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Constraints Encountered by Sugarcane Farmers in Adopting Water Management Practices

Shanjeevika V.[1*], Balasubramaniam P.[2], Venkatesa Palanichamy N.[3], Venkata Pirabu J.[4] and Duraisamy, M.R.[5]

[1]Ph.D. Scholar, Department of Agricultural Extension & Rural Sociology, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu), India.
[2]Director (Open & Distance Learning), Directorate of Open & Distance Learning, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu), India.
[3]Dean (Agriculture), Agricultural College & Research Institute, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu), India.
[4]Professor, Department of Agricultural Extension & Rural Sociology, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu), India.
[5]Professor & Head, Department of Physical Science and Information Technology, AEC&RI, TNAU, Coimbatore (Tamil Nadu), India.

(Corresponding author: Shanjeevika V.)*
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ABSTRACT: Sugarcane is India's most important cash crop. Sugarcane production plays an important role to the Indian economy. The present study was conducted with the explicit aim of analyzing the constraints faced by sugarcane farmers in putting recommended water management practices into reality. Tiruvannamalai district of North Eastern Zone in Tamil Nadu was purposively selected for the study as it had highest number of revenue blocks under critical groundwater explosion. Two villages from Thandrampet block namely Kolunthampet and Sirupakkam were selected for the study. Sugarcane is one of the water- guzzing crops which has number of water management practices to be followed. Hence sugarcane was selected for the study. Constraints in adopting water management practices was assessed by using Henry Garrett Ranking technique. A total of 80 respondents were selected for the analysis. Poor quality of drippers (67.26), Complex procedure in availing Drip Irrigation system (65.85), Difficulty in relay out of drippers for next season (64.81), High cost of coir pith (59.73), Clogging of drippers due to salt water (54.93), Non availability of buds of required varieties to adopt Sustainable sugarcane Initiative (56.54) were the major constraints encountered by the farmers. These constraints have to be cast away in order to improve the adoption of water management practices among farmers.

Keywords: Constraints, Water Management practices, Sugarcane, Henry Garrett Ranking.

INTRODUCTION

Water is becoming scarce, limiting agricultural production in developing countries worldwide. About 50.00 per cent of the world's water demand can be met by 2025 if irrigation technologies are used effectively (Ganesan *et al.*, 2018). Water scarcity is a pressing issue, and many steps are being taken by the Government and Non-Governmental Organisations to use water as efficiently as possible (Pandian *et al.*, 2014). To ensure global food security, the world will need to produce 60% more food by 2050, while conserving and improving the natural resource base (Dhawan, 2017). Water stress and scarcity indicators are commonly used to reflect a country's or region's overall water availability. According to international standards, a country is classified as water stressed or water scarce if its per capita water availability falls below 1700 m^3 or 1000 m^3. With a per capita water availability of 1544 m^3, India is already a water-stressed country on the verge of becoming water scarce (Asoka and Mishra 2015). Water is an important input in the production of food, from the field to the end of the value chain. With rising demand and competition for water, the planet's water resources are under increasing strain as a result of climate change, poor management, and pollution (FAO, 2021). Now, there is no other option but to save every drop of water for irrigation in the field.

Sugarcane is India's most important cash crop. Sugarcane is grown in various states all through the country's subtropical and tropical regions. Sugarcane production plays an important role to the Indian economy. India is the second largest producer of sugarcane after Brazil. During 2015-16, the area under sugarcane was estimated to be 49.27 lakh hectares, which was higher than the normal area coverage (Indiastat, 2021) In India, sugarcane cultivation covered 5 million hectares, or roughly 2.57 percent of the total planted area. It supports the livelihood of almost 60 lakh sugarcane farmers and numerous association members through indirect employment. Tamil Nadu is

