Emperor International Journal of Management

ISSN: 2583-1267 **Mayas Publication®** **www.mayas.info**

Volume-VI **Issue-III** **March 2026**

Productivity Efficiency of Sugarcane Cultivation in Tiruchirapalli District

A. Rajan

Ph.D., Research Scholar,
P.G and Research Department of Commerce,
Sri Sankara Arts and Science College,
Enathur, Kanchipuram -631561.

Dr.R.Mayakkannan

Associate Professor and Research Supervisor,
P.G and Research Department of Commerce,
Sri Sankara Arts and Science College,
Enathur, Kanchipuram -631561.

Abstract

In recent years, farmers in India have expanded sugarcane cultivation at a notable compound growth rate, with the country contributing approximately 23.25% of the world's total sugarcane production. Sugarcane output in India increased from 226 million tonnes to 280 million tonnes during the period 1999–2007 to 2007–2024, largely due to improvements in both the cultivated area and crop yield. During the same period, the area under sugarcane cultivation expanded from 3.4 million hectares to 3.9 million hectares. The average yield also showed a slight improvement, rising from 65.6 tonnes per hectare in 1999–2024 to 71.1 tonnes per hectare. In 1998–1999, the global figures for sugarcane cultivation recorded 4.1 million hectares of area, 296 million tonnes of production, and an average yield of 72.6 tonnes per hectare. Several factors influence sugarcane cultivation and its productivity. Tiruchirapalli district, which has traditionally held a significant position in sugarcane production, has the potential to further strengthen its performance. This study therefore examines the impact of various factors affecting sugarcane cultivation, particularly in relation to farmers' characteristics and farming conditions. The main objective of this research is to evaluate the productivity efficiency of sugarcane cultivation in Tiruchirapalli District and to identify the key factors that influence production and yield. The study focuses on sugarcane cultivation in selected blocks of Tiruchirapalli District and is based

primarily on secondary data. Information was collected regarding the area under cultivation, production levels, and yield of sugarcane in the district. Additionally, the study attempts to understand the socio-economic background of sugarcane farmers in the research area. Based on the findings, the study also proposes appropriate remedial measures to address the challenges faced in sugarcane cultivation in the district.

Keywords: Sugarcane, Growth Production, Productivity Efficiency

I. INTRODUCTION

Sugarcane is one of the most important cash crops cultivated in India. The development of sugarcane farming and the growth of the sugar industry have progressed alongside agricultural development and have a long historical connection with rural livelihoods. The role of sugarcane and sugar in the socio-economic history of India is significant and deeply rooted. In the modern rural economy, the expansion of sugarcane cultivation and the sugar industry has contributed greatly to rural development by utilizing local resources, generating employment, improving income levels, and supporting transport and marketing facilities. Approximately 7 million farmers are engaged in sugarcane cultivation in India, along with a large number of agricultural labourers involved in related farming activities. In addition, the sugar industry provides employment to nearly five lakh skilled and semi-skilled workers, most of whom live in rural areas. Botanically, sugarcane is a perennial grass belonging to the genus *Saccharum*. It is mainly grown for its sweet juice, from which sugar is produced. Most modern commercial varieties are hybrids derived from the species *Saccharum officinarum*, which originated from wild cane species. Sugarcane cultivation requires a tropical or subtropical climate and generally needs at least 24 inches of annual rainfall.

Sugarcane is usually propagated through stem cuttings, which has become the most common method of cultivation. Each cutting must contain at least one bud, and these cuttings are typically planted manually. Once established, a sugarcane crop can be harvested several times. After each harvest, new shoots called ratoons grow from the remaining roots. However, yields generally decline with each successive ratoon crop, and eventually the field must be replanted. Depending on agricultural practices, two to ten harvests may be obtained before replanting becomes necessary.

In India, sugarcane is commonly processed into jaggery (gur) and also refined into sugar, which is widely used in beverages such as tea and coffee, confectionery products, and in the production of alcoholic drinks. Sugarcane also has several industrial uses, including the production of sugar, molasses, rum, soft drinks, and ethanol. The residue from sugarcane crushing, known as bagasse, can be burned to generate heat and electricity, often supplying power to the grid. Because of its high cellulose content, bagasse can also be used as a raw material for

producing paper, cardboard, and other products.

