

An Economic Analysis of Agricultural Mechanization in Guntur District of Andhra Pradesh

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Abstract

The debate on the impact of mechanisation on agriculture has continued unabated since four decades. This debate has become further complicated by the biological, mechanical and other technological innovations. Research has been conducted on different aspects of mechanisation throughout the world. Later on a good number of studies have been conducted in various parts of the country on farm mechanizations brief review of select studies is presented in the next few pages. Various aspects of mechanisation were reviewed and grouped as Study of impact of Machanisation on Labor Employment, Income and productivity and Economic Efficiency. The main objective of the paper is to compare the cost of cultivation among the mechanized and non- mechanized farm households in Guntur district of Andhra Pradesh. This study is on primary and secondary data. Guntur district of Andhra Pradesh has been chosen for the study. 200 farmers are selected through multi stage random sampling. The empirical data clearly shows that the total cost of production is Rs 90,256/- on mechanised farm holdings and Rs. 83376/- on non-mechanised farm holdings. The intensive use of inputs, the higher per acre investment by all cost concepts and in all size groups of holdings is associated with the mechanization. The per acre prime cost on mechanised farm holdings is Rs.72,724/-, Rs.75,700/-, Rs.73,263/- and Rs. 67,684 on marginal, small, medium and large farms respectively, while they are Rs.68,124/-, Rs.67,546/-, Rs.68163/- and Rs.66,267/- on corresponding size groups of non-mechanised farm holdings respectively. This implies that per acre prime cost is higher in all size-groups of mechanised farms when compared to the corresponding size groups of non-mechanised farm holdings. Thus the inter-size-group comparison of prime cost reveals that there is a direct relation between farm size and prime cost on mechanised farm holdings while no consistent relationship is found on non-mechanised farm holdings.

Key Words: Mechanisation, Non mechanization, Gross income, Farm business income, Net income

Introduction

In India, mechanization of agriculture has advanced considerably. In certain region, the level of mechanization has gone far ahead of the average level in the country. Human and animal power sources are no longer the predominant sources on Indian farms. Presently, India is the largest manufacture of tractors in the world accounting for about one third of the global production and more than 50 percent of 2017 of which 43,553 units were exported. There are 20 tractor manufacturers, 9 power tiller manufacturers and a number of agricultural implement and machinery manufacturers. On the basis of annually critical review of the mechanization position, one observes that the shortages of labour and high labour wages are the main factors which strongly propel mechanization. Consequently, the more labour intensive operations, such pumping of irrigation water, land preparation and threshing are the first operations which are mechanized.

Large amount of labour or draught power which can be replaced through machines provides a strong incentive to mechanize. Available mechanization technologies from the industrialized countries have limited scope of introduction in the developing world. Hence, indigenous solutions must be found for some of the mechanizations problems particularly for paddy production system. Efforts have to be made to develop rice transplanter, rice harvester and appropriate rice milling machinery appropriate to the location specific conditions of South and South East Asian Countries.

The different equipments are used to till the land for agricultural purposes. These different applications are commercially available and accepted by the farmers. It is also used on custom hire basis, for rice, and wheat harvesting. The land levelers, seed-cum-fertilizer drills have also been accepted by the farmers but on limited scale. Major adoption of agricultural machinery in addition to irrigation equipment and tractor, was thresher for rice crop. Due to various applications of paddy straw, preference has been limited for paddy threshers. Self propelled / tractor operated combines, reaper harvester, potato and groundnut mechanization machinery are also commercially available and accepted by the farmers in states where tractors were introduced.

Review of literature

The debate on the impact of mechanisation on agriculture has continued unabated since four decades. This debate has become further complicated by the biological, mechanical and other technological innovations. Research has been conducted on different aspects of mechanisation throughout the world. Later on a good number of studies have been conducted in various parts of the country on farm mechanizations brief review of select studies is presented in the next few pages. Various aspects of mechanisation were reviewed and grouped as Study of impact of Machanisation on Labor Employment, Income and productivity and Economic Efficiency.

