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ASCERTAINING THE TECHNOLOGICAL GAP IN ADOPTION OF SUGARCANE PRODUCTION TECHNOLOGY

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ABSTRACT

The term "technological gap" refers to the disparity between the current level of technology utilized in sugarcane cultivation and the latest advancements available. It serves as a measure of the difference between existing technological practices in sugarcane farming and the potential achievable practices through the adoption of improved technology, highlighting areas for advancement in the industry. This study aims to assess the extent of technology adoption among sugarcane growers and measure the technological gap in the adoption of sugarcane production technology in Haryana. Data for this study was collected from 120 sugarcane farmers of Haryana. Statistical tools such as weighted mean score, correlation analysis etc. were employed to analyze the data and interpret the findings. Technological gap was calculated as the difference between the percentage that should be fully implemented according to the recommended package of practices and the percentage of sugarcane production technology that is currently being adopted. The study found that most farmers showed a medium level of adoption (60.80%). Mean technological gap in adoption of sugarcane production technology was 30.19 per cent. Maximum technological gap (38.06%) exists in the case of insects-pests and their control, followed by diseases and their control (36.67%) and least technological gap was found for irrigation i.e., 21.95 per cent. Education positively influenced adoption ($p < 0.05$), while other factors like income, social participation, and innovation were significant at a higher level ($p < 0.01$). By analyzing the adoption levels, particularly in light of the calculated technological gap, the study seeks to empower farmers and advance sugarcane cultivation practices in Haryana.

Keywords: *technological gap, adoption, sugarcane production technology, sugarcane growers*

INTRODUCTION

Sugarcane, scientifically known as *Saccharum officinarum*, is an important agro-industrial crop, contributing significantly to the nation's economy. In India, sugarcane cultivation is typically carried out in two distinct agro-climatic zones: tropical and sub-tropical. The tropical zone, which includes states such as Maharashtra, Karnataka, Gujarat, Madhya Pradesh, and Tamil Nadu, is an important region for sugarcane production. In the northern region of India, Uttar Pradesh, Punjab, Bihar, and Haryana are the four main states where sugarcane is prominently cultivated. Among them, Uttar Pradesh, and Maharashtra hold the top positions in terms of area and production of sugarcane. Notably, Haryana boasts the highest productivity rate in the sub-tropical zone, with an average yield of 86.18 tonnes per hectare of sugarcane (Agarwal *et. al*., 2024). The average cane yield in India is approximately 73.0 tonnes per hectare, with a sugar recovery rate of around 10.0 per cent. However, there is potential for increasing the average cane yield to 100 tonnes per hectare and the sugar recovery rate to 11.0 per cent through the transfer of new technologies to farmers' fields (ICAR Statistics, 2021).

In recent times, innovation technologies have been developed at agricultural universities and research stations, indicating that the issue of concern is not the lack of technology but rather the lack of its dissemination from the point of its creation to the point of its application. In the agricultural sector, specifically, farmers in the majority of developing nations are not able to keep up with the advancing technology, resulting in a significant disparity between the production of knowledge and its utilization (Sardhara *et al.,* 2020; Vinaya and Tapan, 2023). The term "technological gap" denotes the variance between the present technology level that is being utilized by individuals, organizations, or nations and the latest and advanced technology available. It is a gauge of the gap between the current status of technology and the level that could potentially be attained through the adoption of improved technology. Several factors contribute to this gap, including insufficient access to technology, inadequate knowledge or skills to operate the technology or

inadequate infrastructure to support the technology which were studied as variables in the study.

Understanding and addressing this technological gap is crucial for enhancing agricultural productivity and sustainability. Therefore, the present study aims to assess the extent of technology adoption among sugarcane growers in the region, ultimately empowering farmers and advancing sugarcane cultivation practices in Haryana.

OBJECTIVE

To know ascertaining the technological gap in adoption of sugarcane production technology

METHODOLOGY

Among the 22 districts in the state of Haryana, the study purposively chose three districts namely Yamuna Nagar, Kaithal, and Rohtak. The selection was made on the criterion of sugarcane cultivation area, with Yamuna Nagar and Rohtak being the two districts with the highest area under sugarcane cultivation. Kaithal was specifically selected due to its notable contribution to sugarcane production. One block was chosen at random from each of the three selected districts and further, two villages from each block were selected randomly. Mand Kheri and Panjeto selected from Chhachhrauli, Rasina and Sanch selected from Pundri, Rithal and Kahni selected from Rohtak block. A total of 120 farmers were selected as a sample for the present study and interviewed using a well-structured interview schedule in the year 2023.

A list of independent variables was prepared based on their relevance and significance in everyday experiences and as per the objectives of the present study. The independent variables included in this study were age, socio-economic status, family type, family size, mass media exposure, cropping pattern, economic motivation, innovativeness, risk orientation, extension contact and extension participation of the respondent. Adoption and technological gap were taken as dependent variables for the study.

