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Technological Adoption in Sugarcane Cultivation: A Study of Growers in Vijayapura District of Karnataka

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Abstract

Sugarcane is a vital commercial crop sustaining millions of farm livelihoods in India. However, gaps in the adoption of improved production practices continue to limit its productivity and profitability. The present study was undertaken to assess the extent of adoption of recommended sugarcane production technologies and to identify factors influencing the adoption behaviour of sugarcane growers in Vijayapura district of Karnataka. An ex-post facto research design was employed for the investigation. The study was conducted in two major sugarcane-growing taluks, namely Indi and Sindagi, selected based on the extent of area under sugarcane cultivation. A total of 120 sugarcane growers were selected from six villages using a multistage sampling technique. Primary data were collected through personal interviews using a structured and pre-tested interview schedule. Adoption of recommended sugarcane production practices was assessed with respect to varieties, planting methods, nutrient management, irrigation practices, pest and disease management and intercultural operations. The findings revealed that complete adoption was observed for basic and well-established practices such as recommended varieties, appropriate planting season, furrow irrigation, earthing-up and harvesting at the right stage. Partial adoption was recorded for practices related to nutrient management, chemical weed control and management of major pests and diseases, mainly due to input costs and availability. In contrast, advanced and knowledge intensive practices such as drip irrigation, pit or trench planting, paired-row spacing, soil testing, propping and green manuring exhibited low levels of adoption, owing to technical complexity, higher labour and investment requirements, and limited exposure to extension services. Overall, a majority of the sugarcane growers exhibited a medium level of adoption of recommended production technologies. The study concluded that inadequate knowledge, low motivation to adopt innovations, and non-availability of critical inputs at the appropriate time were the major constraints affecting adoption. Strengthening extension efforts through focused training, field demonstrations and timely input support is essential to enhance adoption levels and reduce the yield gap in sugarcane cultivation.

Keywords: Sugarcane growers, adoption performance, small famers, big farmers

Introduction

Sugarcane is one of the most important commercial crops cultivated in India and plays a vital role in the country's agricultural and industrial economy. Sugarcane (*Saccharum officinarum*), belonging to the family Poaceae, is widely grown in tropical and sub-tropical regions. Originating from New Guinea, sugarcane is among the world's oldest cultivated crops and has emerged as a major cash crop due to its assured domestic demand and extensive industrial utilization. The crop serves as a key raw material for the sugar industry and several allied industries, thereby contributing significantly to employment generation, income enhancement, and rural development.

The sugarcane and sugar industry occupies a prominent position in the Indian economy and is the second largest agro-based industry after cotton. It directly and indirectly supports the livelihoods of more than five crore farmers and their dependents. India is the largest consumer and the second largest producer of sugar in the world. On an average, the country produces about 35.5 crore metric tonnes of sugarcane annually, which is utilized to manufacture nearly 3 crore metric tonnes of sugar, while domestic consumption is estimated at around 2.6 crore metric tonnes. Sugarcane occupies approximately 5.09 million hectares in India, producing about 430.50 million metric tonnes with an average productivity of 82.50 tonnes per hectare

(Anonymous, 2021-22) ^[1, 2]. Sugarcane cultivation in India is largely concentrated in a few major states. Uttar Pradesh accounts for the largest share of area under sugarcane cultivation, while Maharashtra leads in total production. Karnataka, Tamil Nadu, Bihar, and Andhra Pradesh also contribute substantially to national sugar output, and together these states account for nearly 90 per cent of total sugar production. Karnataka ranks third in sugarcane production, cultivating the crop over an area of about 4.23 lakh hectares with a production of 420.9 lakh metric tonnes and an average productivity of 96 tonnes per hectare (Anonymous, 2021) ^[1]. The major sugarcane-growing districts in the state include Belagavi, Bagalkot, Vijayapura, Mandya and Mysore.

