Asian Journal of Agricultural Extension, Economics & Sociology

39(11): 138-145, 2021; Article no.AJAEES.75403
ISSN: 2320-7027

Awareness, Knowledge and Adoption of Sugarcane Technologies Popularization through AICRP - A Case in the Theni District of Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i1130734
Editor(s):
(1) Prof. Md. Abiar Rahman, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Bangladesh.
Reviewers:
(1) Dipak Nath, Central Agricultural University, India.
(2) Velivelli Vijaya Lakshmi, PJTSAU, India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/75403

Original Research Article

Received 10 August 2021
Accepted 17 October 2021
Published 22 October 2021

ABSTRACT

The study was conducted to know the knowledge and adoption level of demonstrated sugarcane technologies among the AICRP sugarcane farmers in Madurai, Sivagangai, and Theni districts of Tamil Nadu. The study was conducted in Sivagangai, Madurai, and Theni districts with 120 AICRP and 120 Non AICRP sugarcane farmers. Among the 120 AICRP sugarcane farmers, the knowledge level and adoption of demonstrated technologies were assessed. The study concluded that Cent per cent of AICRIP sugarcane farmers adopted the component of Sustainable Sugarcane Initiative namely transplanting young seedlings, maintaining the wider space and drip irrigation. None of the AICRIP sugarcane farmers adopted the pit method of sugarcane cultivation in the subsequent years after the demonstration conducted through AICRIP. Half of the AICRIP farmers increased the sugarcane area in the next year due to the additional yield from the demonstration of sugarcane technologies. An overall 56.66% of farmers expressed that the pit method of sugarcane cultivation technology is very difficult to understand and it leads to non-adoption of technology after the demonstration.

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Keywords: Sugarcane; awareness; knowledge and adoption.

1. INTRODUCTION

Sugarcane is the world's largest commercial crop and is grown in over 110 countries; an estimated 1,683 million metric tons were produced worldwide which amounts to 22.4% of the total world agricultural production by weight. The area under sugarcane in India has been increasing and has reached a maximum of 4.20 million ha during the year 2005-06 with the production of 281.17 million tonnes and the productivity of sugarcane was in the same year 66928 kg/ ha. Sugarcane contributed 25 percent of the national income of the country. The production per hectare is the highest in Tamil Nadu, followed by Andhra Pradesh, Karnataka, Kerala, and Maharashtra. The agricultural research system in the country has a strong technological backup suited for all regions. The sugarcane research stations and other research institutes concerned with sugarcane crops release new sugarcane varieties and related crop production and protection technologies. All these technologies have to reach the cane growers so as to realize an increase in cane productivity [1].

In Tamil Nadu, the area under sugarcane has declined due to continuous drought, and production has also declined considerably. Recent trend in Tamil Nadu shows a stagnated yield level of around 100 t/ha and tends to decline further due to inadequate irrigation water and erratic monsoon. This situation has created a need to improve sugarcane productivity in the state to meet the increasing rate of domestic consumption requirements [2]. Sociological studies among cane growers have revealed the prevalence of a wide technological gap as well as yield gap in sugarcane that leads to reduced production and productivity [3]. The technologies in sugarcane that can minimize the cost of cultivation with increased returns include wider row spacing, biofertilizers, bud chip settling transplanting, integrated nutrient management, etc. [4].

All India Coordinate Research Project – Irrigation management has conducted demonstrations in crop production technologies and crop protection technologies in sugarcane crops in Madurai, Sivagangai, and Theni districts. Keeping this in view a study was undertaken to identify the knowledge and adoption level of demonstrated sugarcane technologies among the AICRP sugarcane farmers and to study the awareness, knowledge, and adoption level of sugarcane technologies among non AICRP sugarcane farmers in the same demonstrated village.

