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Precision Nutrient Management for Augmenting Sugarcane yield in Cauvery Command Area

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A B S T R A C T

On farm demonstrations taken up on the precise management of nutrients and water in the Cauvery Command area (CCA) in Karnataka state over an area of 300 acres has revealed that with drip fertigation and grid based nutrient application sugarcane productivity was recorded to be higher (179.8 t/ha) compared to surface irrigated crop (123.6 t/ha) with an increase of 45.5 per cent and saving of irrigation water to the tune of 39.7 per cent. The demonstrations have amply suggested that higher B: C ratio can be obtained with drip fertigation (3.7) over conventional surface irrigation.

Introduction

Sugarcane is a natural renewable agricultural resource that provides, sugar, bio fuel, fiber, and manure besides many by products. The crop is grown mainly to extract sugar and making gur. It is one of the important commercial crops of sugar in the world. Globally sugarcane is cultivated in over an area of 26 million hectares with a production of 1830 million tones and productivity of 70.38 tones/ha. India has a distinction of second largest producer of sugar after Brazil, and the world's biggest consumer of the sweetener (24 million tonnes). In the country, sugarcane is grown under diverse agro climatic situations covering an area of 5.74m.ha producing 453 million tons sugarcane with the annual productivity of 79 tones/ha (Anonymous, 2025). India accounts for over one fifth of the total area under cane in the world. In the country, Uttar Pradesh accounts for nearly half of the total cane area. Other major cane producing states are Maharashtra (13%), Tamil Nadu (12% each), Karnataka (9%) and Andhra Pradesh (6%). In Karnataka sugarcane is grown both in command and well irrigated areas and nearly 99 percent crop area is irrigated. The state ranks third during 2021-22 in area

(6.37 lakh ha) and fourth in production (61.15 million tones), but ranks second with respect to productivity (96 tones /ha) after Tamil Nadu, (111 t/ha) (Anonymous, 2025). The share of the cane area to the total sugarcane area planted accounts for 6.41 per cent contributing 8.06 per cent of the total cane production in India.

By 2020 AD, it is likely that the sugarcane production system would undergo marked changes due to scarcity of water, land and labour, high cost of inputs, vigorous competitions from the other crops and enterprises and the price scenario of sugar in the international market. Adoption of modern frontier technologies would become necessary to overcome many of the problems faced by sugarcane farmers. Under the circumstances, the sophisticated tools and technologies namely drip irrigation, fertigation, leaf color chart or SPAD chlorophyll meter, and remote sensing etc.., will have to be put to use on farm level for enhancing productivity with improved water and nutrient use efficiency, monitoring crop conditions. Precision agriculture is one such tool which encompasses some of the aforesaid modern technologies for enhancing the productivity.

Precision Agriculture is the application of technologies and principles to manage spatial and temporal variability associated with all the aspects of agricultural production system for the purpose of improving crop performance and environmental quality. The basic steps in precision agricultural are assessing variability, managing variability and evaluation. As sugarcane is a long duration crop it requires higher doses of nutrients and the efficiency of nutrient uptake is very low coupled with lower use efficiency have contributed to the lower productivity of sugarcane in the command area. Hence, in the present study on precision agriculture two important aspects of sugarcane production system i.e., precision nutrient management and water management have been given impetus to augment the productivity of the crop. Hence the present study was undertaken on the farmers fields to demonstrate the precision water and nutrient management through surface and sub-surface drip irrigation in sugarcane on the farmer's fields.

Materials and Methods

Farmers who are sugarcanegroweres with drip fertigation from Villages in Mandya, K.R. Pet, Mysore, Maddur, T. Narasipura, Hunsur, H.D. Kote, Nanjanaguduand Malavalli and Kunigal taluks of Mandya and Mysore districts were selected to take up the demonstrations as they form the study area form the Cauvery command area for the precision agriculture technologies with surface and sub-surface drip irrigation with other accompanying technologies for enhancing water and nutrient use efficiency for increasing sugarcane productivity.

