Assessing Farmers' Knowledge of Sugarcane Production Technology in Haryana, India

ABSTRACT

Aim: This study aims to assess the knowledge level of sugarcane growers in Haryana, India, regarding sugarcane production technology and to propose strategies for enhancing their knowledge.

Methodology: A total of 120 sugarcane farmers were purposively selected from three key sugarcane-producing districts: Yamuna Nagar, Kaithal, and Rohtak. Farmers were interviewed using a well-structured knowledge assessment schedule covering ten key components of sugarcane production. Statistical tools including weighted mean score, correlation analysis, and ranking were employed to analyze and interpret the data.

Results: The study revealed that 68.34 per cent of farmers had a medium level of knowledge regarding production technology, with significant gaps observed in manure and fertilizer use (75.80% lacked full knowledge) and pest control. On the other hand, 85.00 per cent of farmers had full knowledge of irrigation practices. Positive correlations were found between knowledge levels and factors such as education, income, social participation, and media exposure.

Conclusion & Recommendations: Strengthening farmers' knowledge through systematic education and extension services is essential for bridging the technological gap and improving agricultural productivity. To address these knowledge gaps, the study recommends targeted extension programs, farmer training workshops, and the use of mass media to improve farmers' access to updated agricultural practices. Increased collaboration with agricultural cooperatives and research institutions could also play a vital role in enhancing farmers' knowledge and boosting sugarcane production in the region.

Key words: Knowledge level, Sugarcane production technology, Sugarcane growers

INTRODUCTION

Sugarcane (*Saccharum officinarum*) is a tall perennial grass belonging to the Poaceae family, recognized globally as one of the most significant crops due to its role in sugar production, bioenergy, and other by-products. Major sugarcane producers include Brazil, India, China, and Thailand, with India notably cultivating sugarcane on approximately 4.85 million hectares (Statistical Abstract of Haryana, 2021-22). In 2021-22, India produced 500 million metric tonnes of sugarcane and 39.4 million metric tonnes of milled sugar, also exporting 10.98 million metric tonnes, making it the world's largest producer and consumer of sugar, and the second largest exporter (PIB Delhi, 2022).

The primary use of sugarcane is sugar production, with the industry extracting sucrose and processing it into various types of sugar. By-products such as molasses and ethanol further contribute to its economic value. Despite India's significant sugarcane output, challenges remain, particularly in regions like Haryana where harsh weather conditions impede optimal production. High temperatures, dry winds, and limited irrigation lead to poor germination and reduced crop quality, impacting overall yields (Agarwal *et al.*, 2024). Technologies such as high-yielding varieties, integrated nutrient management (INM), and precision irrigation

systems have been introduced to improve productivity and sustainability, yet traditional methods continue to dominate, resulting in lower-than-expected yields.

Modern technologies, such as drought-resistant varieties and advanced irrigation systems, can mitigate these issues, but farmers' understanding and implementation of such solutions vary. This study aims to assess how well farmers are informed about these technologies and how climate-related constraints influence their adoption. The focus of this study is on assessing the knowledge and adoption levels of modern sugarcane production technologies among farmers in Haryana. These technologies include improved cultivars, optimal planting techniques, fertilizer management, and pest control measures that have been developed to enhance efficiency and output. Despite the availability of these advancements, adoption rates remain low due to various factors such as limited awareness, insufficient extension support, and socioeconomic barriers.

Previous studies have provided valuable insights into the knowledge and adoption of sugarcane technologies, though much of the existing research is dated. While older studies focused on traditional practices, recent developments in sugarcane farming require updated research to address the current technological gaps. This study addresses this research gap by examining the extent of farmers' knowledge and adoption of contemporary sugarcane production technologies and identifying the factors that impact this adoption.

Given the critical role of knowledge in bridging the technological gap in sugarcane production, this study aims to assess the knowledge levels of sugarcane growers in Haryana regarding sugarcane production technology. Understanding these knowledge levels can inform strategies to enhance technology dissemination and utilization, ultimately improving sugarcane production and productivity in the region.

