

## IMPACT OF AGRICULTURAL MECHANIZATION ON PRODUCTION, PRODUCTIVITY AND EMPLOYMENT OF LABOUR

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### Abstract

*Indian agriculture is characterized by over-whelming small holdings due to higher population density and nearly two-third of its population residing in the rural areas coupled with unabated land fragmentation due to the inheritance laws of the country. Nearly 62 per cent of the estimated 142 m ha area is rain fed. Major sources of farm power include both animate (humans and draught animals) as well as inanimate sources such as diesel engines, tractors and electric motors. India's well-orchestrated Green Revolution began in the mid 60's. It was ushered in through the adoption of higher and balanced doses of the biological, chemical and mechanical inputs together with the timely intervention of the Government.*

### Introduction

The later ensured the availability of the required inputs of high yielding seed varieties, fertilizers, pesticides water and improved power sources and equipment. The Government provided the minimum support price, easy access to procurement markets, rural roads and other infrastructures which helped to trigger the green revolution in selected areas of the country. Resultantly gross food production increased from 50.8 M tons in 1950-51 to 199.3 M tons in 1996-97 and land productivity rose from 0.58 tons/ha/year to more than 2.14 tons/ha/year. Whereas the quantum jump in production and productivity was brought about by a combination of factors, farm mechanization was often at the centre of controversy due to its impact on employment of human labour in a labour abundant economy. This paper reviews the findings of various researchers on the impact of farm mechanization on agricultural production and productivity, cropping intensity, human labour employment on the farm, subsidiary and non-farm employment as well as gross farm income and net return.

### Impact of Mechanization on Agricultural Productivity

Farm mechanization is regarded as sine-qua-non to reduce the human drudgery and enhance the agricultural productivity. During the post-green revolution period, the impact of farm mechanization on agricultural production and productivity has been well recognized

in India. Depending upon the use of other inputs such as irrigation, high yielding seed varieties, chemical fertilizers, herbicides and pesticides, different States in India have attained different levels of mechanization. Consequently the agricultural production & productivity has witnessed three to four fold increases. Studies have been conducted by various organizations & individuals which have highlighted the impact of agricultural mechanization on farm production and productivity.

Singh and Singh (1972) concluded that tractor farms gave higher yields of wheat, paddy and sugarcane and produced a higher overall gross output per hectare than non-tractor farms. NCAER (1973) compared the values of annual farm output per hectare of net sown area under different levels of mechanization. The output per hectare was found to increase as the level of mechanization increased from irrigated non - mechanized farms to tube well, tractor-thresher farms. Singh and Chancellor (1974) found that though, tractor and tube well farms had significantly higher yields than bullock farms in case of wheat, much of the difference was accounted for by difference in other factors such as level of irrigation. The use of tube well was found to be associated with significantly higher yields compared to the Persian wheel irrigation. ITES, Madras (1975) found that tractor - owned farms obtained increased productivity of paddy, sugarcane and groundnut by 4.1 to 28.3 per cent, 13.1 to 34.2 per cent and 9.8 to 54.8 per cent with an average value of 15.8 per cent, 23.2 per cent and 31.8 per cent respectively. Likewise, the average increase of productivity on farms hiring tractors was reported to be 11.8 per cent, 13.0 percent and 16.0 percent for paddy, sugarcane and groundnut respectively.

Pathak et al. (1978) conducted survey on five different categories of farms in Ludhiana District of Punjab to assess the effect of power sources on production and productivity. The yield of paddy, reported to be higher on tractor farms than on bullock farms. The yield of wheat after paddy or maize was significantly higher on tractor farms than bullock farms. The use of tractors enhanced agricultural productivity due to better seed-bed preparation, timeliness of operations and precision in distribution and placement of seed and fertilizer owing to the use of the seed-cum-fertilizer drills. NCAER (1980) conducted a survey of farms owning tractors, using tractors on custom-hire and owning bullocks in seven States belonging to three major agro climatic zones. A sample of 815 farming households was selected randomly from 85 villages. It was reported that an average tractor-owning farm obtained higher yields than a bullock farm, which varied from crop to crop and ranged from 72 per cent in the case of sorghum to 7 per cent in the case of cotton. Tractor users also obtained higher yields compared to bullock farms.

