



RESEARCH ARTICLE

Sustainable chilli (*Capsicum annum* L.) production under AI-driven IoT irrigation systems: Yield response and economic feasibility

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Abstract

The integration of Artificial Intelligence and Internet of Things technologies into precision irrigation management presents a promising pathway toward sustainable horticultural production. This study evaluated the yield performance and economic feasibility of chilli (*Capsicum annum* L.) cultivation under drip irrigation methods and irrigation scheduling approaches at Water Technology Centre fields, College Farm, College of Agriculture, Rajendranagar, Hyderabad, during the 2022-23 and 2023-24 Rabi seasons. The experiment was laid out in a split-plot design with two main plots, viz., drip irrigation methods (surface drip and subsurface drip) and four subplots, viz., irrigation scheduling approaches (soil moisture sensor, plant water stress sensor, evapotranspiration (ET) system sensor-based irrigation triggering & irrigation scheduling at 1.0 E_{pan} by manual). Results showed that subsurface drip irrigation resulted in significantly higher yields (green fruit + stalk) and economics (₹ 669148 ha⁻¹) and benefit-cost ratio (4.98) between drip irrigation methods. Among irrigation scheduling approach treatments, yield (green fruit + stalk) and economics (₹ 696735 ha⁻¹) and benefit-cost ratio (5.20) were better with ET sensor-based irrigation triggering. The study demonstrates that integrating AI-based decisions with IoT-enabled irrigation sensors can optimize resource utilization, enhance water use efficiency and support climate-resilient and economically viable chilli production. The findings provide a replicable framework for scaling sustainable smart-farming interventions across smallholder horticultural systems.

Keywords: automation; economics; green fruit yield; sensor-based drip irrigation; stalk yield

Introduction

Agriculture remains the main source of livelihood for nearly half of India's population, making it one of the country's most vital economic sectors in terms of gross domestic product (GDP) (1-3). Irrigated agriculture alone consumes more than two-thirds of the total fresh water on the planet, creating substantial competition in freshwater allocation between agriculture and other economic sectors (4). India, as the world's largest producer, consumer and exporter of chilli, contributes approximately 40 % to the global chilli production, with an area of 760.98 thousand ha dedicated to its cultivation and an annual yield of 1605.01 thousand mt (5). Chilli accounts for the largest share of spice exports from India, accounting

for about 34 % of India's total spices exports during 2023-24 (6). Despite its high economic importance (exports, value-addition, livelihoods), chilli is sensitive to both water excess and deficit, meaning that careful water management can significantly improve yields, quality and resource use efficiency. Management of water efficiently and effectively can potentially double the crop productivity (7). Nonetheless, irrigation is labour-intensive and difficult to manage, particularly in large-scale farming operations (8). One of the strategies for optimizing irrigation scheduling is adopting modern irrigation systems, such as drip and subsurface irrigation systems in the fields, instead of traditional surface irrigation (9, 10). Modern irrigation methods, such as drip and sprinkler systems, though effective, integrating them with Artificial Irrigation and

Internet of Things-based irrigation are transforming modern agriculture by offering a sustainable and highly efficient alternative to labour-intensive irrigation practices, helping farmers to save time, cut labour costs, enhance water use efficiency and boost overall agricultural productivity (8).

Materials and Methods

An investigation was conducted in chilli (*Capsicum annuum* L.) during *Rabi* seasons of 2022-23 and 2023-24 at Water Technology Centre fields, College Farm, College of Agriculture, Rajendranagar, Hyderabad, Telangana, India. The geographical area of Hyderabad comes under dry tropical and semi-arid regions. The seasonal rainfall received was 75 mm (2022-23) and 16.0 mm (2023-24) respectively. The soil of the experimental farm was sandy loam in texture with low in available N (245.75 kg ha⁻¹) and high available P₂O₅ (26.98 kg ha⁻¹) and K₂O (338.32 kg ha⁻¹). The total available soil moisture (mm) for a depth of 0-30 cm was 46.25 mm. A split plot design was employed with different drip irrigation methods as main plots and various irrigation scheduling approaches imposed as subplots and furrow irrigation at 1.0 IW/CPE treatment (farmer's practice) was imposed for comparison. All treatments were replicated three times. The drip irrigation methods studied were surface drip (I₁) laid at 0 cm from the soil surface and subsurface drip (I₂) at 15 cm deep below the soil surface. Irrigation scheduling approaches imposed were soil moisture sensor-based irrigation triggering (S₁), plant water stress sensor-based irrigation triggering (S₂), ET sensor-based irrigation triggering (S₃) and irrigation scheduling at 1.0 Epan by manual.