MATERIALS AND METHODS

This study was conducted in the state of Haryana, India, across three major sugarcane-producing districts: Yamuna Nagar, Rohtak, and Kaithal. These districts were selected purposively based on their significant contribution to sugarcane cultivation in the region. Yamuna Nagar and Rohtak are among the leading districts in Haryana in terms of sugarcane acreage, while Kaithal, though smaller in area, contributes significantly to the state's overall sugarcane production.Yamuna Nagar has an area of approximately 19,700 hectares under sugarcane cultivation, and Rohtak has around 8,500 hectares (Statistical Abstract of Haryana 2021-22). Kaithal, with about 4,500 hectares, plays a crucial role in contributing to sugarcane production despite its smaller land allocation. The selection of these districts provides a representative sample of Haryana's sugarcane production scenario, ensuring the validity of the study.

The study employed a multistage random sampling technique. In the first stage, one block from each of the selected districts was randomly chosen. The blocks selected were Chhachhrauli in Yamuna Nagar, Pundri in Kaithal, and Rohtak block in Rohtak district. In the second stage, two villages were randomly selected from each block using a random number generator to ensure that the selection process was unbiased. The villages selected were Mand Kheri and Panjeto from Chhachhrauli, Rasina and Sanch from Pundri, and Rithal and Kahni from Rohtak block. From each village, 20 sugarcane-growing farmers were randomly selected, making a total sample size of 120 farmers. The list of sugarcane growers was obtained from local agricultural extension offices, and randomization was conducted using a random number table to avoid bias in farmer selection. The allocation of sample farmers was proportionate to

the population size of the sugarcane growers in each village, ensuring that the sample was representative of the farming community in each area.