Donde (1971) in his study observed that due to tractorisation of farms, the crops grown and gross cropped area have changed. Kahlon *et al* (1971) expressed the opinion that mechanisation of agriculture is an important factor in creating opportunities for more and more employment in secondary and territory sectors.

Shivamggi (1972) examined the impact of farm mechanisation on human labour employment and bullock labour employment and observed that the substitution effect on bullock and human labour may vary from operation to operation and estimation of power requirements on aggregate basis would be misleading. Intensive operations by human labour do not offer scope for mechanisation while intensive operations which involve bullock power also involve more employment of human power. Hence, the farm operations like land reclamation and mechanisation are creating more employment and mechanisation of preparatory tillages-irrigation etc., would squeeze scope of employment.

The N.C.A.E.R (1973) observed that Labour use is found to be higher'on tube well farms when compared to the non-mechanised farms of same size. The addition of tractor leads to labour displacement and further addition of thresher aggravates the effect. Abercrombic (1973) in his review of experience of tractorisation in Latin America notes that tractor use is largely concentrated in Argentina, Brazil, and Mexico and has benefited agricultural production in those countries. He finds that overall effect of tractorisation has been to displace labour. Clayton (1973) has also reviewed the experience of various countries in East Africa. From the Ugandan experience, where tractorisation has been receiving government support since the mid-sixties, he notes that the scheme has proved to be both uneconomic and labour displacing (in terms of labour input per acre). In Kenya too, tractors have led to displacement of labour, particularly on

large farms. He pointed out, however, that the economic justification of tractorisation and effects of tractors on employment can vary with ecological conditions and factor endowments of the farms under examination. He observes for instance that in certain regions of Kenya where two cash crops are grown over the year, tractor use has led to an increase in farm employment, particularly on farms where the land to man ratio has exceeded 2.5 acres per man.

N.C.A.E.R (1981) has studied the overall effect of employment of human labour and observed that overall employment of human labour higher on tractorised farms than on bullock farms. Bolish and Singh (1981) assessed the employment effects of three different levels of mechanisation in the Agra district of Uttar Pradesh, and found that the labour use per hectare of cropped area has decreased but labour employment per hectare of cultivated area has-increased with an increase in the level of mechanisation.- The latter phenomenon was attributed to the increase in cropping intensity and the shift from labour intensive to greater labour intensive crops with mechanisation.

Statement of the problem

Nowadays in India, the increasing population also increases the demand for food crops especially rice. But, while comparing with the increase in demand for rice, the production of rice in India is not satisfactory. By this same time, due to urbanization the size of cultivable land for rice has been reducing since 1990's and the productivity of rice also declining due to non-availability of inputs such as labour, fertilizers, seeds, and machineries. To increase the supply of rice to meet its demand, implementation of mechanization in the paddy cultivation will be the only solution. But, the implementation of mechanization in rural India is having lot of challenges like, lack of awareness of farmers, high cost of machineries and nonavailability of quality inputs. Mechanization has to be carried out to increase the agricultural production to feed the mass population. So this study has focused the implementation of mechanization in paddy and commercial crops cultivation and the problems involved in it. It is expected that this analysis attempted here will be of some help in providing guidelines for agricultural development in the country and particularly in the field of paddy cultivation.

Objectives of the Paper

The main objective of the paper is to compare the cost of cultivation among the mechanized and non-mechanized farm households in Guntur district of Andhra Pradesh

Methodology

This study is based on the primary data. Guntur district of Andhra Pradesh has been chosen for the study. 200 farmers are selected through multi stage random sampling. In the first stage West Godavari district is purposively selected for the study. In the second stage, Guntur district consists of four revenue divisions namely, Guntur, Tenali, Narasaraopeta and Gurazala. Each revenue division one mandal were selected. Which is Thadikonda mandal from Guntur, Duggirala from Tenali, Narasaraopeta from Narasaraopeta, Grazala from Gurazala revenue division. In the third stage each mandal one village were selected for the study Kanteru from Thadikonda, Evani from Duggirala mandal, Jonnalagadda from Narasaropet mandal and Gottimikkala from Gurazala mandal, altogether four villages are selected from the list of villages in the selected mandals,