2. METHODOLOGY

The study was conducted in Sivagangai, Madurai, and Theni districts with 120 AICRP and 120 Non AICRP sugarcane farmers. In AICRP water management scheme, Agricultural College and Research Institute, Madurai conducted demonstration sugarcane technologies namely paired row system of sugarcane planting, subsurface drip system of sugarcane cultivation, pit method of sugarcane cultivation, and sustainable sugarcane initiative in Madurai, Sivagangai, and Theni districts. Among the 120 AICRP sugarcane farmers, the knowledge level and adoption of demonstrated technologies were assessed. Among the 120 non AICRP farmers, awareness, knowledge, and adoption level of sugarcane technologies were assessed. The list of components of sugarcane technologies demonstrated was listed by a discussion with sugarcane scientists and farmers were asked whether they are knowing or not. The adoption of sugarcane technologies was measured on a two-point continuum namely adopted and not adopted. The interview schedule was constructed and pretested in nonsampling area.

3. RESULTS AND DISCUSSION

The results are presented in Table 1.

3.1 Knowledge Level of AICRIP Sugarcane Farmers on Popularized Sugarcane Technologies

Cent percent of AICRIP sugarcane farmers were having knowledge on all the components of the popularized sugarcane technology namely paired row system of planting, sustainable sugarcane initiative, and sub-surface sugarcane cultivation. Only 20.00 percent of AICRIP sugarcane farmers were having knowledge of the pit method of cultivation. The low percentage of knowledge on pit method of cultivation is due to the complexities of technology in the pit method of cultivation.

Table 1. Knowledge and Adoption of technologies by Sugarcane farmers popularized through AICRIP (n=30)

S.NO	Key Technologies Used	Knowledge		Adoption	
		Number	Percent	Number	Percent
A	**Paired row system of planting**				
	Paired row 75(25x25x25)/120cm	30	100.00	30	100.00
	Application of 12.5 t FYM	30	100.00	22	73.33
	Healthy setts – 7-8-month-old	30	100.00	30	100.00
	Two budded setts – 7 setts /meter	30	100.00	30	100.00
	Preparation of setts just before planting	30	100.00	28	93.33
	Planting either side of furrow – Dual row planting in every row	30	100.00	16	53.33
	Drip system – Laterals 1.95 m	30	100.00	30	100.00
	Laterals between two furrows	30	100.00	30	100.00
B.	**Sustainable sugarcane Initiative (SSI)**				
	Raising nursery using single budded chips	30	100.00	6	20.00
	Transplanting young seedlings -25-35 days old	30	100.00	30	100.00
	Maintaining wider spacing (5x2 feet) in the main field	30	100.00	30	100.00
	Following drip irrigation	30	100.00	30	100.00
	Fertigation through drip	30	100.00	26	86.66
	Intercropping	30	100.00	24	80.00
C	**Pit method of cultivation**				
	Preparing pit (4444pits /Ha) Pit to pit spacing – 1.5x1.5 meter Pit depth -37.5 cm Pit diameter – 0.9 m Pit digger machine	6	20.00	0	0
	Filling native soil 15 cm and leaving 22.5 cm from the top of soil	6	20.00	0	0
	7-8-month-old nursery cane	30	100.00	0	0
	Carbendazim recommendations	30	100.00	0	0
	Soak the pit	30	100.00	0	0
	16 number of double budded setts	30	100.00	0	0
	Place the setts like cycle tire forks	30	100.00	0	0
	Gentle press – buds in sideway	30	100.00	0	0
	Keep the pits moist condition up to 15 days	30	100.00	0	0
	Drip – Microtube to the center	30	100.00	0	0
D	**Sub Surface Method of Sugarcane cultivation**				
	Form drenches Depth -30cm Width -40cm Row to row spacing -180 cms	30	100.00	10	33.33
	Planting 8 2 budded setts per running meter	30	100.00	28	93.33
	Plant the setts on either side of furrow – dual row planting	30	100.00	23	76.66
	Inline drip laterals	30	100.00	30	100.00
	Place the laterals below the setts to a depth of 25 -30 cm	30	100.00	30	100.00
	Drippers must face upwards	30	100.00	17	56.66
	Lateral to lateral spacing -180 cm	30	100.00	19	63.33

3.1.1 Adoption of technologies by Sugarcane farmers popularized through AICRIP

3.1.1.1 Paired row system of planting

All the AICRIP sugarcane farmers adopted the technology continuously namely the spacing (75(25x25x25)/120cm), healthy setts, two budded setts (7 setts per meter), drip system of irrigation, and placing the lateral between the row. The majority of AICRIP sugarcane farmers adopted the technology namely preparation of setts just before planting and application of FYM with 93.33 and 73.33 percent respectively. Half of the farmers did not adopt the technology namely planting either side of the row. Continuous extension efforts and follow-up activities by sugar factory officials might be the reasons for the adoption of technologies.

