	84.66			
Mean	85.46	84.86	84.24	82.34	81.69				
Control	87.30	**CD(5%)**							
Others	83.72	0.48							
				5.00 PM					
0.4 PE	87.48	86.36	86.07	84.06	83.79	85.55	0.31	0.50	NS
0.8 PE	89.10	88.60	88.13	86.28	85.28	87.48			
Mean	88.29	87.48	87.10	85.17	84.53				
Control	89.79	**CD(5%)**							
Others	86.51	0.52							

by Xu and Leskover (2014), Singh (2016) and Singh (2019).

The highest RLWC in 3DF might be due higher soil moisture retention due to increased soil porosity and aggregation compared to other treatments. Again the diurnal variation of RLWC indicated that there was increase in RLWC at 7.00 AM and 5.00 PM as compared to 10.00 AM and 2.00 PM. This might be due to low ET demand of crop at morning and evening then that of day and noon period.

Crop growth parameter

The data pertaining to the effect of drip irrigation and *jeevamrit* application scheduling on plant height at 30 DAT and 90 DAT is given in Table 5. At 30 DAT, among different irrigation scheduling, significantly higher values of plant height were recorded in 0.8 PE (81.97 & 80.71 cm) than 0.4 PE (80.21 & 76.28 cm) under both crop I & crop II, respectively. The higher plant height in 0.8 PE might be due to enhanced availability of soil moisture with higher application rate throughout the crop growth period. Similar results were also reported by Acharya *et al*. (2013) and Pires *et al*. (2011). Similarly among different fertigation scheduling, significantly higher values of plant height were recorded in 3DF (83.98 & 84.50 cm) under both crop I & crop II, respectively as compared to other treatments. The increase in plant height in 3DF might be due to high availability of soil moisture due to improved physical properties and improved nutrient status of soil, leading to the adequate supply of nutrients to the plants for promoting the maximum vegetative growth. Similar findings have been reported by Mellek *et al*. (2010), Gore and Sreenivasa (2011), Pati and Udmale (2016) Safiullah *et al*. (2018) and Sharma *et al*. (2020) in different field and vegetable crops. The interaction between irrigation

Table 5. Effect of drip irrigation and *jeevamrit* application schedules in plant height (cm)

30 DAT	**Drip irrigation (D**			***Jeevamrit* fertigation (F)**						
	3DF	**1WF**	**2WF**	**3WF**	**4WF**	**Mean**		**CD (5%)**		
				Crop (I)						
	0.4 PE	83.51	81.63	79.58	78.41	77.93	80.21	**D**	**F**	**D×F**
	0.8 PE	84.44	83.85	82.10	79.95	79.52	81.97	0.65	1.03	NS
	Mean	83.98	82.74	80.84	79.18	78.73				
	Control	79.40	**CD(5%)**							
	Others	81.09	1.08							
				Crop (II)						
	0.4 PE	82.51	79.33	76.08	73.35	70.16	76.28	0.76	1.20	NS
	0.8 PE	86.48	85.14	80.25	77.23	74.47	80.71			
	Mean	84.50	82.23	78.17	75.29	72.31				
	Control	75.93	**CD(5%)**							
	Others	78.50	1.26							
90 DAT	**Drip irrigation (D)**			***Jeevamrit* fertigation (F)**						
		3DF	**1WF**	**2WF**	**3WF**	**4WF**	**Mean**	**CD (5%)**		
				Crop (I)						
	0.4 PE	180.85	178.46	177.00	173.49	172.12	176.3827	D	F	D×F
	0.8 PE	184.75	182.53	179.11	177.20	174.11	179.54	1.37	2.16	NS
	Mean	182.80	180.50	178.06	175.34	173.12				
	Control	175.61	**CD(5%)**							
	Others	177.96	2.27							
				Crop (II)						
	0.4 PE	173.88	172.30	170.99	167.79	166.14	170.22	2.04	3.22	NS
	0.8 PE	178.96	176.60	172.80	171.53	168.61	173.70			
	Mean	176.42	174.45	171.90	169.66	167.38				
	Control	169.48	**CD(5%)**							
	Others	171.96	NS							

scheduling and fertigation scheduling on plant height was non-significant for both crops. In control vs others comparison, significantly higher values of plant height were recorded in others (81.09 & 78.50 cm) than control (79.40 & 75.93 cm) under both crop I & crop II, respectively. The higher plant height in 'others' might be due to the better moisture and nutrient availability resulted from improved physical, chemical and biological properties of soil which increased the efficient utilization of nutrients and their uptake and consequently enhanced different growth parameters crops.

At 90 DAT, the plant height was significantly higher under 0.8 PE (179.54 & 173.70 cm) than 0.4 PE (176.38 & 170.22 cm) under both crop I & crop II, respectively. Similarly, among different fertigation scheduling, significantly higher values of plant height were recorded in 3DF (182.80 cm) under crop I as compared to other treatments. However, in crop II, the treatment 1 WF was statistically at par with treatment 3DF. The interaction between irrigation scheduling and fertigation scheduling on plant height was non-significant for both crops. In control vs others comparison, significantly higher values of plant height were recorded in others (177.96 cm) than control (175.61 cm) under crop I.

Correlation study

The correlation between soil moisture stock and relative leaf water content at 30, 60, 90 and 120 DAT for both crop I and crop II were studied and the coefficient of correlation (r) values are given in table 6. The coefficient of correlation (r) between soil moisture stock and relative leaf water content were highly significant and positively correlated for both the crops.

Conclusion

Based on the two season of study in tomato indicated that the drip irrigation applied @ 0.8 PE on daily basis was the most suitable treatment having higher soil moisture content, plant height, relative leaf water content and better crop growth leading to higher yield as compared to 0.4 PE. Similarly, among *jeevamrit* fertigation schedules, the relatively higher soil moisture content, relative leaf water content and better crop growth was recorded in 3DF as compared to other fertigation schedules.

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Table 6. Coefficient of correlation (r) between soil moisture stock and relative leaf water content

Soil moisture stock	Relative leaf water content			
	30 DAT	60 DAT	90 DAT	120 DAT
30 DAT	0.959** (Crop I) 0.928** (Crop II)	—	—	—
60 DAT	—	0.967**(Crop I) 0.935**(Crop II)	—	—
90 DAT	—	—	0.951**(Crop 0.910**(Crop II)	—
120 DAT	—	—	—	0.947**(Crop I) 0.745**(Crop II)

** Significant at 1 per cent level of significance

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