Global Scenario

At present, India, Brazil, and the European Union (EU) are among the world's largest producers of sugar. They are followed by countries such as the United States, China, Thailand, Mexico, Australia, Cuba, and South Africa. According to the International Sugar Organization (ISO), a global sugar deficit of around 4–5 million tonnes was expected in 2024–25. If Brazil were to increase its sugar output by about 3% beyond the estimated level, the deficit could decline to approximately 2.0–2.5 million tonnes. Earlier estimates by the ISO indicated a very small global sugar surplus of 0.222 million tonnes, compared with 6.857 million tonnes recorded in 2002–03. During 2023–24 (October–March), Pakistan was expected to produce around 3.8 million tonnes of sugar, compared with 3.6 million tonnes in 2002–03. However, domestic demand in the country is estimated at only about 3.3 million tonnes. In 2002–03, the Trading Corporation of Pakistan (TCP) purchased approximately 200,000 tonnes of sugar, and plans were made to export 25,000–50,000 tonnes during 2023–24. In 2004, the World Trade Organization (WTO) ruled against the European Union's sugar export subsidies. As a result, the EU was expected to reduce its sugar exports by at least 2 million tonnes per year, which could potentially raise global sugar prices by around 10%. Thailand, the largest sugar exporter in Asia, ships nearly 7 million tonnes of sugar annually, including both raw and refined sugar. In November 2004, the United States Department of Agriculture (USDA) projected global sugar production at 141.7 million tonnes for 2024–25, while worldwide consumption was estimated at 140.5 million tonnes. Global sugar exports were projected at 31.7 million tonnes, with end-of-year stocks also estimated at 31.7 million tonnes. The increase in production during 2024–25 was mainly attributed to higher output in Brazil, Australia, and China, where production was expected to rise by approximately 2 million tonnes, 0.5 million tonnes, and 0.4 million tonnes, respectively.

Since 2002–03, Brazil's sugar output increased by about 4.6 million tonnes, reaching 28.4 million tonnes, which accounts for nearly 20% of global sugar production. Meanwhile, sugarcane production in Pakistan was expected to decline from 47 million tonnes in 2024–25 to 46 million tonnes in 2025–06. The United States was also expected to import around 800,000 tonnes of sugar in 2025–06. In 2024–25, sugarcane output had already decreased by approximately 21%. The United States consumes around 3.8 million tonnes of sugar annually, but domestic production in 2025–06 was expected to reach only 3.0 million tonnes. In February 2025, Pakistan removed its import tax on sugar, while the United States imported approximately 973,000 tonnes of raw and refined sugar during the same year. According to the International Sugar Organization, global sugar production was projected to increase to 149.7 million tonnes in 2025–06, while global consumption

was expected to reach 150.7 million tonnes. In comparison, global sugar production during 2024–25 was about 144.4 million tonnes. Furthermore, Brazil's sugarcane production was projected to decline slightly to 394.4 million tonnes in 2025–06 (May–April) from 397.1 million tonnes in 2024–25.

Sugarcane Production in World

Tamil Nadu holds a significant position in sugarcane cultivation in India. The state accounts for about 0.35 million hectares of sugarcane-growing area, representing roughly 8.5% of the country's total sugarcane area. It produces approximately 46.67 million tonnes of sugarcane, contributing about 15.8% of India's total production. Tamil Nadu is particularly notable for its high productivity, recording around 134.2 tonnes per hectare, which places it at the top among Indian states, while most other states do not exceed 100 tonnes per hectare. However, the average sugar recovery rate in Tamil Nadu is relatively low at 8.83%, which is slightly below the national average. Despite this, the state produces about 1.73 million tonnes of crystal sugar, ranking third in the country. In addition, Tamil Nadu produces nearly 1.20 million tonnes of gur (jaggery). Around 44.6% of the sugarcane produced in the country is processed through organized sugar industries. The sugar industry is one of the most important agro-based industries in India, second only to the textile industry. Across the country, there are around 435 sugar mills, which utilize 40–50% of the total sugarcane produced and generate approximately 15 million tonnes of sugar annually. The industry directly employs nearly five lakh workers, while many others gain employment in related sectors that use by-products of the sugar industry as raw materials. Economically, the sugar industry contributes significantly to government revenue. It provides more than ₹1000 crores annually to the central government through excise duties and taxes. In addition, state governments receive a similar amount through purchase taxes and other levies. At prevailing sugarcane prices, the total value of sugarcane produced in India is estimated to be around ₹15,000 crores.