Sugarcane farmers in from these taluks, who had taken up sugarcane under drip irrigation either surface or sub-surface drip were selected during three years of demonstrations i.e., 2013-14, 2014-15, 2015-16. These demonstrations were compared with surface irrigation as check. Grid soil samples of 50x50m size were collected by using GPS at a depth of 0-15 cm and analysed for major nutrients *viz*., N, P_2O_5, K_2O and pH &EC. Nutrient scheduling was done based on the soil analysis results and nutrients were given through drip fertigation. Nitrogen in the form of urea, phosphorus in the form of urea phosphate liquid fertilizer and potassium in form of Muriate of potash (white) were applied through drip fertigation.

Results and Discussion

The precision Agriculture demonstrations were taken up in an area of 311.8 acres across 11 taluks in Mandya Mysuru & Tumkur districts in the Cauvery Command Area covering in all 109 farmers. Grid soil samples of 50x50 m grid size were collected and analyzed for pH, EC & NPK status of soils. Nutrients were applied based on the grid soil sample analysis results using LMH concept.

Soil analysis results

From the analyzed soil samples, around 40 per cent of soil were found to be saline with remaining 60 per cent falling under normal category and 20 per cent of the samples were found to be critical with regard to EC and 80 per cent were normal (Table 2). The collected soil samples were medium in available nitrogen with only few samples were found to be low whereas, available phosphorus and potassium were analyzed to be in medium range (Table 1).

Sugarcane yield

The mean sugarcane yield recorded (Table 3 & 4& Fig.1) from the demonstrations across three years reveal that

there is a overall 42.67 per cent increment in sugarcane yield in drip fertigation demonstrations over conventional method or irrigation and fertilizer application across different taluks. Mandya (63.98) followed by Maddur (53.35) recorded higher increment in cane yield with drip fertigation over conventional irrigation in all the other taluks, with minimum increment in yield recorded in H.D. Kote, Mysuru and K.R. Pet taluk demonstrations, indicating that the traditional sugarcane areas have a greater benefit of drip fertigation demonstrations. The study by Sadhana *et al.,* 2024 reveals that drip irrigation leads to higher water use efficiency, improved crop quality, and environmental sustainability. The adoption of drip irrigation in sugarcane cultivation results in significant economic benefits, with higher net returns and increased yields then farmers following flood irrigation.

Table.1 Soil Fertility Status of Demonstration Plots

Taluk	Total		
	N	P_2O_5	K_2O
Mysore	246.8	44.88	338.94
T. Narasipura	181.8	35.45	491.75
H.D. Kote	235.9	36.5	422.5
Hunsur	271.8	41.9	303.9
Nanjanagudu	216.6	31.2	274.7
K.R.Pet	264.2	27.1	271.1
Malavalli	202.5	32.0	386.1
Mandya	261.2	47.9	277.6
Maddur	272.4	37.4	339.9
Nagamangala	291.3	38	147.6
Kunigal	284.7	36.6	236.3
Mean	248.1	37.2	317.3

Table.2 pH and EC of the Demonstration Plots

Taluk	pH			EC (dS/m)	
	Acidic	Neutral	Saline	Normal	Critical
Mandya	-	70.80	29.20	84.67	15.33
K.R.Pet	-	69.04	30.96	74.11	25.89
Malavalli	-	49.02	50.98	76.47	23.53
Mysore	-	28.57	71.43	61.22	38.78
Nanjanagudu	-	48.84	51.16	79.07	20.93
T.Narasipura	-	40.00	60.00	74.29	25.71
Hunsur	-	94.74	5.26	78.95	21.05
Maddur	-	19.23	80.77	100.00	0.00
Mean		60.13	39.87	79.49	20.51

Table.3 Sugarcane Yield (t/ha) in the Precision Agriculture Demonstrations across Three Years

Taluk	Total		
	Demo.	Check	% Increase
Mysore	130.8	103	26.99
T. Narasipura	199.5	147.5	35.25
H.D. Kote	127.3	102	24.8
Hunsur	155.1	118.3	31.11
Nanjanagudu	157.5	121.5	29.63
K.R.Pet	166.3	121.1	37.32
Malavalli	170.25	121.5	40.12
Mandya	175.935	107.29	63.98
Maddur	261.07	170.25	53.35
Kunigal	119	88	35.23
Mean	179.8	123.6	45.5

