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An analysis of mechanised Farm cotton cultivation in Thoothukudi District of Tamilnadu

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Abstract

The role of mechanisation is crucial in the context of the growing commercialisation of agriculture. Increased output owing to more precise input application and more timely operations has led to a rise in the use of farm machinery in India's agricultural sector. There are more issues associated with growing cotton than with other agricultural commodities. In general, rainfall, high-yielding seed varieties, climatic conditions, and soil fertility are the most important factors in cotton cultivation. When it comes to growing cotton, the farmers are having a tough time. Mechanisation plays a crucial role in the increasingly commercialised agricultural sector. On its own, mechanisation would allow for a multiple cropping programme, which would eventually lead to more job opportunities in the servicing, repair, and maintenance of tractors and other farm machinery. The use of farm machinery has grown in India's agricultural sector. This is because these machines help farmers be more efficient and precise with their inputs, which in turn increases their output. Due to inefficient crop production technologies, late field operations, insufficient inputs, and a lack of irrigation (70 percent of the area is under rainfed conditions), cotton yields are low. Conventional cotton farming tools are still in use, and they're inefficient and wasteful. Whenever workers are scarce, it's usually because of labour-intensive tasks like planting, weeding, and picking. Yield is lost when operations are not finished in a timely manner. Tractors' intercultural machinery is underutilised. It is necessary to evaluate the potential of mechanical picking. Equally important in rural areas is the promotion of the custom hiring system for farm implements. To determine the kind of income inequality between large and small farmers in Thoothukudi District who use mechanised and non-mechanised cotton farms and to describe the machinery that is available for mechanising cotton cultivation in Thoothukudi District, this study uses a quantitative approach.

Key words : Mechanisation, cotton cultivation, agricultural operations, commercial crops, value addition.

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A great increase in agricultural output has been achieved with the aid of farm mechanisation. As a result, agricultural mechanisation is crucial. There may be a plethora of reasons to strengthen farm mechanisation in the nation. Thanks to automation, the timeliness of operations is now more important than ever before when it comes to getting the best yields from various crops.

One of India's most important cash crops is cotton. While India ranks third in global cotton production with 11.64 million bales, it tops the list for the area under cultivation with 8.76 million hectares (170 kg each). The majority of cotton cultivation operations are still done in the traditional way, which requires much labour. Thus, the average yield is very low, at about 226 kg/ha, compared to the global average of 584 kg/ha.

In 2010 and 2011, India ranked second globally in cotton production, consumption, and exports, a testimony to the country's remarkable cotton sector progress in recent years[8]. Only 35.8% of India's cotton cropland is irrigated[18]. An important factor influencing production and yield in any given year is the yearly variation in monsoon rainfall since approximately 65% of India's cotton acreage is dependent on it[1].

The goal of mechanisation in the field is to increase productivity while decreasing labour-intensive tasks, unit production costs, and seedbed preparation times[5]. It also improves the accuracy and precision of seed, fertiliser, pesticide, irrigation, and harvesting metering. Produce and byproduct conservation, agro-processing and value addition, and the creation of new jobs and income are all aided by this[6].

The cotton sector follows a similar pattern to other agricultural sectors in terms of the prevalence of mechanisation; this ranges from 42% for soil working and seedbed preparation to 37% for irrigation, 34% for plant protection, and 29% for planting and seeding. However, when it comes to the harvesting process, nearly all of India's cotton is hand-picked by human workers. This labour-intensive process costs approximately 0.9 man-hours per kilogramme of cotton, consumes nearly 10 times as much water as irrigation, and doubles the amount spent on weeding[13]. Here is the percentage breakdown of cotton's level of mechanisation. When compared to other major cotton producers, India is far behind when it comes to the use of harvesting machinery.

While every cotton crop in the US is harvested by machines, by 2020, it is predicted that roughly 60% of China's cotton will be harvested mechanically in certain regions. India is anticipated to encounter labour shortages soon and increasing farm wages, which will force it to automate its cotton harvesting processes[3].