In final stage each village 50 sample households are selected, altogether 200 sample respondents are selected through the random sampling method. A well-structured interview schedule will be prepared for collecting the details from the respondents

Results and Discussions

Mechanisation, as a result of timely completion of different agricultural operations in time and intensive use of inputs, coupled with changes in the composition of crops grown is likely to result in higher returns from cultivation. The rationale for their expectation lies in the possibility of increased per acre yield of crops grown on mechanised farm holdings and in the higher per unit value of these crops.

To study the overall impact of mechanisation on farm business, changes in the cultivation practices, cost of cultivation, net returns and input-output ratios of sample households are analysed. For this, costs of cultivation of mechanised farms are compared with those of non-mechanised farm holdings. The analysis presented in this paper relates to per acre unless otherwise specified

Cost of Production by Different Concepts

The information pertaining to per acre cost of production according to various cost concepts viz., cost A_x , cost A_2 , cost B, and cost C is shown in table 1. Here, cost A_1 represents the out of pocket expenses incurred by the farmer, cost A_2 represents rental value of leased in land along with cost A_1 , cost B represents imputed values of owned land along with cost A_2 and cost C represents imputed values like value of family labour and interest on fixed capital along with cost B. The per acre cost of production by all these concepts which are shown in the table- 1 are high on mechanised farm holdings. Cost C which indicates the total cost of production is Rs 90,256/- on mechanised farm holdings and Rs. 83376/- on non-mechanised farm holdings.

A similar pattern is observed among different size groups of holdings on the basis of different cost concepts. It could also be observed that among different categories of farms, small farms appear to be more intensive in the use of inputs as the per acre cost of production on the basis of different cost is higher on this farms as compared to other farm groups. Perhaps this may be due to the relatively higher proportion of area under commercial crops on small farms.

The' above discussion clearly establishes that consequent upon intensive use of inputs, the higher per acre investment by all cost concepts and in all size groups of holdings is associated with the mechanisation.

Table-1 Per Acre Cost of Cultivation Size wise

(In Rupees)

Farm Size		CostA	Cost A1	Cost B	Cost C	Prime Cost
Marginal	Non Mechanised	48258	63512	78262	85232	68124
	Mechanised	52358	67612	82562	90032	72724
Small	Non Mechanised	49261	63850	78600	84135	67546
	Mechanised	56415	71604	87454	93689	75700
Medium	Non Mechanised	50704	64371	79574	85579	68163
	Mechanised	55204	69071	84674	91179	73263
Large	Non Mechanised	46876	59574	75014	79459	61832
	Mechanised	52228	65376	81616	86561	67684
Total	Non Mechanised	48500	62660	77639	83376	66247
	Mechanised	54080	68490	84019	90256	72327

Source: Primary Data

Prime Cost

As Cost C presented in table- 1 includes most of the imputed values, it may not represent the true cost of production of the farmer. This cost includes all the paid-out of pocket expenses represented by cost A₁ and value of family labour excluding irrigation charges. It can be observed from the table that per acre prime cost is higher by 8.62 per cent on mechanised holdings as compared to non-mechanised farm holdings. While it is Rs.73,327/- on mechanised farms it is Rs.66,247/- on non-mechanised farm holdings.

Among different size groups, variations can be found in the value of prime cost on mechanised and non-mechanised holdings. The per acre prime cost on mechanised farm holdings is Rs.72,724/-, Rs.75,700/-, Rs.73,263/- and Rs. 67,684 on marginal, small, medium and large farms respectively, while they are Rs.68,124/-, Rs.67,546/-, Rs.68163/- and Rs.66,267/- on corresponding size groups of non-mechanised farm holdings respectively. This implies that per acre prime cost is higher in all size-groups of mechanised farms when compared to the corresponding size groups of non-mechanised farm holdings. Thus the inter-size-group comparison of prime cost reveals that there is a direct relation between farm size and prime cost on mechanised farm holdings while no consistent relationship is found on non-mechanised farm holdings.