3.1.1.2 Sustainable Sugarcane Initiative (SSI)

Cent percent of AICRIP sugarcane farmers adopted the component of SSI namely transplanting young seedlings, maintaining the wider space, and drip irrigation. The majority of the farmers have adopted fertigation through drip and intercropping with 86.66 and 80.00 percent respectively. Farmers were not interested to raise the nursery using two budded chips in portray.

3.1.1.3 Pit method of sugarcane cultivation

None of the AICRIP sugarcane farmers adopted the pit method of sugarcane cultivation in the subsequent years after the demonstration conducted through AICRIP.

3.1.1.4 Subsurface method of sugarcane cultivation

The majority of AICRIP sugarcane farmers were continuing the adoption of placing the laterals below the 30 cm depth, inline drip laterals and planting eight two-budded setts. Only half of the farmers were adopting the components namely lateral to lateral spacing and placing the dripper upwards with 63.33 and 56.66 percent respectively. Practical difficulties in adopting the technology components like upward placement might be the reasons for lower adoption.

Table 2. Awareness, Knowledge, and Adoption of technologies by Non - AICRIP Sugarcane farmers (n=120)

S.NO	Key Technologies Used	Awareness		Knowledge		Adoption	
		Number	Percent	Number	Percent	Number	Percent
A	**Paired row system of planting**						
	Paired row 75(25x25x25)/120cm	102	85.00	88	73.33	88	73.33
	Healthy setts – 7-8-month-old	120	100.00	120	100.00	103	85.83
	Two budded setts – 7 setts /meter	120	100.00	106	88.33	68	56.66
	Preparation of setts just before planting	120	100.00	120	100.00	120	100.00
	Planting either side of furrow – Dual row planting in every row	86	71.66	64	53.33	48	40.00
	Drip system – Laterals 1.95 m	120	100.00	120	100.00	98	81.66
	Laterals between two furrows	93	77.50	115	95.83	66	55.00
B.	**Sustainable sugarcane Initiative (SSI)**						
	Raising nursery using single budded chips	104	86.66	59	49.16	14	11.66
	Transplanting young seedlings -25-35 days old	116	96.66	100	83.33	64	53.33

S.NO	Key Technologies Used	Awareness		Knowledge		Adoption	
		Number	Percent	Number	Percent	Number	Percent
	Maintaining wider spacing (5x2 feet) in the main field	102	85.00	80	66.67	64	53.33
	Following drip irrigation	120	100.00	100	83.33	72	60.00
	Fertigation through drip	120	100.00	100	83.33	72	60.00
	Intercropping	120	100.00	100	83.33	84	70.00
C	**Pit method of cultivation**						
	Preparing pit (4444pits /Ha) Pit to pit spacing – 1.5x1.5 meter Pit depth -37.5 cm Pit diameter – 0.9 m Pit digger machine	28	23.33	4	3.33	0	0
	Filling native soil 15 cm and leaving 22.5 cm from the top of soil	0	0	0	0	0	0
	7-8 month old nursery cane	98	81.66	98	81.66	0	0
	Carbendazim recommendations	82	68.33	82	68.33	0	0
	Soak the pit	38	31.66	26	21.66	0	0
	16 number of double budded setts	0	0	0	0	0	0
	Place the setts like cycle tire forks	0	0	0	0	0	0
	Gentle press – buds in sideway	0	0	0	0	0	0
	Keep the pits moist condition up to 15 days	0	0	0	0	0	0
	Drip – Microtube to the center	10	8.33	8	6.66	0	0
D	**Sub Surface Method of Sugarcane cultivation**						
	Form drenches Depth -30cm Width -40cm Row to row spacing - 180 cms	106	88.33	16	13.33	0	0
	Planting 8 2 budded setts per running meter	88	69.16	28	23.33	0	0
	Plant the setts on either side of furrow – dual row planting	90	75.00	10	8.33	0	0
	Inline drip laterals	54	45.00	28	23.33	0	0
	Place the laterals below the setts to a depth of 25 -30 cm	0	0	0	0	0	0