Among these districts, Vijayapura occupies an important position in sugarcane cultivation. The crop is grown over an area of about 38,920 hectares in the district, supported by the presence of a sugar factory. The district records a production of approximately 4.32 lakh tonnes with an average productivity of 79 tonnes per hectare. Although sugarcane productivity in the district has shown a gradual increase over the years, the improvement has been modest, and a considerable gap persists between potential yield and actual yield realized at the farm level. The yield gap in sugarcane cultivation arises due to a combination of environmental, technological, and socio-economic factors. These include sub-optimal cropping systems, limited use of improved varieties, imbalanced fertilizer application, inadequate pest and disease management, and constraints related to irrigation and labour availability. In addition, institutional and economic factors such as marketing problems, delayed payments, and post-harvest issues further affect productivity and profitability. Despite sustained research efforts leading to the development of improved and location-specific sugarcane production technologies, their adoption by farmers has remained uneven. Adoption of agricultural technologies is a complex process influenced by farmers' knowledge, attitudes, resource availability, and access to extension services. In sugarcane cultivation, adoption of recommended practices such as improved varieties, scientific planting methods, balanced nutrient management, integrated pest and disease management, and efficient water use is essential for enhancing productivity and profitability. However, variations in education, farm size, extension contact, and exposure to information sources result in differential adoption levels among farmers. Understanding the adoption behaviour of sugarcane growers is therefore crucial for identifying gaps between recommended technologies and actual field practices. Such an assessment provides valuable insights for strengthening extension systems and designing effective, farmer-oriented interventions. In this context, the present study focuses on the adoption of recommended sugarcane production practices among growers in Vijayapura district of Karnataka, with the aim of generating empirical evidence to support sustainable sugarcane production and improved farmer livelihoods.

Methodology

The present study was carried out in Vijayapura district of

Karnataka, which lies in the Northern Dry Zone of the state. The district was purposively selected as sugarcane is one of the major commercial crops cultivated extensively in the region. Among the five taluks of Vijayapura district, namely Vijayapura, Basavana Bagewadi, Indi, Muddebihal, and Sindagi, Indi and Sindagi taluks were purposively selected for the study due to their comparatively larger area under sugarcane cultivation. An ex-post facto research design was adopted, as the factors influencing the adoption of sugarcane production technologies had already occurred and were beyond the control of the researcher. A multistage sampling procedure was followed for the selection of respondents. From each selected taluk, three villages having a predominance of sugarcane cultivation were purposively chosen, resulting in a total of six villages. From each selected village, 20 sugarcane growers were selected through random sampling, comprising both small and large farmers. Thus, the total sample size of the study consisted of 120 sugarcane growers.

Primary data were collected through personal interviews using a structured and pre-tested interview schedule. The interview schedule was developed based on a thorough review of relevant literature, recommended package of practices for sugarcane and consultation with experts in agricultural extension. Adoption of recommended sugarcane production practices was assessed by examining the extent to which farmers followed key practices related to varieties, planting methods, nutrient management, irrigation, pest and disease management and intercultural operations.

Each practice was assigned appropriate scores and an overall adoption score was computed for each respondent. Based on mean and standard deviation, the respondents were categorized into low, medium and high levels of adoption. The collected data were coded, tabulated, and analyzed using suitable descriptive statistical tools such as frequency, percentage, mean and standard deviation.

Results and Discussions

A. Adoption performance of small sugarcane growers

Table 1 showed that, cent per cent of small farmers adopted recommended varieties and planting season, furrow irrigation, earthing up and harvesting time followed by more than three fifth (68.33%) fully adopted 120 cm row spacing. Majority (86.66%) of respondents are partially adopted recommended setts rate, followed by recommended dose of NPK (76.66%), frequency of irrigation (75.00%), recommended quantity of FYM (63.34%), chemical weed management (58.33%), root grub management (53.33%), early shoot borer management (51.67%) and grassy shot disease management (46.67%). Cent per cent of small farmers not adopted drip irrigation and pit or trench method of spacing, followed by paired row method of spacing (96.67%), propping (93.33%), soil testing (90.00%), 150 cm wide row spacing (71.67%), setts treatment (68.32%), green manure crops (60.00%), woolly aphid management (50.00%), Detrashing (48.33%), smut disease management (46.67%), intercropping (43.34%).

Table 1: Adoption performance of small sugarcane growers

Sl. No.	Recommended practices	Small sugarcane growers (n=60)					
		Full adoption		Partial adoption		No adoption	
		No.	%	No.	%	No.	%
1	Soil testing	06	10.00	00	0.00	54	90.00
2	Recommended varieties	60	100.00	00	0.00	00	0.00
3	Recommended planting season	60	100.00	00	0.00	00	0.00