Gross Income

The data pertaining to the per acre gross returns from cultivation on mechanised and non-mechanised farm holdings by the size of the holding along with the breakup of these holdings into mechanised and non-mechanised farms is given in table -2 . It can be observed from the table that per acre gross returns on mechanised holdings is Rs.1,00,351/- which is higher by about 15 per cent than that on non-mechanised farm holdings. The gross returns per acre are high on all size-groups of mechanised holdings as compared to that of corresponding size groups of non-mechanised farm holdings. An direct relation between farm size and productivity is observed on both mechanised non mechanised farm holdings. The only exception is the large farms of mechanised category which recorded the highest gross returns per acre. This may indicate that marginal and small farms are in no way inferior to either medium or large farms in the efficient management of farms and in fact our findings are in collaboration with the findings of earlier farm management studies i.e. pre-green revolution studies.

Table--2 Per acre Gross Income: Size wise

Farm Size	(In Rupees)	
	Non Mechanised	Mechanised
Marginal	82520 (100.00)	95535 (113.62)
Small	84000 (100.00)	99435 (115.52)
Medium	86755 (100.00)	100777 (113.91)
Large	87685 (100.00)	108658 (119.3)
Total	85240 (100.00)	100351 (115.16)

Source: Primary Data

(Figures in parenthesis shows percentages to the total)

Farm business income

Farm business income represents the return to the farmers land, family labour, fixed capital and management. It can be obtained by deducting the paid-out costs, i.e., cost A_1 , or cost A_2 as the case may be from gross returns per acre. Farm business income on mechanised and non-mechanised holdings is shown in table -3. From the table it can be observed that farm business income per acre on mechanised and non mechanised farm holdings is about Rs.47400 and Rs.37,263/- respectively. This means that farm business income on mechanised holdings is higher by about 21 per cent than that on non-mechanized holdings.

It can also be observed from the table that the per acre farm business income is higher in all size groups of mechanised farm holdings, when compared to corresponding size groups of non-mechanised farm holdings. This phenomenon may be attributed to cropping pattern and mechanisation.

It can also be observed from the table that per acre farm business income shows an inverse relationship with farm size in both categories of farms. That is, per acre farm business income is decreasing: as the farm size increases on both categories of farms.

Table- 3 Per acre Farm Business Income: Size wise –All Crops
(In rupees)

Farm Size	Non Mechanised	Mechanised
Marginal	34262 (100.00)	43777 (121.74)
Small	35867 (100.00)	44448 (119.3)
Medium	37075 (100.00)	46897 (120.94)
Large	40874 (100.00)	56795 (128.03)
Total	37269.5 (100.00)	47400.5 (121.37)

Source: Primary Data

(Figures in parenthesis shows percentages to the total)

Net-Income

Net income indicates the profit or loss from farm business. It is residual of gross income after deducting total cost C from it. The per acre net income of the mechanised) I and non-mechanised farms is presented in table -4. A glance at the table indicates that the farmers of the mechanised holdings are getting higher profits from farm business than their counterparts of non-mechanised farms of same size. The per acre net income of mechanised holdings is Rs.10,085/- while it is only Rs.1,864/- on non-mechanised farm holdings. The net income on mechanised farm holdings is 81.53 per cent higher than that on non-mechanised farm holdings.