S.NO	Key Technologies Used	Awareness		Knowledge		Adoption	
		Number	Percent	Number	Percent	Number	Percent
	Drippers must face upwards	0	0	0	0	0	0
	Lateral to lateral spacing -180 cm	0	0	0	0	0	0

3.2 Awareness, Knowledge, and Adoption of Technologies by Non - AICRIP Sugarcane Farmers

3.2.1 Paired row system of planting

The results show that all the Non AICRIP sugarcane farmers were aware and having knowledge on the technology namely planting healthy setts -7-8 months old, drip system of irrigation, and preparation of setts just before planting. Cent percent of farmers are aware of the number of two budded sets per meter and 88.33 percent of non AICRIP farmers are having the knowledge about the number of two budded sets. This may be due to continuous advisory services provided by the sugar factory extension personnel.

Regarding the adoption of sugarcane technology, cent percent of non AICRIP farmers have followed the preparation of setts just before planting, the number of setts per meter by 85.53 percent, drip system of irrigation by 81.66 percent, spacing by 73.33 percent, and lesser percentage of farmers were adopted the dual row planting in every row technology. Similar results were also reported by Gowda et al [5] and Ramalakshmidevi et al [6].

3.2.2 Sustainable Sugarcane Initiative (SSI)

Cent percent of non AICRIP sugarcane farmers were aware of the drip system, fertigation through drip and intercropping technology and 83.33 percent of farmers were having knowledge. Regarding the adoption of this component of technology, only 60.00 percent of them adopted it. The water shortage problem motivates the farmers to search the alternatives for water-saving technology. This might be the reason for the cent percent adoption of the drip system in the study area.

Half of the non AICRIP sugarcane farmers have adopted the spacing and planting of young seedlings. A very less number of farmers (11.66 percent) adopted the raising of nursery using single budded chips in portray.

3.2.3 Pit method of cultivation

Fifty percent of Non AICRIP farmers were aware and having knowledge about some components of pit method technology namely 7-8 months old cane for planting, carbendazim recommendation, and soak the pit before planting. None of the farmers adopted the pit method of sugarcane cultivation. The farmers have not been convinced of the result of the pit method of cultivation and it might be the reason for nonadoption.

3.2.4 Sub Surface Method of Sugarcane cultivation

The majority of the Non AICRIP farmers were aware of some components of the subsurface method of sugarcane cultivation namely planting two budded setts, planting either side of furrow and form drenches. None of the farmers have adopted the sub-surface method of sugarcane cultivation.

3.3 Impact of Adoption of Popularized Sugarcane Technology through AICRIP

The majority of the farmers cleared the debts in the bank, relatives, and money lenders from 50,000 to 2, 00,000 (81.67 percent) due to increased yield and income through the adoption of popularized sugarcane technology.

All the adopted farmers got social respect among the sugarcane growers and with villagers due to the appreciation from the sugar factory officials. Also, they established good linkage with the extension personnel of the state department and sugar factory.

Half of the AICRIP farmers increased the sugarcane area in the next year due to the additional yield from the demonstration of sugarcane technologies. (56.66 percent). The increased area under sugarcane is due to additional income earned.

The majority (81.67 percent) of the AICRIP sugarcane farmers spent more money for their

social and cultural aspects due to the adoption of sugarcane technologies. Fifty to sixty percent of AICRIP farmers purchased jewels, farm implements, and household articles due to the higher income from the adopted sugarcane technologies.

One-third of the AICRIP sugarcane farmers saved money in the range of Rs. 50,000-2,00,000. The increased income is due to the adoption of drip irrigation and also by the increased area under sugarcane.