the third largest producer of sugarcane (Department of Agriculture and Cooperation, 2016). Despite of these benefits, sugarcane is a water-guzzling crop. On average, 1 kg of sugar requires about 1500–2000 kg of water. Paddy and sugarcane use the majority of the nation's irrigation systems, which reduces the amount of water available for other crops. In States like Maharashtra, pressure on water due to sugarcane cultivation has become a severe concern, necessitating more effective and sustainable water usage through alternate cropping patterns. This is particularly crucial in areas where the usage of groundwater has reached a critical point and is overexploited or if more than 50% of surface water is used for irrigation of sugarcane alone. (Shanthy *et al.,* 2021) Considering the critical need of water conservation, the task group of NITI AYOG advises switching some of the land currently used for sugarcane cultivation to less water-intensive crops by offering farmers the right incentives The task force also suggest to expand drip irrigation in sugarcane cultivation which saves about 40 % to 50 % of water (Singh *et al*., 2021). As a result, the Government is making a number of efforts to increase water use efficiency in cultivation. To conserve water, measures including mulching technology, popularizing drip irrigation, and other water management techniques are being used. However, farmers are experiencing difficulties implementing these practices. The results won't be successful until these constraints are extracted. The present study was conducted with the explicit aim of analyzing the constraints faced by sugarcane farmers in putting recommended water management practices into reality.

METHODOLOGY

The study was Tiruvannamalai district of Tamil Nadu's North Eastern zone which has 18 blocks. Thandrampet block was purposively selected for the study because it had major area under sugarcane cultivation. Kolunthampet and Sirupakkam villages were purposefully selected from the block because they had highest area under sugarcane cultivation. Agriculture Department's records and the block's statistics handbooks were used to compile a list of all sugarcane farmers in each village. A total of 80 respondents were selected using Proportionate random sampling technique. The respondents were selected using the formula:

$ni = [Ni / N] \times n$

Where, ni = Number of respondents to be selected from ith district

Ni = Total number of respondents in the ith district

N = Total number of respondents in the three districts

n = Sample size (n = 80)

Finally, 45 respondents were chosen from a total of 658 sugarcane farmers in Kolunthampet village, and another 35 respondents were chosen from a total of 523 sugarcane farmers in Sirupakkam village, for a total of 80 respondents. The constraints were ranked using the Henry Garrett ranking technique.

OPERATION OF HENRY GARRETT RANKING TECHNIQUE

The respondents were shown the constraints and asked to rank them in order of importance. The method was used to rank the constraints perceived by respondents in adopting water management practices in Sugarcane. It is used to identify the most significant constraint influencing respondents' adoption. Problem rankings can be converted into scores using Henry Garrett's Ranking Technique. As a result, each constraint will be assigned a unique rank. The primary advantage of this technique over simple frequency distribution is that the constraints are arranged according to their severity in the eyes of respondents. As a result, the same number of respondents on two or more constraints may have ranked differently. Garrett's formula for converting rank to percentage is as follows:

Percent position = $100 * (R_{ij} – 0.5)/Nj$

Where, R_{ij} = rank given for ith constraint by jth individual;

N_j = number of constraints ranked by jth individual

Table 1: Total number of ranks provided for each constraint by respondents.

Constraint	Rank														
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
C_1	39	2	2	4	0	6	6	4	4	0	0	3	4	0	6
C_2	28	11	6	0	2	4	7	9	6	1	6	0	0	0	0
C_3	4	2	4	12	12	10	4	8	8	8	3	0	0	4	1
C_4	3	41	6	8	0	0	2	8	4	4	0	0	0	0	4
C_5	0	9	22	6	10	8	9	6	2	4	0	2	0	0	2
C_6	0	0	4	0	4	4	2	2	14	9	16	9	6	8	2
C_7	2	5	3	10	5	5	6	0	4	6	4	9	0	10	11
C_8	0	2	4	0	2	6	3	5	2	6	9	4	6	9	22
C_9	2	2	7	8	4	2	2	2	4	11	2	6	10	10	8
C_{10}	2	4	10	14	12	7	4	4	9	4	1	4	5	0	0
C_{11}	0	0	4	6	2	6	0	13	5	4	13	4	9	8	6
C_{12}	0	2	4	2	14	4	4	6	2	5	2	2	23	8	2
C_{13}	0	0	0	0	2	7	9	7	3	6	6	20	6	11	3
C_{14}	0	0	0	0	7	4	7	2	4	8	10	11	8	10	9
C_{15}	0	0	4	10	4	7	15	4	9	4	8	6	3	2	4