An intra-size-group comparison shows that net income is consistently higher on all size groups of mechanised farms when compared to the corresponding size groups of non-mechanised holdings. However the variation in net income of corresponding size groups of mechanised and non-mechanised farm holdings varies from one size group to another. The net

income is higher by 149.28 per cent, 102.35 per cent 87.74 per cent and 62.77 per cent in marginal, small, medium and large farms of mechanised holdings respectively as compared to the same size in non-mechanised holdings. This variation in percentage change in net income on

Table-4 Per Acre net Income: Size wise –All Crops
(In rupees)

Farm Size	Non-Mechanised	Mechanised
Marginal	-2712 (100.00)	5503 (249.285)
Small	-135 (100.00)	5746 (202.39)
Medium	1176 (100.00)	9598 (187.74)
Large	8226 (100.00)	22097 (162.77)
Total	1864.25 (100.00)	10095 (181.53)

Source: Primary Data

(Figures in parenthesis shows percentages to the total)

Conclusion

The total cost of production is Rs 90,256/- on mechanised farm holdings and Rs. 83376/- on non-mechanised farm holdings. The intensive use of inputs, the higher per acre investment by all cost concepts and in all size groups of holdings is associated with the mechanization. The per acre prime cost on mechanised farm holdings is Rs.72,724/-, Rs.75,700/-, Rs.73,263/- and Rs. 67,684 on marginal, small, medium and large farms respectively, while they are Rs.68,124/-, Rs.67,546/-, Rs.68163/- and Rs.66,267/- on corresponding size groups of non-mechanised farm holdings respectively. This implies that per acre prime cost is higher in all size-groups of

mechanised farms when compared to the corresponding size groups of non-mechanised farm holdings. Thus the inter-size-group comparison of prime cost reveals that there is a direct relation between farm size and prime cost on mechanised farm holdings while no consistent relationship is found on non-mechanised farm holdings.

Incomes from the cultivation among mechanized and non-mechanized farms is clearly shows that the per acre gross returns on mechanised holdings is Rs.1,00,351/- which is higher by about 15 per cent than that on non-mechanised farm holdings. The gross returns per acre are high on all size-groups of mechanised holdings as compared to that of corresponding size groups of non-mechanised farm holdings. A direct relation between farm size and productivity is observed on both mechanised non mechanised farm holdings. The only exception is the large farms of mechanised category which recorded the highest gross returns per acre. This may indicate that marginal and small farms are in no way inferior to either medium or large farms in the efficient management of farms and in fact our findings are in collaboration with the findings of earlier farm management studies i.e. pre-green revolution studies.

The farm business income per acre on mechanised and non mechanised farm holdings is about Rs.47400 and Rs.37,263/- respectively. This means that farm business income on mechanised holdings is higher by about 21 per cent than that on non-mechanized holdings.

It can also be observed from the table that the per acre farm business income is higher in all size groups of mechanised farm holdings, when compared to corresponding size groups of non-mechanised farm holdings. This phenomenon may be attributed to cropping pattern and mechanisation.

It can also be observed from the table that per acre farm business income shows an inverse relationship with farm size in both categories of farms. That is, per acre farm business income is decreasing: as the farm size increases on both categories of farms.

The family labour income on mechanised farms is Rs.16,332/- on non-mechanised farm holdings it is only Rs.7,601/- per acre. Per acre family labour income on mechanised farms is 53 per cent higher than that on non-mechanised farm holdings. Also it can be observed from the table that all the size groups of mechanised holdings show higher family labour income than non-mechanised farm holdings.

The intra-size-group comparison indicates that there is an direct relation between family labour income and farm size in both mechanised and no-mechansised farm holdings. The

difference in percentage change in family labour income in different size groups may be attributed to cropping pattern and machine use.

The per acre net income of mechanised holdings is Rs.10,085/- while it is only Rs.1,864/- on non-mechanised farm holdings. The net income on mechanised farm holdings is 81.53 per cent higher than that on non-mechanised farm holdings.

An intra-size-group comparison shows that net income is consistently higher on all size groups of mechanised farms when compared to the corresponding size groups of non-mechanised holdings. However the variation in net income of corresponding size groups of mechanised and non-mechanised farm holdings varies from one size group to another. The net income is higher by 149.28 per cent, 102.35 per cent 87.74 per cent and 62.77 per cent in marginal, small, medium and large farms of mechanised holdings respectively as compared to the same size in non-mechanised holdings. This variation in percentage change in net income on

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