The availability of labour has decreased from 70.3% of the population in 1961 to 48.9% in 2010, and the cost of picking cotton from the farm has risen from Rs 4 per kilogramme in 2007 to Rs 10–12 per kilogram[7] in 2010. If the cotton plant is too tall and has too many branches, picking all the bolls will be a challenge. To further lessen the quantity of dirt and soil picked up, make sure the bolls are off the ground[13].

Mechanical cotton harvesting is not likely to become commonplace in India for at least another decade, according to some experts[2]. Public and private extension agencies in India should work together to educate and train farmers so that their agronomic practices can change[16].

An important factor in increasing yields is the use of balanced fertilisers, improved cultivation techniques, and plant protection measures[4]. However, it is just as critical to implement advanced processes and better tools. On its own, mechanisation would allow for a multiple cropping programme, which would eventually lead to more job opportunities in the servicing, repair, and maintenance of tractors and other farm machinery[9].

In India, only around 5% of agricultural families own a tractor. Currently, tractors are employed for 21% of sowing operations and 23% of tillage activities on total area[10]. 2012 saw sales of about 500,000 tractors, representing a 5% rise in the cumulative annual growth rate of domestic tractor volumes over the previous ten years[12].

Verma *et al*.,[17] studied that economic analysis of hybrid cotton production and commercialization in Khargone district revealed that whereas the average cost of cultivation (cost C3) was Rs. 21312.34 per hectare and Rs. 30163.20 per farm, respectively. Hybrid cotton produced net profits that added up to an average of Rs. 21889.66 per hectare and Rs. 30864.42 per farm.

The costs and benefits of rotating wheat and cotton in Haryana were examined by Kumar[11]. The returns from rotating cotton and wheat were Rs. 9665, according to the data; in contrast, the returns from rotating sugarcane and arhar-wheat were Rs. 8152 and Rs. 7539 per hectare, respectively.

Inadequate inputs, a lack of knowledge about modern cultivation techniques among Indian farmers, an absence of irrigation facilities, an inability to properly time field operations, and an overreliance on labour are some of the reasons why cotton yields in India are low[19]. This research looks at the income gap between big and small cotton farmers in Thoothukudi District, specifically at the ways in which mechanised and non-mechanised farms differ.

Objectives of the study :

The goals of the research are as follows:

1. To learn about the economic and social structure of farmers who grow cotton using machinery and those who don't.
2. To better understand the causes of the income gap between large-scale farmers who use machinery and those who do not.
3. To comprehend the ratio of large-scale cotton farmers to small-scale farmers who use mechanised farming techniques.

Thoothukudi district in Tamil Nadu was the focus of the research. Data for this study came from a combination of primary and secondary sources. The study's universe is the Thoothukudi district. Two hundred farmers were chosen for the study; 125 were small-scale farmers, and 75 were large-scale farmers. This is based on the primary data obtained from these respondents. The one-on-one interview approach used a tried-and-true

timetable. Information gathered primarily for the fiscal year 2022–2023. Research papers, books, journals, libraries, magazines, newspapers, the internet, and reports from the government's Office of Labor and Employment in the Thoothukudi district are all sources of secondary data. The data that has been collected from various sources will be analysed using statistical tools like variances of logarithms, Gini-coefficients, disparity ratios, percentages, and standard deviations.

Characteristics of sample farmers :

Table-1. Age-wise distribution of sample farmers

Sl. No.	Age (in years)	Mechanised Farm		Non-Mechanised Farm	
		No. of Farmers	Percen-tage	No. of Farmers	Percentage
1.	Less than 30	14	11.20	9	12.00
2.	30 – 40	51	40.80	21	28.00
3.	40 – 50	55	44.00	27	36.00
4.	Above 50	5	4.00	18	24.00
	Total	125	100.00	75	100.00

Source: Survey Data.