In most of the studies, higher yields on tractorized farms were associated with higher levels of fertilizer and irrigation use, but without statistical testing. An exception was the study conducted in Punjab by Kahlon (1976) which found no statistically significant yield effects. Where wheat yields increased significantly, fertilizer use increased in one

area. In the two other areas, the effect did not apply to all farms. No significant differences for high yielding rice varieties were found. Differences were significant for maize in one area and cotton in another. According to Motilal (1971) in Delhi Territory, yields increased significantly for paddy (13.7%), wheat (15.9%), and sugarcane (29.7%). However, tractor farms used 35% more fertilizer, so these increases could not be entirely attributed to tractors. In Uttar Pradesh, tractors gave a yield advantage of 17.6% in sugarcane and 41% in wheat, but significance tests and fertilizer inputs were not reported (Singh & Singh, 1972). In the NCAER study (1980), yield increases with tractors accompanied increased fertilizer use, but sample sizes were small. In other areas, large yield increases were reported for summer paddy in Bihar (28.6%), for desipaddy in kharif and high yielding paddy in Andhra Pradesh, and for groundnuts in Coimbatore (23.9%). However, fertilizer applications were also higher (Bihar, 31.8%; Andhra Pradesh, 36.3%; Coimbatore, 28.7%). Finally, Singh and Chancellor's (1974) regression analysis on 26 maize farms in Meerut District showed no significant effect of tractorization on productivity.

#### **Impact of Mechanization on Cropping Intensity**

Agricultural mechanization has made significant contribution in enhancing cropping intensity. The growth in irrigated areas and tractor density has had direct bearing on the cropping intensity. Findings of the studies conducted in the past are briefly presented to highlight the contribution of mechanization in enhancing the cropping intensity. Chopra (1974) carried out a study on a sample of Punjab farms. He made a comparison of tractor-owning farms in terms of the situation before and after the introduction of tractors. The cropping intensity was reported to be higher after the introduction of tractors. NCAER (1974) conducted a study of tractorised and non-tractorised farms in nine States of India. The study revealed that tractor-owning farms had a higher cropping intensity of 137.5 per cent as compared to 131.8 percent in the case of those without a tractor. Cropping intensity was found to be generally higher on small farms. Among the States surveyed, cropping intensity of tractorised farms was the highest in the Punjab, followed by Uttar Pradesh, Tamil Nadu and the lowest in Rajasthan and Maharashtra.

In a study by Pathak et al. (1978), on a sample of 115 farms in Ludhiana district, the average cropping intensity with fodder crop was reported to be higher on bullock farms than on tractor farms. However the cropping intensity without fodder crop was comparatively higher for tractor farms. On medium size farms of 6 to 12.

Hectares, the cropping intensity with fodder crop on tractor farms were 180 per cent as compared to 174.5 per cent for the bullock farms. The cropping intensity without fodder crop on tractor farms was 153.9 percent as compared to 149.6 percent on bullock farms. The cropping intensity with fodder was higher on bullock farms than on tractor farms whereas the cropping intensity without fodder was lower. But when comparing the

cropping intensities in the two categories having medium size of holdings (6 to 12 hectares), the tractor farms were in a better position since the cropping intensity with and without fodder on these farms was 3.2 and 2.8% higher respectively than on bullock farms. The higher intensity was attributed to the availability of more mobile power on tractor farms than on bullock farms.

### **Impact of Mechanization on Employment of Human Labour**

The impact of farm mechanization on labour employment, particularly in a labour surplus country like India, has been a matter of concern and debate. The available evidences suggest that mechanization had helped in overall increase in employment of human labour. A study by Rao and Singh (1964) on “Tractorization in Kanjhawala Block in Delhi Territory” had showed that both tractor as well as non-tractor farms had on an average 8.2 persons per farm and the labour force at their disposal was neither surplus nor inadequate.

GIPE, Poona (1967) concluded that tractorization generated greater demand for labour by facilitating more intensive cultivation. Thus, there was no significant displacement of human labour after tractorization. UPAU (1969) reported that mechanization accompanied by use of new seed technology and adoption of modern cultivation methods had a beneficial effect on employment. Kahlon (1969-70), reported that reduction in aggregate labour use on tractor-operated farms owning tube wells was only 1.3% as compared to bullock operated farms. Billing and Singh (1970) studied the changes in the demand for labour. The aggregate impact of adopting the improved technologies in Punjab resulted in reduction of human labour employment to the tune of 11.5% compared to conventional level. In Maharashtra, the reduction was negligible at 0.2%. The study, however, failed to estimate the possible increase in human labour employment arising out of the increase in cropping intensity followed by mechanized cultivation.