3.4 Constraints in Adoption of Sugarcane Technologies

All the Sugarcane farmers were expressed that delayed payment for harvested cane is one of the most important problems faced in sugarcane cultivation. The factory is settling the amount even one year after the harvest of cane. Also, they have not given a minimum interest for delayed months.

Cent percent of farmers were expressed that the pit method of sugarcane cultivation technology is very difficult to understand and it leads to non-adoption of technology after the demonstration.

Also, all the sugarcane farmers expressed that inadequate knowledge about drip system maintenance, odent damage, high cost of water-soluble fertilizer is the most important problem in the adoption of sugarcane technology. Lack of follow-up in drip system maintenance problems was expressed by 90.83 percent of sugarcane farmers.

Delayed cutting order is another important problem in sugarcane cultivation and it was expressed by 96.67 percent of sugarcane farmers.

The majority of the sugarcane farmers expressed that the machine harvest damage the first crop up to 15 percent of the sugarcane crop and it was expressed by 97.50 percent of sugarcane farmers. Also, the machine harvest damage the laterals and it was expressed by 80.00 percent of sugarcane farmers.

The factory is deducting the farmer's PACB loan amount from their harvested cane amount and has not settled the deducted amount to PACB. The PACB is charging interest for the delayed period also and it was expressed by 92.08 percent of sugarcane farmers.

Table 3. Impact of adoption of popularized sugarcane Technology through AICRIP

Sl.No.	Constraints	Number	Percent
1	Increased yield (15-20 tonnes /ha)	104	86.66
2	Increased income due to higher yield	104	86.66
3	The increased area under sugarcane (1-2 acres)	68	56.66
4	Purchased additional land	0	0
5	Established good linkage with extension personnel	120	100.00
6	Social respect among sugarcane growers and villagers	120	100.00
7	Cleared the debt (50,000- 2,00,000)	98	81.67
8	Savings (50,000-1,00,000)	42	35.00
9	Purchased jewels	63	52.50
10	Purchased household articles	78	65.00
11	Spent more money towards cultural aspects	98	81.67
12	Purchased farm implements	68	56.66

Table 4. Constraints faced by sugarcane farmers in adoption of Sugarcane Technologies (n=240)

Sl.No	Constraints	Number	Percent
1	Delayed payment from the factory	240	100.00
2	Delayed cutting or harvesting	232	96.67
3	Not settling the loan amount to PACB by Sugar factory (Deducted for settlement)	221	92.08
4	Water shortage	188	78.33
5	Planted of machine harvesting and harvested by manual cutting	164	68.33
6	Machine harvest damage the first crop to the extent of 10-15 percent	234	97.50

Sl.No	Constraints	Number	Percent
7	Rodent damage	240	100.00
8	Inadequate knowledge about drip system maintenance	240	100.00
9	Unable to understand the technology – Pit method and fertigation schedule	240	100.00
10	High cost of water-soluble fertilizers	240	100.00
11	Damage to lateral by machine harvest	192	80.00
12	High Interest to inputs supplied by factory and not for delayed payment	175	72.92
13	Lack of follow up in drip system management	218	90.83
14	Nonavailability of spare parts for drip irrigation	169	70.42
15	High cost for harvesting	204	85.00

Also, the sugarcane farmers expressed that water shortage (78.33), planted for machine harvest and harvested by manual cutting (68.33), high cost of harvesting (85.00), and non-availability of spare parts for drip system maintenance (40.42) are the problems faced by sugarcane farmers in sugarcane cultivation. The drip company did not follow the maintenance activities and it leads to the discontinuation of the drip irrigation system.

4. CONCLUSION

The study concluded that the majority of the AICRP sugarcane farmers were adopted the components of demonstrated sugarcane technologies. Training and Demonstration may be conducted in the latest sugarcane technologies by the extension officials of the State Department of Agriculture. The sugar factory extension officer is contacting the farmers only those who registered their cane with the sugar factory. Government interventions are needed to rectify the delayed payment to sugarcane farmers from the factory. Most of the farmers are not concentrating or adopting the recommended practices for ratoon crops. Training and demonstration may be conducted for ratoon crops to increase the yield.

CONSENT

As per international standard, respondents' written consent has been collected and prserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/75403