Statement of the Problem

The study focuses on the **growth, production, and productivity efficiency of sugarcane cultivation in Tiruchirapalli District**. Although sugarcane plays an important role in the agricultural economy of the region, limited research has been conducted to identify the key underlying factors that influence productivity efficiency. In particular, little attention has been given to understanding how workforce management, resource allocation, and socio-economic conditions of farmers affect the growth and productivity of sugarcane cultivation.At present, sugarcane cultivation depends on several factors related to farm resources, management practices, and the adoption of modern agricultural techniques. Tiruchirapalli District has the potential to further strengthen its

position in sugarcane production. Therefore, it is important to evaluate the impact of various parameters associated with farmers and their farming practices. This includes examining the socio-economic background of sugarcane farmers and their views on the benefits of adopting improved technologies, better processing methods, inventory and warehouse management, and other production-related practices.

The study also considers several aspects of sugarcane cultivation such as **asset ownership, crop details, cost of cultivation for both planted and ratoon crops, input costs, labour availability, and challenges in processing and marketing sugarcane**. In addition, factors such as transportation facilities provided by sugar factories and the relationship between farmers and sugar industries are examined. These elements play a crucial role in determining the efficiency and productivity of sugarcane cultivation. In the modern agricultural environment, sugarcane cultivation is closely linked with the functioning of the sugar industry. Therefore, it is necessary to analyze the efficiency of production processes, the techniques and tools used in cultivation, and the production practices followed by farmers. The background of this study is thus motivated by the need to evaluate the **production and productivity efficiency of sugarcane cultivation in Tiruchirapalli District** and to identify the major factors influencing farmers' performance and workforce management. Overall, the study aims to provide a comprehensive analysis of sugarcane cultivation in Tiruchirapalli District, with the objective of identifying the factors affecting productivity and suggesting measures to improve the efficiency and sustainability of sugarcane farming in the region.

Importance of the Study

Sugarcane cultivation has undergone significant transformation over the years, particularly with the introduction of modern technologies and improved farming practices since the late 1960s. This transition from traditional cultivation methods to more advanced approaches has created new opportunities for improving growth, production, and overall efficiency in the sugarcane sector. These developments have also influenced the performance of the sugar industry by enhancing productivity and contributing to better value creation for both producers and consumers. Such changes have paved the way for increased production and improved efficiency in sugarcane cultivation, especially in regions like **Tiruchirapalli District**. Studying these developments helps to understand how modern technologies and management practices influence the growth and productivity of sugarcane farming. At the same time, this type of research provides valuable insights for policymakers, enabling them to design effective policies that benefit both farmers and consumers. The study highlights the importance of examining productivity efficiency in sugarcane cultivation in order to evaluate how

effectively resources are utilized in the production process. This includes analyzing the **area under sugarcane cultivation, the cost of production, and the returns obtained by farmers at the farm level**. Understanding these aspects is essential for improving the efficiency and sustainability of sugarcane farming. The primary objective of this research is to identify the different factors affecting productivity efficiency in sugarcane cultivation and to evaluate the performance of the sector within the study area. Since the growth and production of sugarcane play a crucial role in the agricultural economy, this topic has been selected to provide a comprehensive analysis of the **growth, production, and productivity efficiency of sugarcane cultivation in Tiruchirapalli District**.

Objectives of the Study

1. To Determinants of yield, yield gap and yield constraints in Tiruchirapalli District
2. To examine the prices and benefits of sugarcane cultivation in the look at the location
3. To confirm problems, prospects, and method of sugarcane cultivation

Hypothesis of the Study

H0= There isn't any prices and benefits of sugarcane cultivation
Hi = There is any prices and benefits of sugarcane cultivation

The Methodology of the Study

This study focuses on the growth, production, and productivity efficiency of sugarcane cultivation, as well as the tools and techniques used in the decision-making process. The research is both analytical and descriptive in nature and is based on the use of primary and secondary data. The research methodology forms the foundation of the study, as it determines the approach used to achieve the research objectives. It guides the researcher in conducting the study in a systematic and organized manner, thereby ensuring the reliability and validity of the results. The methodology includes details regarding the data collected for the study, sources of information, sampling design, population of the study, and the geographical area of the research. It also describes the tools and instruments used for data collection, the methods adopted for gathering information, and the procedures used for analysis and interpretation.