Automatic irrigation was scheduled using various sensors, which were calibrated before installation in the field. The linear regression technique is used to model the behaviour of the capacitance soil moisture sensor (SW-10) and the ET system coupled with solar radiation sensor (EMC-01) and the ambient temperature sensor. A logistic regression technique with edge computing at the device side is used to model the behaviour of canopy (NTC-10K) and ambient temperature sensors in the plant water stress system. Based on the crop performance, 40 % DASM (depletion of available soil moisture) was fixed for the irrigation scheduling in soil moisture sensor-based treatment, at which the gravimetric moisture readings of 16.8 and 23.6 % were set as lower and higher threshold values respectively. At these points, the voltage readings of sensors were recorded and used in programming of irrigation.

The irrigation triggering under plant water stress system was based on crop water stress index (CWSI). The CWSI was evaluated by using the following formula suggested previously (11).

$$CWSI = \frac{(T_c - T_a) - (T_c - T_a)_{ll}}{(T_c - T_a)_{ul} - (T_c - T_a)_{ll}} \quad (\text{Eqn.1})$$

Where (T_c-T_a) = difference between canopy and air temperature, (T_c-T_a)_{ll} = lower limit of the temperature difference for a well-watered crop and (T_c-T_a)_{ul} = the upper limit of the temperature difference of severely stressed crop.

Based on the crop stress tolerance, the CWSI=0.3 was taken as the lower threshold value for the irrigation triggering and CWSI=0, as the higher threshold value to stop the irrigation.

Sensors in the ET system automatically record the real-time weather data of the experimental location and send the collected

data to the microcontroller, where calculations of crop ET take place. The Hargreaves-Samani equation is used for the prediction of reference ET. The crop ET was computed from the following equation,

$$K_c = \frac{\text{Crop evapotranspiration (ETc) (mm day}^{-1}\text{)}}{\text{Reference crop evapotranspiration (ETO) (mm day}^{-1}\text{)}} \quad (\text{Eqn.2})$$

The K_c values for the initial 20 DAT (days after transplanting) (0.52), next 40 DAT (0.80) and next 70 DAT (1.05) and end stage (0.78) were taken as per the Food and Agriculture Organization of the United Nations (FAO) recommendation. The microcontroller then switches ON the solenoid valve automatically for irrigation at the set time and automatically switches OFF after the irrigation and uploads the information to the dashboard/personal computer.

Paired row planting with a spacing of 80/40 cm × 60 cm was adopted in the drip irrigation methods, whereas in the ridge and furrow method, seedlings were transplanted at a spacing of 60 cm × 45 cm. The Recommended Dose of Fertilizer (RDF) for chilli crop is 300:60:120 N:P₂O₅:K₂O kg ha⁻¹. In the ridge and furrow method, irrigation was applied at a ratio of 1.0 IW/CPE with 50 mm irrigation water. The daily evaporation data were recorded from USWB class A open pan evaporimeter situated at Meteorological Observatory, Agro-Climatic Research Centre, Agricultural Research Institute, Rajendranagar.

The fruits of chilli cultivar 'Devsena 88' were harvested in six pickings. At all the pickings, fruits in the net plot were harvested treatment-wise separately and weighed immediately on an electronic weighing balance to register the fruit yield (kg plot⁻¹). Finally, the six pickings yield was summed up and expressed in terms of kg ha⁻¹. The stalks of the net plot were cut to the ground level and sun-dried after the final picking of green fruits, in the respective treatments for about 10-15 days and then the bundled stalks were weighed using a spring balance and the weight was expressed in kg ha⁻¹.

$$\text{Net returns (₹ ha}^{-1}\text{)} = \text{Gross returns} - \text{Cost of cultivation} \quad (\text{Eqn.3})$$

Economic analysis was carried out by calculating the cost of cultivation for different field operations done during crop growth and development. Gross returns were computed from the fresh fruit yield of chilli crop obtained from different treatments and multiplied by respective market prices of fruit yield. Net returns were worked out by deducting the cost of cultivation from gross returns.