The percent position of each rank is converted into scores using table provided by Garrett and Woodworth (1969). Individual respondents' scores will be added together and divided by the total number of respondents for each constraint. The mean scores for all constraints are arranged in descending order, and the constraints are ranked accordingly. The percent position of each rank is converted to scores using the table provided by Garrett and Woodworth (1969). For each constraint, the scores of each respondent are added up and divided by the total number of respondents. The constraints are arranged in decreasing order based on the mean scores for all constraints.

From Table 4, it is evident that poor quality of drippers was found to be the major constraint with a mean score of 67.26. Although drip irrigation systems are offered at 100% subsidy for small farmers and 75% subsidy for large farmers, the drippers' quality is debatable. The respondents also added that drip irrigation systems barely last for two years. Some micro irrigation firms provided very low-quality valves that broke frequently with handling and had inappropriate design. Therefore, a high-quality drip irrigation system is required. Measures has to be taken to double check the quality of drippers before installing in the framer's field. Moreover, monitoring committee can be appointed and supervision can be done in the 3rd year. In case the drippers are damaged; measures can be taken to replace the drippers. The findings are in line with Hiremath and Makadia (2021) who mentioned that poor quality of drippers as major constraint in their study.

Complex procedure in availing Drip Irrigation System for water management was administered as second major constraint with a mean score of 65.85. This was because of the fact that necessary documents have to be submitted by farmers to the officers to avail Drip Irrigation System. These documents include Patta, Adangal, Small Farmers Certificate and Field Measurement Block Sketch. But many of these certificates are valid only for six months, so there were in need of upgrading it regularly. If a mistake is found then the document will be returned back. This subsequently caused a delay in the drip system installation and subsidy release. The Extension personnel claimed that ratio of extension workers to farmers were less. Thereupon, measures have to be unleashed by Government to increase the Extension personnel: Farmer ratio. This was in accordance with findings of Meti (2012).

Table 2: Percent position and the corresponding Garret value for the ranks.

Rank	$100(R_{ij} – 0.5)/N_j$	Percent position	Garret Value
1	100(1-0.5)/15	3.33	86
2	100(2-0.5)/15	10	75
3	100(3-0.5)/15	16.66	69
4	100(4-0.5)/15	23.33	64
5	100(5-0.5)/15	30	60
6	100(6-0.5)/15	36.66	57
7	100(7-0.5)/15	43.33	53
8	100(8-0.5)/15	50	50
9	100(9-0.5)/15	56.66	47
10	100(10-0.5)/15	63.33	43
11	100(11-0.5)/15	70	40
12	100(12-0.5)/15	76.66	36
13	100(13-0.5)/15	83.33	31
14	100(14-0.5)/15	90	24
15	100(15-0.5)/15	96.66	15

Here the formula used is as follows:

Percent position= $100(R_{ij}- 0.5)/N_j$

Where,

R_{ij} =1st,2nd,3rd,4th,5th,6 th,7th,8th,9th,10th,11th,12th,13th,14th,15th ranks

N_j= Total ranks given by 80 respondents =15

Table 3: Total score for each constraint.