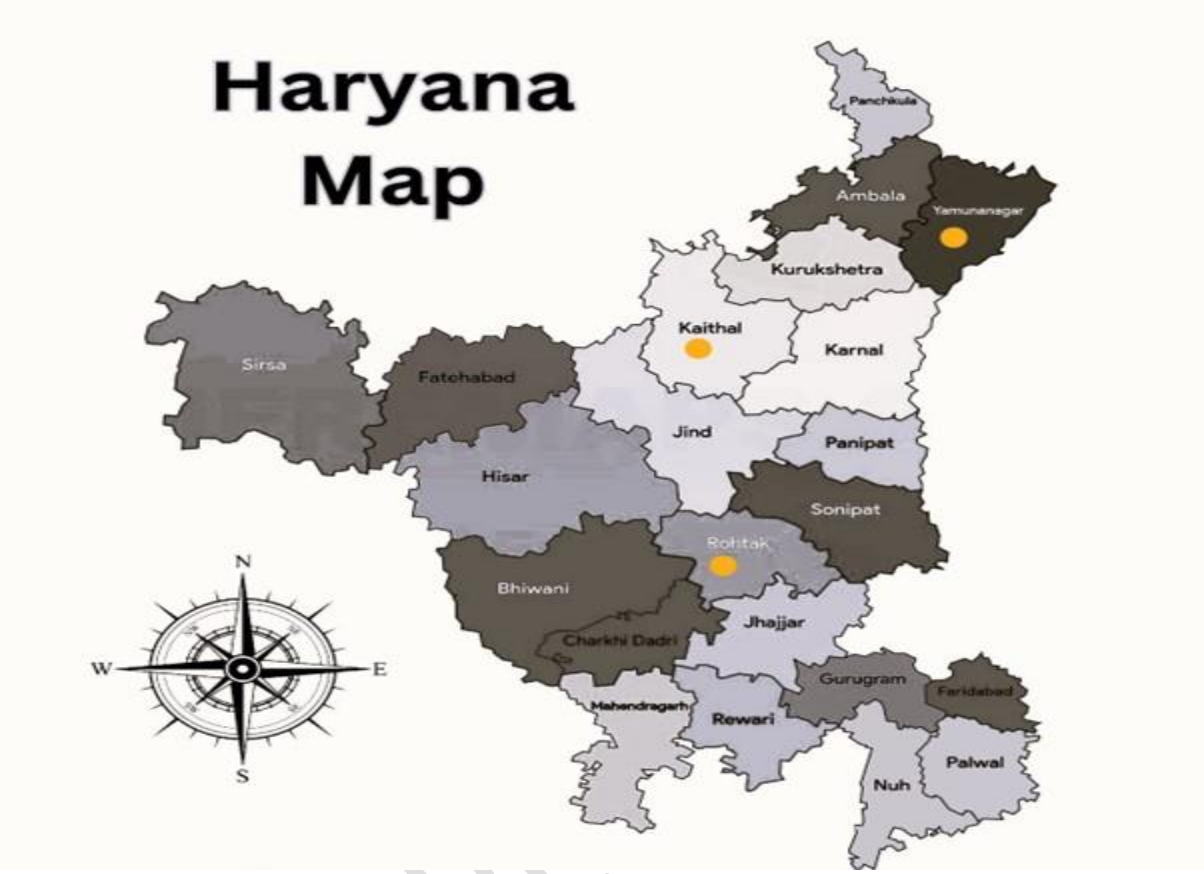

Figure 1. Map of the study area (study area shown by yellow dots)

Knowledge, defined as the understanding and awareness of agricultural, technological, and management practices, is essential for improving agricultural productivity and rural livelihoods. This study aimed to assess the knowledge level of sugarcane growers in Haryana. A knowledge assessment schedule, developed in collaboration with experts, covered ten key components: recommended cultivars, seed rate, time of planting, planting distance, manure and fertilizers, time and method of fertilizer application, intercultural operations, irrigation, insects-pests and their control, and diseases and their control. Respondents' answers were scored as fully correct (three points), partially correct (two points), or incorrect/no answer (one point). The total scores of different responses were calculated for each category. Afterwards, the mean and standard deviation were used to categorize the farmers into low, medium, and high levels of knowledge. This methodology provided a quantitative measure of the farmers' knowledge, highlighting areas for improvement in knowledge dissemination and technology adoption.

Various statistical tools were employed to analyze the collected data. Descriptive statistics, including mean, standard deviation, and percentages, were used to summarize demographic data and assess farmers' knowledge levels. Weighted mean scores were calculated to rank the knowledge components based on the farmers' responses, providing insights into areas where knowledge gaps were more prominent. Correlation analysis was performed to explore relationships between socio-economic variables such as education level, income, social

participation, extension contact, and the farmers' knowledge levels regarding sugarcane production technology.. These statistical tools facilitated a comprehensive understanding of the factors influencing the adoption of recommended sugarcane production technologies.

RESULTS AND DISCUSSION

Fig. 1 reveals that a significant proportion of the respondents, 68.34 per cent, exhibited a medium level of knowledge, while 14.16 per cent demonstrated a low level of knowledge and 17.50 per cent displayed a high level of knowledge. These results indicated a need for targeted interventions to address the knowledge gaps among sugarcane growers. The probable reason behind the distribution of knowledge levels could be attributed to various factors such as access to agricultural information and extension services, limited access to comprehensive and specialized training programs, educational background, socioeconomic status, and previous farming experience etc (Agarwal *et al.*, 2024). The results are in line with Prajapati (1995), Patel & Vyas (2014), Jaiswal & Tiwari (2014) and Godara *et al.* (2020) who also revealed medium level of knowledge among respondents with similar reasons.

Fig. 1: Distribution of respondents based on overall knowledge about recommended sugarcane production technology