According to Table-1, 44.00 percent of farmers in the Mechanized Farm were between the ages of 40 and 50, and 40.80 percent were between the ages of 30 and 40. Merely 12,000 farmers under 30 years old make up the total. Just 4.0 percent of those over 50 formed. The proportion of farmers under 30 years old on the non-mechanised farm was a mere 12.000 out of the total. The over-50 crowd made up only 24.0 percent. The respondents who fell into the 30–40 and 40–50-year age groups made up 28.00 and 36.00 percent of the total.

Table-2. Size of the Operational holdings of the sample farmers

Sl. No.	Size of Holdings (in acres)	Mechanised Farm		Non-Mechanised Farm	
		No. of Farmers	Percen-tage	No. of Farmers	Percentage
1.	Less than 1	7	5.60	31	41.33
2.	1 – 2	11	8.80	21	28.00
3.	2 – 3	21	16.80	11	14.67
4.	3 – 4	34	27.20	8	10.67
5.	Above 4	48	38.40	4	5.33
	Total	125	100.00	75	100.00

Source: Survey Data.

According to Table-2, in the case of the Mechanized Farm, 5.60 percent of the operational holding was less than one acre, 8.80 percent was between one and two acres, 16.80 percent was between three and four acres, 27.20 percent was between three and four acres, and the remaining 38.40 percent was above four acres. Regarding the Non-Mechanised Farm, 41.33 percent of the operational holding was less than one acre, 28.00 percent was between one and two acres, 14.67 percent was between three and four acres, 10.67 percent was between three and four acres, and the remaining 5.33 percent was over four acres.

Nature of distribution of per acre value of Net income for Small and Large farmers of Mechanised Farm :

Per acre net income of the farmers has been taken for the current study to evaluate the type of inequality in the income distribution between small and large farmers of mechanised agriculture. A few key details about the distribution of net income per acre for both large and small mechanised farmers in the study area are provided in Table-3.

Table-3. Frequency Distribution of Per Acre Value of Net Income for Small and Large Farmers of Mechanised Farm

Sl. No.	Net Income (in Rs.)	Small Farmers		Large Farmers	
		No. of Farmers	Percen-tage	No. of Farmers	Percentage
1.	5000-6000	24	19.20	5	6.67
2.	6000-7000	32	25.60	7	9.33
3.	7000-8000	33	26.40	20	26.67
4.	8000 – 9000	17	13.60	26	34.67
5.	9000-10000	11	8.80	11	14.66
6.	10000 & above	8	6.40	6	8.00
	Total	125	100.00	75	100.00

Source: Survey Data.

Table-3. demonstrates that, among small farmers in Mechanized Farm, the highest percentage of individuals (26.40 percent) fall into the category of net income between Rs. 7000 and Rs. 8000, while the second-highest percentage (25.60 percent) make between Rs. 6,000 and Rs. 7,000 monthly. Furthermore, 24 (19.20%) earn between Rs. 5,000 and Rs. 6,000 per month, 17 (13.60%) earn between Rs. 8,000 and Rs. 9,000, 11 (6.40%) earn between Rs. 9,000 and Rs. 10,000, and 8 (6.40%) earn more than Rs. 10,000 per month.

Regarding the large farmers in Mechanized Farm, the highest percentage of individuals (34.67 percent) fall into the net income category of Rs. 8000-9000, while the next highest percentage (26.67 percent) earn between Rs. 7,001 and Rs. 8,000 monthly. Furthermore, 7 (9.33 percent) and 11 (14.66 percent) earn between Rs. 6, 001 and Rs. 7, 000 per month and Rs. 9, 001 and Rs. 10, 000 per month, respectively. Furthermore, 5 (6.67 percent) and 6 (8.00 percent) of the respondents earn between Rs. 5,001 and Rs. 6 000 per month and Rs. 10,001 or more, respectively.

Table-4. Compound Values of Averages, Standard Deviation, Coefficient of Variation and Coefficient of Skewness

Sl.No.	Measures	Small Farmer	Large Farmer
1.	Arithmetic mean in Rs.	6135.89	4832.53
2.	Median in Rs.	5321.64	2408.97
3.	Mode in Rs.	5831.07	2639.04
4.	Standard Deviation in Rs.	547.52	257.37
5.	Coefficient of Variation	8.01	5.81
6.	Coefficient of Skewness	0.41	0.32

According to Table-4, most large and small farmers operating mechanised farms fall into the lower and middle-income brackets. Hence, the provided distribution would have shown more variation towards the higher values of per acre net income in the study area for both small and large farmers.