To examine the collected data effectively, various statistical techniques are employed in order to evaluate the strength and significance of the findings. In addition, the study also outlines the limitations encountered during the research, particularly those related to the collection of primary data.

Sources of Data

To achieve the objectives of the study, the researcher used both primary and secondary sources of data. The primary data were collected directly from farmers in Tiruchirapalli District through field surveys and interactions. In addition to the primary information, secondary data were also gathered to support the analysis. These data included information related to the socio-economic background of farmers, cost and benefit aspects of sugarcane cultivation, cultivation practices, and the major problems faced by farmers. The secondary information was obtained from various sources such as institutional reports, annual reports, bulletins, and other published documents. These sources helped provide additional insights and strengthened the overall analysis of the study.

Sampling Plan

The population in the selected study area is very large, making it impractical to interview all respondents due to time and logistical constraints. Therefore, only a selected group of farmers was chosen for the study. Since many farmers in the area are engaged in sugarcane cultivation, data were collected from those respondents who were willing to provide the required information. To ensure proper representation, a two-stage stratified random sampling technique was adopted for the study. This method helped in selecting respondents from different demographic groups within the study area. By using this sampling approach, the researcher was able to obtain a representative sample of sugarcane farmers for the analysis.

Location of the Study

Tiruchirapalli District in Tamil Nadu was selected as the study area because agriculture serves as a major source of livelihood for a large section of the population in the region. The district also provides a suitable setting for examining issues related to sugarcane cultivation and productivity. The findings of this study are expected to serve as a useful model that could be applied or replicated in other regions of the country facing similar agricultural conditions. Therefore, Tiruchirapalli District constitutes the universe of the study.

Statistical Tools for Analysis

This study is mainly based on **primary data**, which were collected from selected blocks in relation to the **growth, production, and productivity efficiency of sugarcane cultivation** using a structured questionnaire. In addition to primary data, **secondary data** were also used for the study. These were obtained from published sources such as **books, journals, magazines, and annual reports**.

The data collected from both primary and secondary sources were carefully **examined, edited, and organized in tabular form** for further analysis. The collected information was then analyzed using the **Statistical Package for Social Sciences (IBM SPSS–21)** to obtain meaningful interpretations and results.

Determinants of yield, yield gap and yield constraints in Tiruchirapalli district

To identify the input factors, which cause variation in the yield of sugarcane with respect to Traditional variety and High Yielding variety and also in the small and large farms producing these two varieties.

Multiple Linear Regression Model

In order to identify the determinants of yield of small and large farms, the following form of log-linear multiple regression model was used.

$\log Y = \alpha_o + \beta_1 \log x_1 + \beta_2 \log x_2 + \beta_3 \log x_3 + \beta_4 \log x_4 + \beta_5 \log x_5 + U$ . . . . . .

Chow's Test

In order to test the structural difference between small and large farms for Traditional and High Yielding variety, Chow's test was performed.

Size - Wise Analysis of Traditional Variety

The results of the linear regression equation fitted to identify the determinants of yield using the five independent variables for the small and large farms cultivating Traditional variety are presented in Table below.

Table 1
Estimated Regression Results for Small and Large Farms Cultivating Traditional Variety

Variable	Small Farms	Large Farms	Total Farms
Intercept	1.0916	1.0811	1.0821
Log X1	0.3216*	0.2811*	0.3166*
	(2.7216)	(2.7911)	(2.7516)
Log X2	0.2765*	0.2511*	0.2511*
	(2.2461)	(3.2511)	(3.2461)
Log X3	0.0314	0.1132	0.0891
	(0.0071)	(0.0862)	(1.1361)
Log X4	0.1964*	0.1761*	0.1732*
	(2.1751)	(3.0141)	(2.8361)
Log X5	0.1765*	0.2261*	0.1961*
	(2.1932)	(3.2261)	(2.1931)
R2	0.8162	0.7816	0.8261

F-value	27.9162	36.2611	32.1541
Residual sum of squares	0.0168	0.0039	0.0306
No. of observations	98	52	150

Figures in brackets represent t–value

* Indicates the co-efficient are statistically significant at 5 per cent level.