Constraints	1st*86	2nd*75	3rd*69	4th*64	5th*60	6th*57	7th*53	8th*50	9th*47	10th*43	11th*40	12th*36	13th*31	14th*24	15th*15	Total
C_1	3354	150	138	256	0	342	318	200	188	0	0	108	124	0	90	**5268**
C_2	2408	825	414	0	120	228	371	450	282	43	240	0	0	0	0	**5381**
C_3	344	150	276	768	720	570	212	400	376	344	120	0	0	96	15	**4391**
C_4	258	3075	414	512	0	0	106	400	188	172	0	0	0	0	60	**5185**
C_5	0	675	1518	384	600	456	477	300	94	172	0	72	0	0	30	**4778**
C_6	0	0	276	0	240	228	106	100	658	387	640	324	186	192	30	**3367**
C_7	172	375	207	640	300	285	318	0	188	258	160	324	0	240	165	**3632**
C_8	0	150	276	0	120	342	159	250	94	258	360	144	186	216	330	**2885**
C_9	172	150	483	512	240	114	106	100	188	473	80	216	310	240	120	**3504**
C_{10}	172	300	690	896	720	399	212	200	423	172	40	144	155	0	0	**4523**
C_{11}	0	0	276	384	120	342	0	650	235	172	520	144	279	192	90	**3404**
C_{12}	0	150	276	128	840	228	212	300	94	215	80	72	713	192	30	**3530**
C_{13}	0	0	0	0	120	399	477	350	141	258	240	720	186	264	45	**3200**
C_{14}	0	0	0	0	420	228	371	100	188	344	400	396	248	240	135	**3070**
C_{15}	0	0	276	640	240	399	795	200	423	172	320	216	93	48	60	**3882**

Table 4: Ranking of constraints in adopting Water Management practices by banana growers.

Sr. No.	Constraints	Total score	Mean score= Total score/ 80	Rank
C_2	Poor quality of drippers	**5381**	**67.26**	**1**
C_1	Complex procedure in availing Drip Irrigation System for water management	**5268**	**65.85**	**2**
C_4	Relay out of drippers for next season is difficult	**5185**	**64.81**	**3**
C_5	High cost of coir pith	4778	59.73	4
C_9	Non availability of buds of required varieties to adopt Sustainable Sugarcane Initiative	4523	56.54	5
C_7	Duration to avail second set of subsidized Drip irrigation system is too long	4391	54.89	6
C_{10}	Damage of laterals during intercultural operations and harvest	3882	48.53	7
C_3	Lack of skilled labour for handling buds	3632	45.40	8
C_{15}	Difficulty in performing propping and trash mulching	3530	44.13	9
C_{12}	Unavailability of labour for trash mulching	3504	43.80	10
C_{11}	Lack of knowledge about improved varieties	3404	42.55	11
C_6	Salt encrustations in drippers	3367	42.09	12
C_{13}	Unavailability of Drip Irrigation System to farmers having less than 1 acre of land	3200	40.00	13
C_{14}	Inadequate follow up by the agency	3070	38.38	14
C_8	Inadequate funds from Government for large farmers	2885	36.06	15

Third major constraint confronted by the respondents were relay out of drippers for next season was difficult with a mean score of 64.81. Removing the drippers during the harvest because of the damage due to machineries is important. But removing the drippers and relay out of these drippers was back- breaking for the farmers.

High cost of coir pith was endured as fourth main constraint with a mean score of 59.73. Application of coir pith was found to have higher retention of soil moisture. Use of composted coir pith at 10 or 5 t/ha is recommended for efficient water management (Dhanapal *et al.,* 2019). But one ton of coir pith ranges between Rs.17,500 to Rs. 18,000. The farmers claimed that the cost of coir pith was higher and also, it was not available during the peak seasons. Hence, Government can take measures in providing coir pith to farmers at subsidized rate along with fertilizers.

Non availability of buds of required varieties to adopt Sustainable Sugarcane Initiative was mentioned as fifth main constraint with mean score of 56.54. Farmers grow a wide range of sugarcane varieties, but only a few popular varieties, such as CoC 86031 and CoC 11015, are in high demand. Canes of the required age (6-8 months) of such varieties are not available in some areas, for which factory management and nursery agencies can take initiatives.

Sixth major constraint put up by them was that the duration to avail second set of subsidized Drip irrigation system is too long. This constraint had a mean score of 54.89. The respondents mentioned that the Drip Irrigation System last only for 2 years. But the beneficiary can avail the next Drip Irrigation System only after 7 years. So, the duration for availing the second set of Drip Irrigation System can be reduced to 4-5 years.