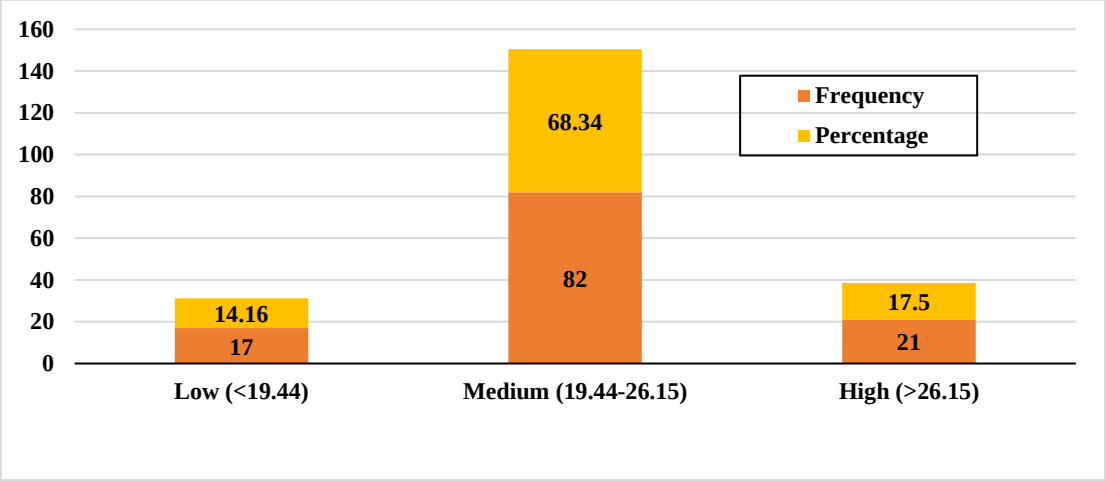

Table 1 provides the mean percent scores for various sugarcane production practices with ranks. The highest knowledge was observed for irrigation practices, with a mean percent score of 85 per cent, indicating that most farmers were either fully or partially knowledgeable about proper irrigation techniques. In contrast, the lowest score was found for pest management, where only 67.50 per cent of respondents demonstrated knowledge. Relatively higher knowledge level (79.72%) regarding recommended cultivars of sugarcane can be attributed to the availability of information through agricultural extension services, farmer training programs, and the involvement of local sugarcane cooperatives. These initiatives likely emphasize the importance of using recommended cultivars that are known for their high yield, disease resistance, and suitability to the local agro-climatic conditions. Regarding seed rate, knowledge level was found 80.55 per cent among the respondents. This knowledge may be attributed to traditional farming practices and the exchange of knowledge among local farmers.

Table 1: Knowledge level about the recommended package of practices for sugarcane production technology (n=120)

S. No.	Practices	Knowledge level			Total weighted score	Weighted mean score	Mean percent score	Rank order
		Full	Partial	Nil				
1	Recommended cultivars	49 (40.80)	69 (57.50)	02 (01.70)	287	2.39	79.72	IV
2	Seed rate	54 (45.00)	62 (51.70)	04 (03.30)	290	2.42	80.55	II
3	Time of planting	60 (50.00)	49 (40.80)	11 (09.20)	289	2.41	80.28	III
4	Planting distance	46 (38.30)	71 (59.20)	03 (02.50)	283	2.36	78.61	V
5	Manure and fertilizers and their quantity	26 (21.70)	91 (75.80)	03 (02.50)	263	2.19	73.05	VII
6	Time and method of application of fertilizer	23 (19.20)	88 (73.30)	09 (07.50)	254	2.12	70.55	VIII
7	Intercultural operations	40 (33.30)	71 (59.20)	09 (07.50)	271	2.26	75.27	VI
8	Irrigation	66 (55.00)	54 (45.00)	00 (00.00)	306	2.55	85.00	I
9	Insects-pests and their control	12 (10.00)	99 (82.50)	09 (07.50)	243	2.02	67.50	X