In a comparative study of tractorised and bullock operated farms in Purnea district of Bihar, Singh and Go swami (1977) reported that the human labour days employed on an average cropped hectare on tractorised farm worked out to 87.6 man-days with 113.9 man-dayson custom-hiring farms and 120.6 man-days on bullock operated farms which were reduced to 3.10 per cent on tractorised farms. The percentage share of labour requirement for inter culture, irrigation, harvesting and threshing operation was higher in case of tractorised farms as compared to bullock operated farms. It would not be out of place to mention that most of the mechanization studies were conducted during the early years of the introduction of the tractors i.e. during 60's and 70's. The opposition to this technology and particularly to the introduction of tractors was based on the findings of some of these studies, which showed that the differences in timeliness of operations and productivity per

hectare did not come out to be statistically significant on tractor farms as compared with bullock farms. While quoting such findings, the limitations of inadequate infrastructure for machinery maintenance and repair and the time it took to master the mechanical skills, which largely contributed to these results, were conveniently forgotten. Against this background, it would be wrong to conclude that tractorization did not improve the timeliness and output of farm operations or increased secondary and tertiary employment.

### **Impact of Mechanization on Gross Farm Income and Net Return**

Farm mechanization has greatly helped the farming community in the overall economic upliftment. The studies conducted on impact of mechanization on farm income clearly support this view -point. AERC (1970& 1971) conducted a series of studies related to economics of mechanization. These studies revealed that the gross income was higher on mechanized farms than non-mechanized farms. The gross crop output per cultivated hectare was reported to be Rs.3144 for tractor operated farms as compared to value Rs.2677 for bullock operated farms only marginally. NCAER (1974) reported that the tractor farms secured 21% more income per hectare of gross cultivated area compared to bullock farms. The net return per hectare of gross cropped area or net cultivated area was higher for tractorised farms than the non- tractorised farms as a result of better utilization of resources.

Another study by NCAER (1980) revealed that the tractor owners and users derived higher per hectare gross income compared to bullock farms. The gross income per hectare of an average tractor-owned household was 63% higher than that of a household using only bullock labour. The gross income per hectare of tractor-using households as a group exceeded that of the bullock farms by 31%. The average net return from a tractor-owning farm on a cropped hectare exceeded that of a bullock farm by 152%. A tractor using farm also derived a net additional income of 84% over a bullock farm. A tractor-owning farm spent 57% more than bullock on material inputs and 62% more on human labour. An average tractor owner and user, in spite of spending more on cultivation expenses, derived higher net income on a cropped hectare compared to bullock farm. However, this should not be attributed entirely to tractor usage as other factors such as hybrid seeds, fertilizer and irrigation also contributed to it. In the study in an irrigated area of Ahmednagar district of Maharashtra, Patil and Sirohi (1987) reported that, on an average, the gross return were higher by about 33 to 34% on tractor-owning farms than those on bullock operated farm. Balishter and others (1991) reported that net return per hectare from mechanized farms having tubewells and tractors and partially mechanized farms having only tubewell were 49% and 29% higher respectively than that from non-mechanized farms.

## Conclusions

A common finding that emerged from various studies was that tractorisation displaced mainly bullock labour up to about 60% in some situations, but its impact on man-power was much less, the displacement being less than 15%. Various studies concluded that owing to this relatively low displacement of man power that was unavoidable, mechanization should not be viewed in isolation. Indeed, mechanization opened up new avenues for human employment such as managerial and supervisory jobs on the one hand and driving, servicing, maintenance and repair of the machines on the other. Therefore, recommended selective mechanization in an increasing manner for farms between 5-20 ha groups, which constituted 40% of the area under cultivation, and near total mechanization in operational holdings greater than 20 ha., which accounted for 13% of the cultivated area. NCA supported the view that animal, mechanical and electric power work complemented each other. NCA advocated tractorization for time bound operations like sowing, planting especially in rainfed areas where the operations were required to be completed in a short span of time while the rain occurred and for harvesting and threshing, as well as for non-repetitive works such as land reclamation, levelling, terracing, eradication of wild-shrubs & perennial weeds like kans, (*Saccharum spontaneum*), as well as for command area development works. Studies were also conducted by several other organizations & individuals on the impact of farm mechanization on agricultural inputs & outputs. Almost all such studies led to the following broad conclusions.

- (i) That farm mechanization led to increase in inputs on account of higher average cropping intensity and larger area and increased productivity of farm labour.
- (ii) That farm mechanization increased agricultural production and profitability on account of timeliness of operation, better quality of work done and more efficient utilization of inputs.
- (iii) That farm mechanization increases on-farm human labour marginally, whereas the increase in off- farm labour such as industrial production of tractors and ancillaries was much more.
- (iv) That farm mechanization displaced animal power to the extent of 50 to 100% but resulted in lesser time for farm work.

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