The benefit-cost (B:C) ratio was calculated by dividing the gross returns by the total investment expenses and was evaluated for each treatment by using the following formula given previously (12). The data collected was subjected to statistical scrutiny by analysis of the variance technique for split-plot design concept and two-sample t-test with equal variances (for comparison of furrow irrigation with best treatments) as suggested by earlier reports (13).

The smart irrigation systems consisted of three main setups: the ET system, soil moisture system and plant water stress system, amounting to a total cost of ₹ 25000, ₹ 15000 and ₹ 20050 respectively.

Results and Discussion

Yield

Green (fresh) fruit yield at different pickings (kg ha⁻¹): The yield potential of a crop is influenced by the genetic potential of the selected cultivar and the management practices under which the crop is cultivated. Fruits of chilli were harvested in green form at six pickings and the data pertaining to each picking were presented in Tables 1 and 2. From the analysis of variance furnished in the table, it can be clearly opined that the green fruit yield of chilli at different pickings was significantly influenced by drip irrigation methods and irrigation scheduling approaches in both years of study. The green (fresh) fruit yield showed an increasing trend up to the third picking and thereafter decreased gradually towards the last picking during both years.

Significantly higher green (fresh) fruit yield of chilli was observed under subsurface drip between drip irrigation methods during first year (6909, 7540, 8229, 6551, 6113 and 5530 kg ha⁻¹) and

second year (7228, 7873, 8569, 6909, 6424 and 5845 kg ha⁻¹) over surface drip at 1st, 2nd, 3rd, 4th, 5th and 6th pickings respectively. The increased fruit yield under subsurface drip irrigation may be attributed to the maintenance of constant soil moisture within the root zone, which meets daily crop ET demands and reduces evaporation losses. This, in turn, enhances the availability of resources such as water and nutrients, promoting the growth of taller plants with a greater number of branches and leaves. These improvements ultimately enhance physiological and photosynthetic activity and facilitate the translocation of assimilates from source to sink (14–18). This directly influenced the increase in yield attributes per plant, that reflected in improved fruit yield. The results agreed with the research findings of previous studies in bell pepper, tomato and okra (19 - 21). The improved yields under subsurface drip irrigation are probably due to enhanced water availability for the plants (22). The mean data of green (fresh) fruit yield at all the pickings also followed the same pattern of superiority.

Among irrigation scheduling approaches, significantly higher

Table 1. Green (fresh) fruit yield (kg ha⁻¹) of chilli as influenced by drip irrigation methods and irrigation scheduling approaches at various pickings

Treatments	1 st picking			2 nd picking			3 rd picking			4 th picking		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean
Main Plot-Drip irrigation methods (I)												
I ₁	6572	6883	6727	7125	7451	7288	7795	8141	7968	6258	6602	6430
I ₂	6909	7228	7069	7540	7873	7707	8229	8569	8397	6551	6909	6730
S.Em±	48	50	52	62	58	65	63	66	68	43	47	40
CD (p=0.05)	294	304	316	377	353	396	382	402	414	262	286	243
Sub plot-Irrigation scheduling approaches (S)												
S ₁	6317	6609	6463	6790	7122	6956	7480	7813	7646	5883	6249	6066
S ₂	6625	6926	6776	7158	7487	7322	7859	8202	8030	6270	6600	6435
S ₃	7093	7416	7254	7766	8087	7927	8446	8800	8623	6813	7172	6992
S ₄	6929	7271	7100	7614	7951	7783	8264	8605	8432	6652	7000	6826
S.Em±	82	83	84	95	92	87	80	86	84	66	73	70
CD (P=0.05)	253	255	260	293	283	269	247	266	259	204	226	216
Interaction (M x S)												
S.Em±	111	113	116	132	127	125	117	125	123	92	101	95
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (S x M)												
S.Em±	116	117	119	134	130	123	113	122	119	94	104	99
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Treatment details:

Main plots- Drip irrigation methods (I)

I₁- Surface drip irrigation

I₂- Subsurface drip irrigation

Subplots- Irrigation scheduling approaches (S)

S₁- Soil moisture sensor based irrigation triggering

S₂- Plant water stress sensor based irrigation triggering

S₃- ET sensor based irrigation triggering

S₄- Irrigation scheduling at 1.0 Epan by manual (control)

Table 2. Green (fresh) fruit and stalk yield at harvest (kg ha⁻¹) of chilli as influenced by drip irrigation methods and irrigation scheduling approaches