Table 1 shows that the R^2 value indicates the five independent variables included in the model collectively explain 82.61% of the variation in yield of total farms cultivating the traditional sugarcane variety. Among these variables, human labour, fertilizers, irrigation, and capital flow were found to be statistically significant at the 5% level. This result suggests that a 1% increase in these inputs would lead to an increase in yield by approximately 0.3166%, 0.2511%, 0.1732%, and 0.1961%, respectively. The F-statistic further indicates that the fitted regression model is statistically significant at the 1% level, confirming the overall validity of the model. Among the different input factors considered in the analysis, human labour was found to have the greatest influence on yield determination.

Table -2

Tests For Stability of Intercept and Slope Between Small and Large Farms Cultivating Traditional Variety (Tv) Of Sugarcane

variable	parameter estimate	t – value
Intercept	1.2711	1.2211
Intercept dummy	0.1811	0.1919
Log X_1	0.2415*	3.2691
Log X_2	0.1821*	2.9696
Log X_3	0.0981	1.4564
Log X_4	0.2261*	2.9936
Log X_5	0.1361*	3.8162
D log X_1	-0.0499*	-3.0816
D log X_2	0.0113	1.0862
D log X_3	0.1361	0.9462
D log X_4	0.0891	1.0924
D log X_5	0.1189	1.1364
R^2	0.8361	1.0999
F – Value	29.1541	1.0696
No. of observation	150	

* Indicates the co-efficient are statistically significant at 5 per cent level.

The results presented in Table 2 indicate that the intercept dummy coefficient is not statistically significant at the 5% level. This suggests that the technical change is neutral for both small and large farms. However, the

coefficients for human labour, fertilizers, irrigation, and capital flow were found to be statistically significant at the 5% level. The analysis shows that a 1% increase in these variables would raise the yield by approximately 0.2415%, 0.1821%, 0.2261%, and 0.1361%, respectively. The structural differences between small and large farms at the slope level are mainly attributed to the human labour variable. Specifically, an increase in human labour could increase yield by 0.2415% in small farms and 0.1880% in large farms. The F-test results confirm that the overall regression model is statistically significant at the 1% level. The findings also indicate that human labour has a stronger influence on per-acre yield in small farms compared to large farms.

Size-Wise Analysis of High Yielding Variety

The results of the estimated regression (5.1) relating to the determination of yield for small and large farms producing variety High Yielding variety are presented in Table 3.

Table 3
estimated regression results for small and large farms cultivating high yielding variety of sugarcane

Variable	Small Farms	Large Farms	Total Farms
Intercept	1.0414	1.0611	1.0399
Log X_1	0.3815*	0.3561*	0.3781*
	(2.7461)	(2.7991)	(2.7761)
Log X_2	0.2496*	0.1421	0.1899*
	(3.2215)	(0.2216)	(3.2261)
Log X_3	0.0172	0.1172	0.0891
	(0.0861)	(0.1791)	(0.0051)
Log X_4	0.1142*	0.0914*	0.1199*
	(2.9815)	(1.9762)	(2.9141)
Log X_5	0.1971*	0.2719*	0.2699*
	(2.1862)	(2.1962)	(2.1781)
$_R2$	0.8214	0.8162	0.8162
F-value	33.1541	29.1541	27.9111
Residual sum of Squares	0.0199	0.0062	0.0381
No. of observations	92	58	150

Figures in brackets represent t –values

* Indicates the co-efficient are statistically significant at 5 per cent level.

Table 3 shows that the R^2 value indicates the variables included in the model collectively explain 82.14% of the variation in yield per acre of small farms cultivating the High Yielding Variety (HYV) of sugarcane. The regression coefficients of all variables, except pesticides, were found to be statistically

significant at the 5% level. The results suggest that a 1% increase in the inputs—human labour, fertilizers, irrigation, and capital flow would lead to an increase in yield by approximately 0.3815%, 0.2496%, 0.1142%, 0.1971%, and 0.1969%, respectively. Among these significant variables, human labour was found to have the strongest influence on yield determination. Furthermore, the F-statistic indicates that the regression model is statistically significant at the 1% level, confirming the overall reliability of the model.