10	Diseases and their control	22 (18.30)	86 (71.70)	12 (10.00)	250	2.08	69.44	IX

The knowledge level of 80.28 per cent regarding the time of planting sugarcane suggests that farmers are familiar with the optimal timing for initiating the planting process. Local agricultural calendars, advice from experienced farmers, and extension services could play a role in disseminating knowledge about the suitable period for planting sugarcane, considering factors such as temperature, rainfall patterns, and crop cycles. Regarding planting distance i.e., 60-75 cm (flat planting), knowledge level was 78.61 per cent. This knowledge may be passed down through generations and reinforced by local agricultural practices, cooperative societies, and extension services. It was observed that the relatively low knowledge level i.e., 73.05 per cent was found for manures and fertilizers among the respondents. Recommendation of urea is 130 kg /acre (195 kg/acre for ratoon crop), SSP is 125 kg /acre, and MOP is 35 kg/acre according to package of practices. Also, the knowledge level regarding time and method of fertilizer application was only 70.55 per cent. This may be due to limited exposure to extension services or agricultural training programs. In case of intercultural operations such as weeding, knowledge level was found 75.27 per cent among the respondents because respondents lacked a bit in the knowledge of chemical dose and method recommended for sugarcane which is 1.6 kg Atrazine 50 WP in 250-300 L water 2-3 days after planting. In case of irrigation, highest knowledge level 85.00 per cent was found among the respondents because farmers recognize the significance of providing adequate water to ensure optimal growth and yield. With regard to insects–pest and their control, knowledge level was found the lowest i.e., 67.50 per cent, most common insects-pests were top borer, early shoot borer, termites and root borer in the study area. There should be training programmes for plant protection. In sugarcane, most common disease was red rot and knowledge level regarding control of red rot was 69.44 per cent found among the respondents because farmers have very low knowledge about the diseases. The findings were found similar to some extent with Singh (2006), Garg (2008) & Godara *et al.* (2020) who also found that highest knowledge level was found for irrigation and it also showed that difference in knowledge of modern technology is affected by the socio-economic status and in turn effect the knowledge level about recommended package and practices.

The correlational analysis (Table 2) revealed that several variables had significant positive relationships with the knowledge level of farmers regarding sugarcane production technology. Computation of correlation coefficients revealed that knowledge level of sugarcane growers about recommended sugarcane package and practices was positive and significantly correlated with annual family income, social participation, land holding, material possession, cropping pattern, extension contact, mass media exposure, risk orientation, economic motivation, innovativeness, extension participation at 0.01 level of significance; however, education was found to have a positive and significant correlation at 0.05 level of significance. Also, for the variables such as age, caste, occupation, family type and family size, coefficient of correlation was found to be non-significant at all levels of significance. The findings were partially supported by Godara et al (2020) who also found age, family type and family size having non-significant relationship, while family income, land holding and extension contact having positive and significant correlation with knowledge; Kadam et al (2008) who also observed caste having non-significant relationship, while risk orientation

having positive and significant relationship; Mohit (2022) who also found education, social participation and mass media exposure positively significant with knowledge and adoption, while occupation was found non-significant; Garg (2008) found similar results with material possession having positive and significant association with knowledge.

Table 2: Correlation between various independent variables and farmers' knowledge level

S. No	Independent variables	Correlation coefficient
1	Age	0.045^{NS}
2	Caste	0.016^{NS}
3	Education	0.198^{*}
4	Occupation	0.164^{NS}
5	Annual family income	0.488^{**}
6	Social participation	0.237^{**}
7	Land holding	0.414^{**}
8	Material possession	0.257^{**}
9	Family type	0.023^{NS}
10	Family size	0.006^{NS}
11	Cropping pattern	0.240^{**}
12	Extension contact	0.356^{**}
13	Mass media exposure	0.404^{**}
14	Risk orientation	0.486^{**}
15	Economic motivation	0.306^{**}
16	Innovativeness	0.255^{**}
17	Extension participation	0.385^{**}

** - Significant at the 0.01 level * - Significant at the 0.05 level NS - Non-Significant

Conclusion & Recommendations

The results revealed that farmers had varying levels of knowledge across different components of sugarcane production. Irrigation practices were the most well-understood, while

significant gaps were observed in pest control and fertilizer application, areas where the majority of farmers demonstrated only partial or no knowledge. The correlation analysis highlighted positive associations between farmers' knowledge levels and variables such as education, landholding size, social participation, and extension contact. These findings suggest that farmers with greater access to educational resources and agricultural extension services tend to be more knowledgeable about modern farming practices. However, it is important to note that while these variables are associated with higher knowledge levels, they do not necessarily cause increased knowledge.

The study reveals the need for targeted educational and extension programs to improve sugarcane farmers' knowledge in Haryana. Enhancing access to information, increasing social participation, and using media effectively can significantly boost farmers' understanding of key production practices, leading to better productivity and sustainability in sugarcane farming.

Disclaimer (Artificial intelligence)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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