Treatments	5 th picking			6 th picking			Stalk yield (kg ha ⁻¹)		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean
Main Plot-Drip irrigation methods (I)									
I ₁	5808	6126	5967	5178	5487	5333	4729	4883	4806
I ₂	6113	6424	6269	5530	5845	5688	4967	5107	5037
S.Em±	48	46	48	54	51	46	35	32	30
CD (p=0.05)	290	277	292	329	311	282	211	193	185
Sub plot-Irrigation scheduling approaches (S)									
S ₁	5497	5803	5650	4856	5142	4999	4564	4687	4626
S ₂	5866	6173	6019	5249	5564	5406	4705	4894	4800
S ₃	6297	6638	6467	5710	6040	5875	5123	5270	5196
S ₄	6182	6486	6334	5602	5918	5760	4999	5130	5065
S.Em±	75	73	71	69	66	71	45	49	51
CD (P=0.05)	232	225	218	211	204	218	138	152	158
Interaction (M x S)									
S.Em±	104	100	99	100	96	98	65	68	70
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (S x M)									
S.Em±	106	103	100	97	94	100	63	70	73
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

green (fresh) fruit yield was recorded in ET sensor based irrigation triggering during first year (7093, 7766, 8446, 6813, 6297 and 5710 kg ha⁻¹) and second year (7416, 8087, 8800, 7172, 6638 and 6040 kg ha⁻¹) at 1st, 2nd, 3rd, 4th, 5th and 6th pickings respectively compared to other irrigation triggering treatments and was comparable with irrigation scheduling at 1.0 Epan by manual during first year (6929, 7614, 8264, 6652, 6182 and 5602 kg ha⁻¹) and second year (7271, 7951, 8605, 7000, 6486 and 5918 kg ha⁻¹) at 1st, 2nd, 3rd, 4th, 5th and 6th pickings respectively.

The mean values of green (fresh) fruit yield of irrigation scheduling approaches followed a similar trend as that observed in the first and second years of study. The interaction of drip irrigation methods and irrigation scheduling approaches could not exert a significant influence on green (fresh) fruit yield at all the respective pickings carried out in both years of study.

Comparative results of furrow irrigation with subsurface drip and ET sensor-based irrigation triggering revealed that the higher green (fresh) fruit yield was registered under subsurface drip (40872 and 42848 kg ha⁻¹) and ET sensor-based irrigation triggering (42125 and 44153 kg ha⁻¹) over furrow irrigation (34230 and 36032 kg ha⁻¹) during respective years (Tables 5 and 6).

Stalk yield (kg ha⁻¹): The stalk yield is an important factor in assessing the overall productivity and sustainability of a cropping system. Data pertaining to the stalk yield was furnished in Table 2. Subsurface drip resulted in significantly higher stalk yield (4967 and 5107 kg ha⁻¹) over

surface drip during the first and second year respectively. Likewise, the average value of two years also followed a similar pattern. The increase in stalk yield may be attributed to the direct supply of irrigation water to the root zone, which minimizes soil moisture exposure to solar radiation and thereby reduces evaporation losses. This process enhances nutrient absorption and translocation, leading to higher dry matter production per plant and, ultimately, increased stalk yield (23, 24). These results are in accordance with findings from previous studies (25).

Among irrigation scheduling approaches, significantly higher stalk yield was registered under ET sensor based irrigation triggering (5123 and 5270 kg ha⁻¹) over other treatments but was comparable with irrigation scheduling at 1.0 Epan by manual (4999 and 5130 kg ha⁻¹) and lowest was registered under soil moisture sensor based irrigation triggering (4564 and 4687 kg ha⁻¹) during first and second year respectively. A similar trend in the mean values of stalk yield was noticed in both years of study.

Economics

Man days: Higher man days were inferred under surface drip (109 and 105) than those of subsurface drip (106 and 102) during the first and second year respectively, with respect to drip irrigation methods (Table 3). Reduced maintenance needs, lower weed infestation and less soil disturbances could be the reason for lower man-days under subsurface drip irrigation (26, 27). Irrigation scheduling at 1.0 Epan by manual required higher man-days

Table 3. Economics (₹ ha⁻¹) of chilli as influenced by drip irrigation methods and irrigation scheduling approaches