Table -4
Yield constraints of small farms cultivating traditional variety

Yield Constraint	Mean Score	Rank	No. of Farms
Water shortage	31.15	V	33
Variety	37.64	III	49
Disease	49.65	II	52
Credit inadequacy	55.21	I	58
Traditional methods	33.15	VI	43

Table 4 reveals that out of the 94 small farms cultivating the traditional variety of sugarcane, 58 farmers identified credit inadequacy as the primary constraint affecting potential yield at the farm level. The second major constraint reported was disease, which was mentioned by 52 farmers.

Another important factor influencing yield differences among farms was the variety of sugarcane, which was identified as the third major constraint by 48 farmers. The fourth constraint, reported by 43 respondents, was the continued use of traditional cultivation methods. In addition, water shortage was also recognized as a significant issue, with 33 farmers highlighting it as a constraint affecting sugarcane productivity.

Table -5
Yield Constraints of Large Farms Cultivating Traditional Variety

Yield Constraint	Mean Score	Rank	No. Of Farms
Water shortage	39.15	V	25
Variety	48.64	III	29
Disease	57.15	II	30
Credit inadequacy	45.22	IV	27
Traditional methods	50.15	I	31

Among the 54 large sample farms cultivating the traditional variety of sugarcane, 31 farmers reported the continued use of traditional cultivation methods as a major constraint. The ranks assigned to the five identified factors were also analysed separately for small farms cultivating the High Yielding Variety

(HYV) of sugarcane. The analysis indicates that there is no significant association between the yield gap and the constraint of disease among large farms producing the High Yielding Variety in the study area. Furthermore, the cross-tabulation of the yield gap and the constraint of credit inadequacy for large farms cultivating the High Yielding Variety of sugarcane is presented in Table 6. This analysis helps in understanding how financial limitations may influence the differences in yield among these farms.

Table 6
Contingency Table Between Yield Gap and Credit Inadequacy with Chi-Square Value, of Large Farms Cultivating High Yielding Variety

Yield Gap (in tons)	Credit Inadequate	Credit Adequate	Total
Below 1.5	7	14	21
1.5 – 2.5	11	8	19
2.5 – 3.5	13	5	18
Total	31	27	58

Calculated Value of Chi-Square = 5.2906

The results clearly show that the calculated value is lower than the table value, indicating that there is no significant association between the yield gap and the yield constraint "credit inadequacy" among large farms cultivating the High Yielding Variety (HYV) of sugarcane. The table further presents the cross-tabulation between the yield gap and the constraint of "traditional methods" among large farms producing the High Yielding Variety of sugarcane. This analysis helps in examining whether the use of traditional cultivation practices has any relationship with the observed yield differences among these farms.

Table 7
Contingency Table Between Yield Gap and Traditional Methods with Chi-Square Value, of Large Farms Cultivating High Yielding Variety

Yield Gap	Traditional Methods	Modern Methods	Total
Below 1.5	14	9	23
1.5 – 2.5	12	9	21
2.5 – 3.5	8	6	14
Total	34	24	58

*Calculated Value of Chi-Square = 0.1769

*Table Chi-Square value with 2 degrees of freedom at 5 per cent level = 5.991

It means that there is no association between yield gap and the yield constraint, "traditional methods" of production, as far as large farms producing High Yielding variety of sugarcane in the study area are concerned.

Table 8
direct and indirect estimates of production elasticities of tv and sugarcane varieties

	Direct	Indirect	Direct	Indirect
Human Labour	0.1849*	0.1965	0.1763*	0.2162
	(4.0915)		(3.1561)	
Fertilizers	0.1349*	0.1761	0.1811*	0.1621
	(3.9916)		(2.1121)	
Pesticides	0.0493*	0.0511	0.0416	0.0311
	(3.6415)		(0.0513)	
Bullock Pair	0.0085	0.0188	0.0045	0.0462
	(0.0018)		(0.0029)	
Land	0.4315*	0.4215	0.4011*	0.4274
	(2.6516)		(3.1121)	
Capital	0.3261*	0.1731	0.2510*	0.1543
	(3.7516)		(2.9915)	
Sum of Elasticities	1.0993	0.9961	1.0162	1.0034
R2	0.7969		0.8261	