Adoption can be defined as a decision to make full use of an innovation as the best course of action available (Rogers, 2003). Adoption in agriculture refers to the process wherein farmers and rural communities actively accept, implement, and integrate new knowledge and practices into their farming systems. To measure overall adoption, 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 level of adoption. The aspect-wise level of adoption was categorized into three groups based on the recommendations of the package of practice. Fully adopted recommendations were awarded a score of 3, partially adopted recommendations a score of 2 and no adoption a score of 1. Statistical tools such as total weighted score, mean weighted score, correlation analysis and mean percent score were used.

The technological gap refers to the disparity between the recommended package of practices for sugarcane production and the extent of adoption of these practices by the farmers. This gap is calculated as the difference between the percentage that should be fully implemented according to the recommended package of practices and the percentage of sugarcane production technology that is currently being adopted.

$$\text{Technological gap index} = \frac{R-A}{R} \times 100$$

Where, R denotes recommended package score and A denotes adoption score

RESULTS & DISCUSSION

Adoption level of respondents regarding sugarcane cultivation practice

Table 1: Distribution of respondents based on overall adoption of recommended sugarcane production technology (n=120)

Sr. No.	Categories	Frequency	Percentage
1	Low (<18.15)	35	29.20
2	Medium (18.15-23.73)	73	60.80
3	High (>23.73)	12	10.00

Table 1 shows that the respondents in the study area exhibited a moderate level of adoption of sugarcane production technology. It can be inferred that there is a significant disparity in the adoption of sugarcane farming practices among farmers in the study area. This gap was observed among all categories of respondents with minor variations. Targeted interventions, considering socio-economic factors, access to resources, awareness, and perceived benefits, are needed to improve adoption rates. Tailored extension programs and stakeholder collaboration can promote the adoption of sugarcane production technologies and foster sustainable practices. The findings of Kadadi & Jahanara (2018) were found similar.

Table 2 presents the results of the investigation, highlighting the variation in adoption levels of sugarcane production technology among sugarcane growers in the study area. The study identified that irrigation practices received the highest level of adoption, with 78.05% of respondents incorporating them, reflecting the significance

Table 2: Adoption level of recommended sugarcane cultivation practices (n=120)

Sr. No.	Practices	Adoption level			Total Weighted score	Weighted mean score	Mean percent score	Rank order
		Full	Partial	No adoption				
1	Recommended cultivars	17 (14.10)	98 (81.70)	05 (04.20)	252	2.10	70.00	V
2	Seed rate	45 (37.50)	69 (57.50)	06 (05.00)	279	2.32	77.50	II
3	Time of planting	33 (27.50)	79 (65.80)	08 (06.70)	265	2.21	73.61	III
4	Planting distance	29 (24.20)	85 (70.80)	06 (05.00)	263	2.19	73.05	IV
5	Manure and fertilizers and their quantity	06 (05.00)	102 (85.00)	12 (10.00)	234	1.95	65.00	VIII
6	Time and method of application of fertilizer	09 (07.50)	100 (83.30)	11 (09.20)	238	1.98	66.11	VII
7	Intercultural operations	20 (16.70)	90 (75.00)	10 (08.30)	250	2.08	69.44	VI
8	Irrigation	44 (36.70)	73 (60.80)	03 (02.50)	281	2.34	78.05	I
9	Insects-pests and their control	06 (05.00)	91 (75.80)	23 (19.20)	223	1.86	61.94	X
10	Diseases and their control	03 (02.50)	102 (85.00)	15 (12.50)	228	1.90	63.33	IX

of water management in sugarcane cultivation. Adoption of recommended cultivars and seed rate showed a relatively higher acceptance indicating a strong adherence to planting density recommendations that are essential for optimal yields. Similarly, a considerable adoption level was observed for the recommended time of planting and planting distance suggesting that while a sizable proportion of growers align with best planting practices, there remains room for improvement. However, the adoption level for manures and fertilizers was relatively low, which could be attributed to limited exposure to extension services or agricultural training programs. The adoption level for the time and method of fertilizer application indicated a need for further education and awareness. The highest adoption level for irrigation highlighted farmers' recognition of its importance. In contrast, the adoption level for pest and insect control was the lowest possibly due to a lack of training programs in plant protection. In terms of diseases, results reflected low knowledge and adoption rates among farmers. These findings underscore the need for targeted training programs and extension services to improve adoption rates and enhance sugarcane production practices. The findings were found similar to some extent with Godara *et al.* (2020) such as highest adoption level was found for irrigation, and least in the case of plant protection, diseases and fertizer application, Amit *et. al.* (2023), Badhala *et. al.* (2023) and Singh *et. al.* (2018), Hadiya *et. al.* (2014).