Treatments	Man days (No. ha ⁻¹)			Cost of cultivation (₹ ha ⁻¹)			Gross returns (₹ ha ⁻¹)		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean
Main Plot-Drip irrigation methods (I)									
I ₁	109	105	107	169758	168650	169204	774720	813743	794247
I ₂	106	102	104	168680	167433	168056	817447	856932	837205
S.Em±	-	-	-	-	-	-	4895	5463	5284
CD (p=0.05)	-	-	-	-	-	-	29783	33240	32152
Sub plot-Irrigation scheduling approaches (S)									
S ₁	104	100	102	169377	168130	168754	736447	774714	755596
S ₂	104	100	102	168765	167423	168094	780525	819009	799782
S ₃	104	100	102	166650	165438	166044	842502	883207	862780
S ₄	117	114	116	172082	171174	171628	824860	864599	844745
S.Em±	-	-	-	-	-	-	6640	7472	6975
CD (P=0.05)	-	-	-	-	-	-	20459	23025	21493
Interaction (M x S)									
S.Em±	-	-	-	-	-	-	9491	10658	10045
CD (P=0.05)	-	-	-	-	-	-	NS	NS	NS
Interaction (S x M)									
S.Em±	-	-	-	-	-	-	9390	10568	9864
CD (P=0.05)	-	-	-	-	-	-	NS	NS	NS

Table 4. Net returns (₹ ha⁻¹) and B:C ratio of chilli as influenced by drip irrigation methods and irrigation scheduling approaches

Treatments	Net returns (₹ ha ⁻¹)			Benefit-Cost ratio		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean
Main Plot-Drip irrigation methods (I)						
I ₁	604962	645123	625043	4.54	4.83	4.70
I ₂	648767	689529	669148	4.85	5.12	4.98
S.Em±	4895	5463	5284	0.03	0.04	0.03
CD (p=0.05)	29783	33240	32152	0.18	0.24	0.20
Sub plot-Irrigation scheduling approaches (S)						
S ₁	567069	606615	586842	4.35	4.61	4.48
S ₂	611759	651616	631688	4.63	4.89	4.76
S ₃	675851	717620	696735	5.06	5.34	5.20
S ₄	652778	693456	673117	4.79	5.05	4.92
S.Em±	6640	7472	6975	0.04	0.05	0.05
CD (P=0.05)	20459	23025	21493	0.12	0.16	0.14
Interaction (M x S)						
S.Em±	9491	10658	10045	0.06	0.07	0.06
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Interaction (S x M)						
S.Em±	9390	10568	9864	0.06	0.07	0.06
CD (P=0.05)	NS	NS	NS	NS	NS	NS

(117 and 114) compared to other sensor-based irrigation triggering approaches (104 and 100) during the first and second years of study respectively. Sensor-based irrigation scheduling reduced human intervention for operating and constant monitoring of the system. Here, sensors can manage irrigation schedules and apply a precise amount of water according to plant needs, considering the prevailing environmental conditions. And this reduced the need for labour, which subsequently resulted in lower man-days (28-30).

Cost of cultivation (₹ ha⁻¹): Economic calculations were performed after determining the cost of cultivation for field operations in each treatment during the crop growth period. Perusal of the data pertaining to the cost of cultivation recorded at the end of the crop season (Table 3) clearly revealed that between drip irrigation methods, expenditure incurred under surface drip was higher (₹ 169758 and 168650 ha⁻¹) in first and second year respectively compared to subsurface drip which might be due to high maintenance cost and more amount of water use.

Irrigation scheduling at 1.0 Epan by manual (₹ 172082 and 171174 ha⁻¹) recorded the higher cost of cultivation and less was registered under ET sensor-based irrigation triggering (₹ 166650 and 165438 ha⁻¹) during the first and second year respectively among irrigation scheduling approaches. The higher cost of cultivation under irrigation scheduling at 1.0 Epan by manual could be attributed to the increased need for labour for irrigation and high water use, which ultimately increased the overall cost of cultivation compared to AI-based irrigation scheduling. These results are in accordance with the findings of a previous study, which reported that the higher cost of cultivation was due to the expenses associated with water and the manpower required for irrigation (31).

Gross, Net returns (₹ ha⁻¹) and B:C ratio: Gross returns were computed by multiplying the green (fresh) fruit yield of chilli obtained from respective treatments presented in Table 3 with the market value, while net returns and B:C ratio were furnished in Table 4. Analysis of variance presented in Tables 3 and 4 opined that gross, net returns and B:C ratio were significantly influenced by drip irrigation methods and irrigation scheduling approaches, but their interaction did not show any significant influence during both the years of study.