Damage of laterals during intercultural operations and harvest was encountered as seventh major constraint with a mean score of 48.53. The majority of the farmers harvested sugarcane on contract, and the cutting labourers paid little attention to lateral damage during harvest. The farmers did not follow detrashing and propping frequently. This made the situation worse. Since the canes were lodging it was extremely difficult for the respondents to take the drippers out. So, they had to practice harvest with the laterals in the field itself. The findings were in conformity with Shanthy *et al.* (2021).

The eight main constraint was lack of skilled labour for handling buds with mean score of 45.40. The main principle of Sustainable Sugarcane Initiative is to transplant seedlings raised from single budded chips. The respondents noticed that extra care has to be taken while transplanting the seedlings or else the roots are damaged. But the labourers were not skilled enough in transplanting.

Difficulty in performing propping & trash mulching and unavailability of labour for trash mulching was perceived as nineth and tenth constraint with a means core of 44.13 and 43.80 respectively. The recommended spacing for sugarcane is 30 × 30 × 30 /150 cm but they follow 20X20X20. Because they feel that closer spacing is providing higher yield which in turn cause difficulty in propping and trash mulching.

Mulching increases the soil moisture by 9.54 per cent (Zhang *et al.,* 2016). The farmers also conveyed that there was scarcity of labour during peak seasons for trash mulching. The farmers suggested that a small portion of beneficiaries of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) can be diverted as agricultural labourers. This would be beneficial for both the farmers and beneficiaries. Effective policy has to be framed for this issue.

Lack of knowledge about improved varieties was appraised as eleventh constraint. Co 86032, Co 88006, CoTl 88322, Co 95014 are varieties which are tolerant to drought. But the farmers are not aware of these varieties. Measures has to be taken to take farmers to Regional Research stations to get updated information on varieties and other practices. The findings were in line with Shanjeevika *et al.* (2020).

Salt encrustations in drippers was perceived as twelfth constraint with a score of 42.09. This was because of the fact that water may contain organic or inorganic components, and the dripper line may become clogged by salt build-up, slowing the rate at which the water is discharged from the sets and causing uneven water distribution. This can be prevented by regular cleaning of drippers with acid or chlorine, flushing it out at regular intervals, proper maintenance of sub main and main pipes. The findings were in accordance with Madhava and Surendran (2016) who reported that clogging of drippers was the major constraint in adoption of drip irrigation system.

Unavailability of Drip Irrigation System to farmers having less than 1 acre of land was the thirteenth constraint. The observation revealed that they shared patta of the land with their relatives. While receiving the subsidies, there were no problems, but when they divided their portions, they fell into this category. Additionally, getting a certificate for Small and Marginal Farmers from the Tahsildar was a time-consuming process. Therefore, policies need to be designed with small farmers who have less than 1 acre of land in mind.

Inadequate follow up by the agency and inadequate funds from Government for large farmers were perceived as fourteenth and fifteenth constraint with mean scores of 38.38 and 36.06 respectively. The findings were in accordance with Singh and Kaur (2020) who reported that follow up after installing the Drip Irrigation System became very low. Large farmers reported that though they have more than 5 acres of land they are in need of subsidized products as their economic status were not upto the mark. So, they requested to extend subsidies to them also.

CONCLUSION

Water supplies available for irrigation and rainfed agriculture will face new constraints over the next few decades. Water demand in agriculture will continue to rise as a result of rising population and economic growth. By 2050, approximately 57.0 percent of the world's population will live in areas with a water shortage for at least one month of the year. As sugarcane is a water-intensive crop, it is critical to implement water management initiatives to minimize water waste. However, it is clear from the preceding context that farmers face a variety of challenges in adopting water management practises. We have a compelling need to eliminate these constraints in order to increase sugarcane farmers' adoption of water management practises. Furthermore, policy notes can be drafted based on farmer suggestions. Organizing water efficiency programmes and public gatherings to raise public awareness of the need to conserve water and its scarcity. Agriculture universities should take the lead in advising farmers on water-saving crop patterns that take soil and other climatic factors into account.

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