Technological gap in adoption of sugarcane cultivation practices

The highest technological gap was observed in the area of insects-pests and their control (Table 3) indicating a significant disparity between the current practices employed by sugarcane growers and the recommended strategies for pest management. Similarly, a substantial technological gap was identified for diseases and their control similar to Dodiya *et al.* (2023), highlighting the need for improved disease management practices among sugarcane growers. Furthermore, the technological gap for manure and fertilizers, as well as the time and method of fertilizer application, underscores the importance of optimizing nutrient management practices in sugarcane cultivation.

Intercultural operations, including weeding and soil cultivation, also exhibited a considerable technological gap, indicating potential inefficiencies in current agricultural practices. While recommended cultivars of sugarcane showed a moderate technological gap, aspects such as planting distance, time of planting, and seed rate exhibited relatively lower gaps. This suggests a relatively higher level of adherence to recommended practices in these areas, albeit with room for improvement. Notably, irrigation emerged as the aspect with the lowest technological gap, indicating a relatively higher level of adoption of efficient irrigation practices among sugarcane growers. This finding is encouraging, as efficient

irrigation management is crucial for maximizing sugarcane yields and optimizing water use efficiency.

The findings are found to be similar with Patel & Padheria (2010), Chaudhary *et. al.* (2016), and Dutta *et. al.* (2024). The overall technological gap calculated from the mean of above data was found to be 30.19 per cent. It means that on average, the farmers are not fully adopting recommended package of practices to the extent that they should be. In other words, there is a gap between the current level of adoption and the optimal level of adoption for these practices. This gap is due to various factors such as lack of knowledge (Ali & Singh (2021), lack of access to resources, or cultural and social barriers. It suggests that there is room for improvement in the adoption of these practices, which could lead to increased sugarcane productivity and improved livelihoods for farmers.

Table 3: Technological gap in adoption of sugarcane production technology (n=120)

Sr. No.	Practices	Adoption Percentage	Technological gap percentage	Rank order
1	Recommended cultivars	70.00	30.00	VI
2	Seed rate	77.50	22.50	IX
3	Time of planting	73.61	26.39	VIII
4	Planting distance	73.05	26.95	VII
5	Manure and fertilizers and their quantity	65.00	35.00	III
6	Time and method of application of fertilizer	66.11	33.89	IV
7	Intercultural operations	69.44	30.56	V
8	Irrigation	78.05	21.95	X
9	Insects-pests and their control	61.94	38.06	**I**
10	Diseases and their control	63.33	36.67	II

Correlation between farmers' adoption level and various independent variables

Computation of correlation coefficients revealed that adoption 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 as shown in Table 4; 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 adoption; Kadam (2008) observed caste having non-significant relationship, while risk orientation having positive and significant relationship; Mohit (2022) concluded education, social participation and mass media exposure positively significant with adoption, while occupation was found non-significant; Garg (2008) found similar results with material possession having positive and significant association with adoption; and Vinayak (2014) proved economic motivation, innovativeness and extension participation having a positively significant relationship with adoption of sugarcane cultivation practices in Bhandara district, Nagpur.

Table 4: Correlation between farmers' adoption level and various independent variables (n=120)

Sr. No.	Independent variables	Correlation coefficient
X_1	Age	0.082^{NS}
X_2	Caste	0.011^{NS}
X_3	Education	0.133^{*}
X_4	Occupation	0.034^{NS}
X_5	Annual family income	0.443^{**}
X_6	Social participation	0.168^{*}
X_7	Land holding	0.335^{**}
X_8	Material possession	0.195^{*}
X_9	Family type	0.036^{NS}
X_{10}	Family size	0.096^{NS}
X_{11}	Cropping pattern	0.215^{*}
X_{12}	Extension contact	0.407^{**}
X_{13}	Mass media exposure	0.331^{**}
X_{14}	Risk orientation	0.431^{**}
X_{15}	Economic motivation	0.338^{**}
X_{16}	Innovativeness	0.289^{**}
X_{17}	Extension participation	0.396^{**}

**** - Significant at the 0.01 level**

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

CONCLUSION

The study concludes a moderate level of adoption of sugarcane production technology among farmers, with significant disparities observed across various practices. While some areas like irrigation show relatively high adoption rates, others such as pest control and fertilizer application require substantial improvement. The overall technological gap indicates room for enhancing adoption levels, potentially leading to increased productivity and improved livelihoods. Factors like income, social participation, and access to resources significantly influence adoption, underscoring the need for targeted interventions and extension services to promote sustainable sugarcane farming practices.

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CONFLICT OF INTEREST:

This is to declare that there is "no conflict of interests" among the authors.

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