Note: Figures in brackets represent t-values. * Major at 5% level

Indirect estimates are considered more reliable than direct estimates because direct estimates may suffer from simultaneous equation bias. Therefore, the indirect estimation of production function elasticities appears to be more logical and consistent with the prior expectations of economic theory. One notable finding is the dominance of land as a factor of production, with an elasticity value of 0.42 for the Traditional Variety (TV) and 0.43 for the High Yielding Variety (HYV). In both varieties, human labour emerged as the second most important factor, with elasticity values of 0.19 for TV and 0.21 for HYV. These results emphasize the importance of land and labour in sugarcane production, where land contributes more than 40%, while labour accounts for approximately 18–20% of the total output for both varieties. Overall, the indirect estimates clearly indicate that land and labour are the dominant factors influencing sugarcane production for both TV and HYV varieties. Furthermore, the sum of the elasticities suggests that farms cultivating both TV and HYV varieties operate under constant returns to scale in the study area.

Suggestion

In summary, the analysis shows that for both small and large farms cultivating the High Yielding Variety (HYV) of sugarcane, several constraints—such as water shortage, variety differences, disease, and credit inadequacy—recorded significant Chi-square values with 2 degrees of freedom at the 5% level.

The significant calculated Chi-square values indicate that farms facing these constraints experienced larger yield gaps compared to farms that did not encounter these limitations. On the other hand, similar to the case of the Traditional Variety (TV), the factor "traditional methods" showed an insignificant Chi-square value for both small and large farms cultivating the High Yielding Variety of sugarcane. Overall, the analysis reveals that disease and variety were the most significant constraints affecting the yield of High Yielding Variety sugarcane among both small and large farms in the study area. These factors played a major role in contributing to the observed yield gaps.

II.CONCLUSION

The analysis indicates that the High Yielding Variety (HYV) of sugarcane and small farms (less than 5 acres) cultivating both Traditional Variety (TV) and HYV achieved better physical and economic performance in terms of yield compared to TV varieties and large farms (5 acres and above) growing both TV and HYV in the study area. Furthermore, factors such as supply responsiveness, labour absorption, and income distribution were found to have a more positive impact in the case of HYV varieties and small farms cultivating both TV and HYV varieties. These findings suggest that smaller farms tend to utilize resources more efficiently and respond better to improved cultivation practices. Overall, the results indicate that HYV varieties and small farms cultivating both TV and HYV sugarcane are more productive and economically beneficial in the study area.

III.REFERENCES

1. Abhi, M.R., Kumar, P. what's more, Mathur, V.C (1983) "Mechanical Change and Factor Shares in Cotton Production: A Case Study of Akola Cotton Farms", Indians Journal of Agricultural Economics, Vol. XXXVIII, No.3, July-September, 1983.
2. Akimi Fujimoto (1983) "Homestead Management Analysis of Malay and Chinese Rice Farming in Province of Wellesley, Malaysia", Journal of Developing Economics, Vol.XXI, No.1, March.
3. Ansari, A.A. what's more, Ismail, S.A(2008) "Paddy Cultivation In Sodic Soil Through Vermitech", International Journal of Sustainable Crop Production, Vol.3(5).
4. Arnold Zellner, (1962) "An Efficient Method of Estimating Seemingly Unrelated Regression and Test of Aggregation Bank, Journal of American Statistical Association, Vol.57, No.2.
5. Baigorria, G.A., Jones, J.W. what's more, O'Brien J.J. (2008). The potential consistency of product yield utilizing a gathering atmosphere gauge by a territorial flow demonstrates, Agricultural and Forest Meteorology, 148:

1353-1361.

6. Bajpai, P.K. furthermore, Venugopalan, R. (1996). Determining Sugarcane Production by Time Series Modeling. Ind. Jour. Sugarcane Tec., 11(1): 61-65.
7. Balakrishnan, M., Meena, K. Furthermore, Shanmugasundram, S. (2025). Fake Neural Networks (ANN) for an expectation of coconut yield. Measurements and Applications. 3(1 &2): 87-92.