The calculated mean value of 6135.89 rupees is higher than the median value of 5321.64 rupees, which is higher than the mode value of 5831.07 rupees. The positive skewness of the net income is confirmed by the computed value of the skewness coefficient, which is 0.41. This means that as the values go up, there will be more variation in the distribution of net income per acre. In terms of net income per acre, the computed mean of 4832.53 is higher than the median of 2408.97, and the mode of (Rs. 2639.04). A positive skewness of the distribution for large farmers is further supported by the computed coefficient of skewness of 0.32. It suggests that there would be more variation in the distribution of net income per acre as the values got higher.

In Table 5, you can see the estimated Gini concentration ratio.

Table-5. Gini Coefficient for Small and Large Farmers of Mechanised Farm Cotton Cultivation

Sl. No.	Particulars	Gini Coefficient
1.	Small farmers	0.0527
2.	Large farmers	0.1043

Table-3 demonstrates that the Gini coefficient is 0.0527 for small farmers and 0.1043 for large farmers. Large farmers have a higher coefficient value, which means that their net income distribution is unequal to small farmers who use mechanised farming. Assuming the variables have a mean of H and a variance of σ_1^2 and σ_2^2, we can estimate the variance of the logarithm to test for the Gini coefficient. The use of the F-ratio allowed us to examine the discrepancy between σ_1^2 and σ_2^2. In Table 6, you can see the predicted F-value.

Table-6. Variance of Logarithms for Small and Large Farmers of Mechanised Farm Cultivation of Cotton

Sl.No.	Particulars	Variance of Logarithm
1.	Small farmers	0.0023
2.	Large farmers	0.0113
3.	F^*	2.21
4.	$F_{(7,113)}$	1.31

Table-6 shows that, when it comes to the mechanised farm, the Gini coefficient indices for big and small farmers were tested with logarithmic variance. For large farmers, the computed variance of logarithms is 0.0113, while for small farmers, it is 0.0023. The computed F-value (F*) of 2.21 was greater than the F-table value of 5% significance with 7,113 degrees of freedom. This leads us to believe that the level of inequality in the study area is significantly different for large farmers compared to small ones. Table 7 displays the results of the disparity ratio measurement.

Table-7. Disparity ratio between small and large farmers of Mechanised Farm Cultivation of Cotton

Sl. No.	Particulars	Disparity Ratio
1.	Small farmers	1:1.22
2.	Large farmers	1:1.31

Table-7 shows that there is a disparity between small and large farmers who use mechanised farming to cultivate cotton. The bottom 10% of small farmers had a mean net income per acre value of 1:1.22, while the top 10% of large farmers had a value of 1:1.31. Large farmers are unequal than small farmers, according to the disparity ratio.

This paper examines the effects of mechanical cotton harvesting on the profitability of cotton farmers in the Thoothukudi District and how it affects the supply of cotton in global markets. The increased use of cotton pickers in Thoothukudi District could boost yields and cotton production, which could have a negative impact on global cotton prices. The rising cost of labour is making manual picking an impractical method of cotton harvesting in India.

A number of groups in India have worked together to prove that machine picking can be done. Project farmers have reported increases in yield of 30–40 percent. The creation of machine-appropriate hybrids and the government's ongoing support will propel the rate of mechanisation adoption. Financial institutions also need to do more to help farmers get the loans they need to implement mechanical harvesting, and they should do more to encourage the growth of specialised service providers.

There is a high demand for custom service providers and farm equipment rental agencies in India because, due to the small land holdings of most farmers, cotton pickers are rented rather than owned. Thoothukudi District cotton farmers can successfully adopt mechanical harvesting with the support of public and private agencies.

Conflicts of Interest

The author does not have any conflict of interest.

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