4	Setts treatment	02	3.34	17	28.34	41	68.32
5	Recommended spacing						
	a. 120 cm row spacing	41	68.33	00	0.00	19	31.67
	b. 150cm wide row spacing	17	28.33	00	0.00	43	71.67
	c. Paired row method	02	03.33	00	0.00	58	96.67
	d. Pit/trench method	00	0.00	00	0.00	60	100
6	Recommended setts rate	08	13.34	52	86.66	00	0.00
7	Recommended quantity of FYM	04	6.66	38	63.34	18	30.00
8	Recommended dose of NPK fertilizer	14	23.34	46	76.66	00	0.00
9	Green manures crops	00	0.00	24	40.00	36	60.00
10	Method of irrigation						
	a. Drip irrigation	00	0.00	00	0.00	60	100
	b. Furrow irrigation	60	100.00	00	0.00	00	0.00
11	Frequency of irrigation	15	25.00	45	75.00	00	0.00
12	Intercropping	08	13.32	26	43.34	26	43.34
13	Intercultural practices						
	a. Earthing up	60	100.00	00	0.00	00	0.00
	b. Detrashing	06	10.00	25	41.67	29	48.33
	c. Propping	00	0.00	04	6.67	56	93.33
14	Chemical weed management	12	20.00	35	58.33	13	21.67
15	Pest management						
	a. Woolly aphid	04	6.67	26	43.33	30	50.00
	b. Root grub	11	18.33	32	53.33	17	28.34
	c. Early shoot borer	11	18.33	31	51.67	18	30.00
16	Disease management						
	e. Grassy shoot	13	21.67	28	46.67	19	31.66
	f. Smut	05	8.33	27	45.00	28	46.67
17	Harvesting time	60	100.00	00	0.00	00	0.00

B. Adoption performance of big sugarcane growers

Table 2 revealed that cent percent of big farmers adopted recommended varieties and planting season, earthing up and harvesting time, followed by furrow irrigation (93.34%) and 120 cm row spacing (55.00%). More than three fourth (76.66%) of big farmers partially adopted recommended setts rate, followed by recommended dose of NPK fertilizers (61.66%), recommended quantity of FYM and frequency of irrigation (60.00%),

early shoot borer management (55.00%), root grub management (50.00%), setts treatment and smut management (46.67%), chemical weed management (45.00%), grassy shoot management (43.34%). Cent per cent of big farmers is not adopted pit or trench method, followed by paired row method and drip irrigation (93.33%), propping (83.33%), soil testing (81.66%), woolly aphid management and 150 cm wide row spacing (61.66%), green manures crops (60.00%), Detrashing (45.00%), intercropping (43.33%).

Table 2: Adoption performance of big sugarcane growers

Sl. No.	Recommended practices	Big sugarcane growers (n=60)					
		Full adoption		Partial adoption		No adoption	
		No.	%	No.	%	No	%
1	Soil testing	11	18.34	00	0.00	49	81.66
2	Recommended varieties	60	100.00	00	0.00	00	0.00
3	Recommended planting season	60	100.00	00	0.00	00	0.00
4	Setts treatment	08	13.33	28	46.67	24	40.00
5	Recommended spacing						
	a. 120 cm row spacing	33	55.00	00	0.00	27	45.00
	b. 150cm wide row spacing	23	38.34	00	0.00	37	61.66
	c. Paired row method	04	6.67	00	0.00	56	93.33
	d. Pit/trench method	00	0.00	00	0.00	60	100
6	Recommended setts rate	14	23.34	46	76.66	00	0.00
7	Recommended quantity of FYM	10	16.67	36	60.00	14	23.33
8	Recommended dose of NPK fertilizer	23	38.34	37	61.66	00	0.00
9	Green manures crops	08	13.34	16	26.66	36	60.00
10	Method of irrigation						
	a. Drip irrigation	04	6.67	00	0.00	56	93.33
	b. Furrow irrigation	56	93.34	00	0.00	04	6.66
11	Frequency of irrigation	24	40.00	36	60.00	00	0.00
12	Intercropping	14	23.33	20	33.34	26	43.33
13	Intercultural practices						
	a. Earthing up	60	100.00	00	0.00	00	0.00
	b. Detrashing	12	20.00	21	35.00	27	45.00
	c. Propping	04	6.67	06	10.00	50	83.33

14	Chemical weed management	23	38.33	27	45.00	10	16.67
15	Pest management						
	a. Woolly aphid	10	16.67	13	21.66	37	61.67
	b. Root grub	19	31.66	30	50.00	11	18.34
	c. Early shoot borer	16	26.66	33	55.00	11	18.34
16	Disease management						
	a. Grassy shoot	21	35.00	26	43.34	13	21.66
	b. Smut	10	16.67	28	46.66	22	36.67
17	Harvesting time	60	100.00	00	0.00	00	0.00

The widespread adoption of recommended sugarcane varieties, planting season, row spacing of 120 cm, earthing-up, and timely harvesting was attributed to assured availability of planting material, ease of intercultural operations, synchronization of monsoon with critical crop stages, and the perceived benefits of yield maximization. Earthing-up was universally practiced as it effectively suppressed weeds, improved soil aeration, prevented lodging, and promoted root development, while timely harvesting was followed to avoid yield loss associated with delayed harvesting. Partial adoption of nutrient, weed, pest, and disease management practices reflected growers' emphasis on practices with immediate and visible yield benefits, supported by availability of farmyard manure, high labour costs, and frequent incidence of pests such as root grub and early shoot borer. Limited adoption of disease management practices was possibly due to lower disease severity and farmers' reliance on self-managed control measures. In contrast, low adoption of pit or trench planting, paired-row spacing, drip irrigation, soil testing, propping,

and green manuring was mainly due to small landholdings, higher labour and input costs, lack of technical knowledge, and non-availability of required inputs.