Table.4 Abstract of Demonstration Yield over Surface Irrigated Sugarcane

Year	Area	Sugarcane Yield (t/ha)		% Increase over check	% water saved
2013-14	63.53	176.53	119.05	48.27	37.1
2014-15	202.75	247.66	167.5	47.85	42.0
2015-16	40.00	115.27	81.54	41.36	40.0
Mean	306.3	179.8	123.6	45.5	39.7

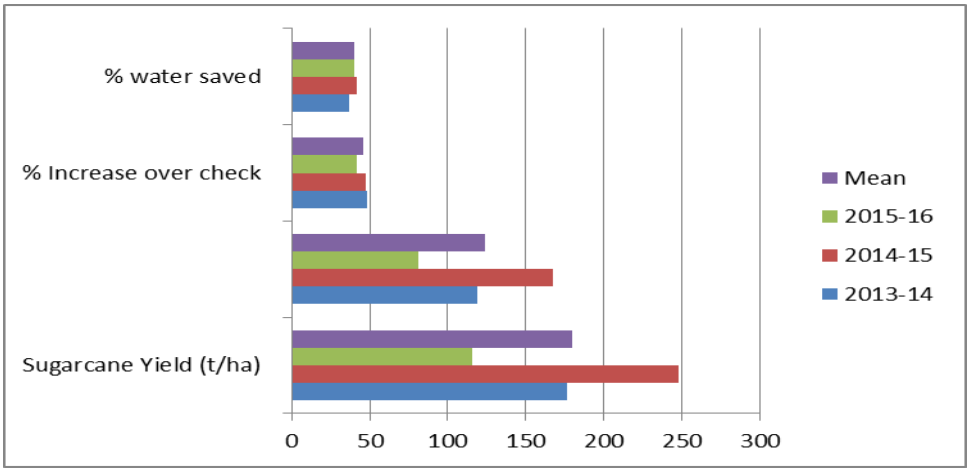
Table.5 Saving in Water and WUE under precision agriculture demonstrations

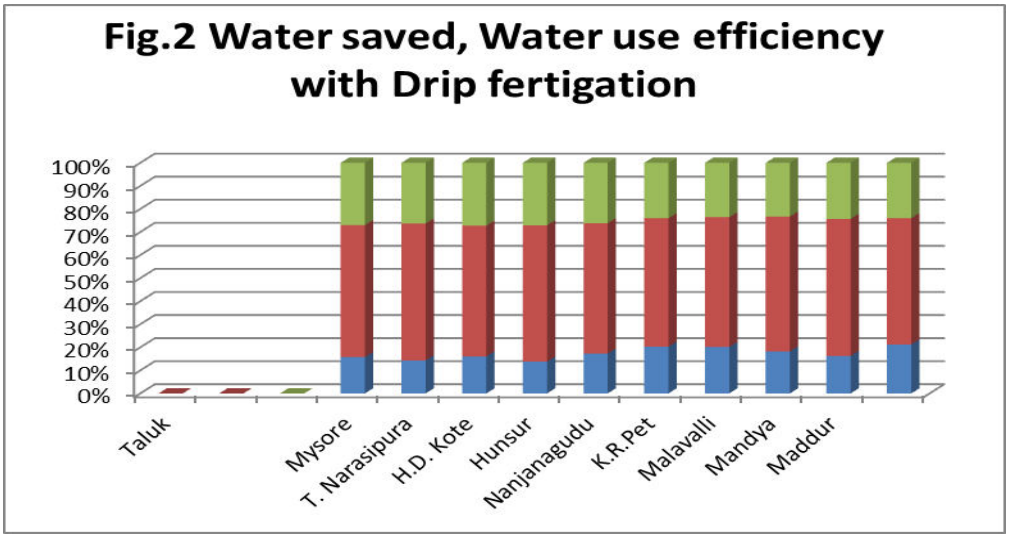
Taluk	% water saved	WUE kg/ha mm	
		Demo	check
Mysore	30	109	51.5
T. Narasipura	40	166.25	73.75
H.D. Kote	30	106.08	51
Hunsur	30	129.25	59.15
Nanjanagudu	40	131.25	60.75
K.R.Pet	40	110.085	47.55
Malavalli	40	112.16	47
Mandya	33.33	106.94	42.68
Maddur	35	128.175	52.44
	39.7	102.76	44.98