Significantly higher gross (₹ 817447 and 856932 ha⁻¹), net returns (₹ 648767 and 689529 ha⁻¹) and B:C ratio (4.85 and 5.12) were registered under subsurface drip over surface drip among drip irrigation methods during the first and second years respectively.

The mean of both years also followed a similar pattern. The similar findings of higher economics under subsurface drip are in corroboration with the results of a previous study (25, 32-35).

With regard to irrigation scheduling approaches, significantly higher gross (₹ 842502 and 883207 ha⁻¹), net returns (₹ 675851 and 717620 ha⁻¹) and B:C ratio (5.06 and 5.34) were registered under ET sensor based irrigation triggering over other scheduling treatments but comparable with irrigation scheduling at 1.0 Epan by manual for gross returns (₹ 824860 and 864599 ha⁻¹) during first and second years respectively. The mean data of two years also followed a similar pattern of superiority. The reason for increased gross returns under subsurface drip and ET sensor-based irrigation triggering might be attributed to higher fruit yields coupled with less cost of cultivation expenses, leading to increased monetary returns.

Comparative results (Table 5 and 6) clearly revealed that there was a significant difference observed in net returns and B:C ratio with higher net returns and B:C ratio obtained under subsurface drip (₹ 648767 and 689529 ha⁻¹) and (4.85 and 5.12) and ET sensor based irrigation triggering (₹ 675851 and 717620 ha⁻¹) and (5.06 and 5.34) compared to that of furrow irrigation (₹ 523315 and 558641 ha⁻¹) and (4.24 and 4.45) during both the years respectively.

Conclusion

It can be concluded that green (fresh) fruit, stover yields and economics were higher with subsurface drip irrigation. Among irrigation scheduling approaches, ET sensor-based irrigation triggering increased yields and economics of chilli cultivation, which could be due to better matching of crop water requirement and lower cost of cultivation. These treatments contributed to higher yields while promoting sustainable and efficient water use. Besides these, this study also encourages public-private partnerships.

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Table 5. Comparison of green (fresh) fruit yield (kg ha⁻¹), net returns (₹ ha⁻¹) and B:C ratio of subsurface drip with furrow irrigation at 1.0 IW/CPE in chilli during 2022-23 and 2023-24

Treatments	Green (fresh) fruit yield (kg ha ⁻¹)			Net returns (₹ ha ⁻¹)			B:C ratio		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean
Subsurface drip	40872	42848	41859	648767	689529	669148	4.85	5.12	4.98
Furrow irrigation	34230	36032	35131	523315	558641	540978	4.24	4.45	4.35
t Stat	5.40**	4.00*	5.26**	5.10**	3.84*	5.01**	4.07*	3.28*	4.18*
P(T<=t) (0.05)	0.006	0.016	0.006	0.007	0.018	0.007	0.015	0.030	0.013

* Significant at 5 % LOS, ** Significant at 1 % LOS

Table 6. Comparison of green (fresh) fruit yield (kg ha⁻¹), net returns (₹ ha⁻¹) and B:C ratio of ET sensor-based irrigation triggering with furrow irrigation at 1.0 IW/CPE in chilli during 2022-23 and 2023-24

Treatments	Green (fresh) fruit yield (kg ha ⁻¹)			Net returns (₹ ha ⁻¹)			B:C ratio		
	2022-23	2023-24	Mean	2022-23	2023-24	Mean	2022-23	2023-24	Mean
ET sensor	42125	44153	43139	675851	717620	696735	5.06	5.34	5.20
Furrow irrigation	34230	36032	35131	523315	558641	540978	4.24	4.45	4.35
t Stat	5.38**	5.91**	6.45**	5.19**	5.78**	6.27**	4.57*	5.33**	5.68**
P(T<=t) (0.05)	0.005	0.004	0.002	0.007	0.004	0.003	0.010	0.006	0.005

Authors' contributions

KB performed the investigation, data collection, statistical analysis and drafted the manuscript. MLP suggested the methodology and supervision of the investigation. TRP participated in the analysis of soil-related parameters and the review of the manuscript. VR assisted in drafting the manuscript and supervision. PR¹ contributed to the technical work related to AI and PR² reviewed and edited the manuscript. KC helped in suggesting the methodology. TLN reviewed the manuscript. KAK helped in the technical work and edited the manuscript. All authors read and approved the manuscript. [PR¹- P Rajaiah, PR²- P Revathi].

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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