C. Adoption performance of sugarcane growers

It is observed from the Table 3 that more than two-fifth (46.67%) of the small farmers had low adoption performance towards recommended practices of sugarcane, followed by medium (38.33%) and high (15.00%) level of adoption performance. With respect to big farmers, more than two fifth (45.00) of them had medium adoption performance about recommended practices of sugarcane practices, followed by high (31.67%) and low (23.33%) level of adoption performance. Regarding overall sugarcane growers, more than two-fifth (41.66%) of them had medium adoption performance and 35.00 per cent of the sugarcane growers had low adoption performance group. nearly one-fourth (23.34%) of the growers had low level of adoption performance, it is also visible through fig 1.

Table 3: Adoption performance of sugarcane growers

Adoption level	Small farmers (n ₁ =60)		Big farmers (n ₂ =60)		Sugarcane growers (n=120)	
	No.	%	No.	%	No.	%
Low < (23.21)	28	46.67	14	23.33	42	35.00
Medium (23.21-26.63)	23	38.33	27	45.00	50	41.66
High > (26.63)	09	15.00	19	31.67	28	23.34
Mean = 24.92 SD= 3.42						

The low level of adoption of recommended sugarcane technologies could be attributed to inadequate knowledge of the practices, low motivation to adopt innovations, and non-availability of critical inputs at the right time. This highlights the

need for strengthened and intensified extension efforts to enhance farmers' knowledge, improve adoption of recommended practices, and thereby reduce the yield gap in sugarcane cultivation.

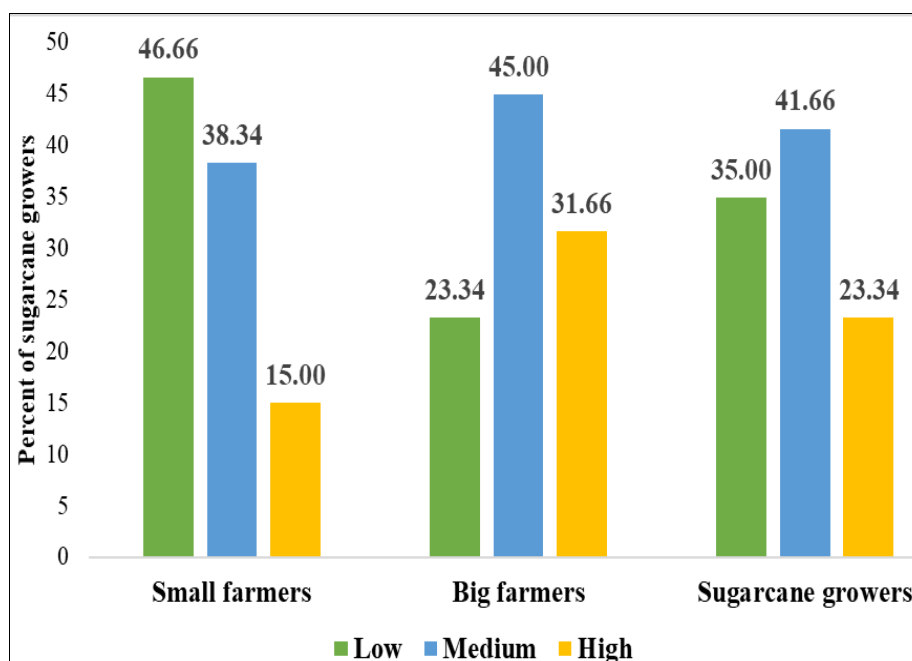


Fig 1: Adoption performance of sugarcane growers

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Conclusion

The study clearly demonstrated that the adoption of recommended sugarcane production technologies among growers was largely moderate with widespread adoption of simple and well-established practices and limited uptake of complex, resource-intensive innovations. While farmers readily adopted practices that were familiar, cost-effective and yield-enhancing, technologies requiring higher investment, technical expertise, and institutional support showed lower adoption levels. The findings highlighted that gaps in knowledge, motivation, and timely availability of critical inputs remained key constraints. Strengthening extension systems through targeted capacity-building programmes, field demonstrations and efficient input delivery mechanisms is essential to accelerate technology adoption, bridge the yield gap and ensure sustainable growth of sugarcane cultivation.

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