Table.6 B: C Ratio of Precision Agriculture over Surface Irrigated Sugarcane

Taluk	Mean
Mysore	2.33
T. Narasipura	4.35
H.D. Kote	2.12
Hunsur	3.08
Nanjanagudu	3.01
K.R.Pet	3.78
Malavalli	4.08
Mandya	5.74
Maddur	7.60
Kunigal	2.59
Mean	3.57

Fig.1 Sugarcane yield and water saved through drip fertigation





Water use efficiency

The very purpose of these demonstrations in the farmers' fields was to educate them about the enormous saving in water and enhanced water use efficiency there by achieved through drip fertigation. From the data (Table 5) it is very clear that the water saved with drip fertigation demonstration ranged from 30-40 per cent with a mean saving 34.45 per cent of water over conventional irrigation method of ridge and furrow irrigation. The saving in water was higher in nontraditional sugarcane growing area like Nagamagala, Mysuru and T.N. Pura compared to Mandya and Maddur taluks.

The water use efficiency which is a measure of efficiency of crop and system, gives a indication of how efficient the system is with regard to water usage. Overall, drip fertigation has recorded 102.76 kg /ha mm in water of water utilization compared to 44.98 kg /ha mm of utilization under conventional method (Table 5 & Fig.2). The results of a study by Ashour, M.A. *et al.,* 2025, has revealed that drip irrigation improves water-use efficiency by 44% and increases sugarcane yields by 22% relative to flood irrigation, while also elevating net profits by 50%. Drip irrigation demonstrated an average efficiency of 85– 90%, compared to 50–60% for flood irrigation. These findings underscore the dual benefits of drip irrigation in addressing water scarcity and enhancing agricultural productivity. This was also supported by the studies by Anbumani *et al.,* 2020, with enhanced water productivity of 9.73 and 10.36 was recorded under SSI and 8.05 and 8.38 was under sett planting with SSDI in main and ratoon crop. Lowest water productivity was in conventional planting with a tune of 5.32 & 5.04 kg/m3 in main and ratoon crop respectively

B: C Ratio

The B: C Ratio of the demonstration conducted over three years gives a fair indication of the economic viability of the system and demonstrations. From the computation of B: C Ratio (Table 6) it is clear that the B: C Ratio across different taluks ranged from 2.33 to 7.60 indicating the profitability of the drip fertigation. The wide range of B: C Ratio is by virtue of the variation in sugarcane yields across taluks over conventional method of irrigation. However, the demonstrations have recorded a mean B: C Ratio of 3.75 which indicate a return of Rs. 3.57 on every rupee invested on drip irrigation. Four years is the period taken as payback period for drip irrigation for evenly distributing the investment made on it. This was also confirmed by Ashour, M.A., 2025.

In conclusion, to increase the productivity of sugarcane in the Cauvery Command area in Karnataka two technologies were aimed at with drip irrigation and fertigation which has resulted in increase in cane yield, saving in water as well as higher B: C ratio for sugarcane cultivation.

Author Contributions

K.V. Keshavaiah: Investigation, formal analysis, writing—original draft. S.S. Prakash: Validation, methodology, writing—reviewing. T. Sheshadri:—Formal analysis, writing—review and editing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Anonymous, 2025, Sugarcane.res.in https://sugarcane.res.in Sugarcane Breeding Institute: ICAR

Anonymous, 2025, Directorate of Sugarcane Development, State wise Area of Sugarcane in country https://sugarcane.dac.gov.in ›

Ashour, M.A., Ali, Y.M., Hasan, A.E. *et al.,* A field study on replacing traditional flood irrigation of sugarcane crop in Upper Egypt with drip irrigation technique. Appl Water Sci 15, 192 (2025). https://doi.org/10.1007/s13201-025-02554-7

Sadhana, H. S., Ramu, M. S., Mahin Sharif, and Seemakowsar, N. 2024. "Impact of Drip Irrigation in Sugarcane Cultivation in Mandya District of Karnataka, India". International Journal of Environment and Climate Change 14 (3):534–542. https://doi.org/10.9734/ijecc/2024/v14i34063.

Anbumani, E. Jamuna and M. Pandian, 2020, Sugarcane Productivity Influenced by Irrigation Techniques and Crop Establishment Methods, International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 9 (4)

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