

Impact of Farm Mechanization on Productivity and Profitability in Irrigated Dry Crops.

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INTRODUCTION

In order to improve cropping intensity, precision, and timeliness of input utilization, minimize losses at various stages of crop production, and lessen human and animal labour, agricultural mechanization entails the use of multiple power sources, upgraded farm tools and equipment. When comparing tractor-operated farms to bullock-operated farms, the total labour reduction was negligible (1.3 to 12%). Tractor-owning farms were reported to have a gross income per acre around 63% higher than bullock farms. Farm mechanization reduced the amount of time spent on agricultural activity by replacing animal power from 60% to 100%. According to ITES, Madras (1975), the productivity improvement on farms that hired or owned tractors ranged from 4.1 to 54.8 percent. 15% of the GDP is made up of the agricultural and related sectors. Mechanization is essential for raising the productivity and profitability of cash crops in India, such as cotton, groundnut, maize, soybean, and chickpea, which contribute to the country's high GDP.

Farm Mechanization: What Is It?

The employment of mechanical technology in various farming tasks such as planting, harvesting, threshing, leveling, watering, spraying, weeding, and so on is referred to as farm mechanization.

WHY MECHANIZATION IS IMPORTANT IN THE MODERN DAYS

1. **Time and Labor Efficiency:** The preparation of the soil is significantly faster and simpler with rotavators. They make greater use of farmers' time and energy because they can quickly cover enormous regions.
2. **Improved Soil Aeration:** A rotavator's rotating blades add air to the soil, which is beneficial for maize plants' roots.
3. **Uniform Seed Placement:** By planting seeds at consistent depths and intervals, seed drills enable uniform plant growth.
4. **Time and Money Savings:** Farmers don't waste seeds because seed drills are so accurate. When planting crops, this reduces both time and costs.
5. **Even Nutrient Distribution:** To ensure that every area of the field receives the proper quantity of fertilizer, fertilizer broadcasters make sure nutrients are distributed equally.
6. **Time Savings:** By speeding up the harvesting process, maize threshers enable farmers to finish their work more quickly.
7. **Less Labor Dependency:** Farmers can save money by relying on fewer labours when they use a machine for threshing.
8. **Residue Decomposition:** Shredders reduce the size of the remaining bits of maize, accelerating their breakdown. It improves the soil for the following crop by incorporating additional nutrients and organic matter.
9. **Weed Control:** The tiny fragments that the shredder leaves behind form a layer that prevents weeds from spreading and stealing water and nutrients.
10. **Better Soil Structure:** By enhancing the soil's ability to retain air and water, returning the shreds back into the soil improves it.
11. **Cost reduction:** By lowering operating costs, mechanization boosts farmers' net income.

India's Status Of Farm Mechanization

When comparing tractor-operated farms to bullock-operated farms, the total labour reduction was negligible (1.3 to 12%). Tractor-owning farms were reported to have a gross income per acre around 63% higher than bullock farms. Animal power was replaced by farm machinery from 60% to 100%, however this resulted in less time for agricultural labour. Land productivity increased from 0.58 tons ha⁻¹year⁻¹ to more than 2.14 tons ha⁻¹year⁻¹, while gross food production climbed from 50.8 million tons in 1950–1951 to 199.3 million tons in 1996–1997. Tractor-owned farms boosted their output in paddy, sugarcane, and groundnut by 4.1 to 28.3%, 13.1 to 34.2 %, and 9.8 to 54.8 %, according to ITES, Madras (1975). Between 1970 and 2005, India's primary crop production required 4-5 times more energy overall. Between 1951 and 2001, the average farm electricity availability in India rose from approximately 0.25 kw ha⁻¹ to approximately 1.35 kw ha⁻¹. Compared to other crops, rice and wheat have a higher degree of mechanization; however, mechanization has also increased the yields of cash crops in India, such as cotton, groundnut, maize, soybean, and chickpea.

1. A pneumatic planter increased groundnut output by twenty to thirty percent.
2. A cotton picker pulled by a tractor increased yield by 20–25%.
3. A tractor-driven seed drill increased maize production by 15%.
4. Mechanical harvesting resulted in a 37.5% decrease in damaged grain loss.
5. In Chickpea, the automated interculture method using a tractor-drawn cultivator proved to be more profitable, yielding the highest net return and B:C (USD 602 and 2.14%).

The Benefits And Importance Of Mechanization

While it's true that there will always be a need for agricultural products, prices fluctuate a lot, and producers typically receive lower prices. This is because crops have seasonal variations in yield, and massive quantities of produce enter the market, driving down prices. Increasing output while also getting greater profits for the producer is a difficult task. Reducing production costs is the most efficient strategy to keep the agricultural sector alive. In large part, mechanization was quite successful in reaching this goal. Small and medium-sized farmers are finding it increasingly unfeasible to buy, run, and maintain specialized machinery due to rising competition, shrinking arable land, and declining farmer investment capacity. In addition, they waste a lot of time performing individual field operations. In this situation, grouping related operations together can save a significant amount of time, energy, and money. Furthermore, the cost of the machines executing combined tasks is lower than the total of the separate specialized ones.

(i) Draft, Power, and Energy: A combine tillage implement (CTI) rotary type rotavator (RR + chisel share) required 64.7% to 71.3% less energy to run than a conventional system.

(ii) Tractor and implement combo performance: The CTI(ST+PH+CR) sringe tine harrow + power harrow + cambridge roller was advantageous in reducing the fuel consumption, engine flywheel power needs, and wheel slippage by at least 50% when compared to the passive tools when used singly.

(iii) Effectiveness Of the operation :Comparing test results from a CTI (RR + digging blade) rotary type rotavator (RR) on red soil and black cotton soil allowed for the evaluation of the operation's effectiveness. The outcome was better than the MP + CL and MP+CL+DH mould board plough + cultivator + disk harrow procedures carried out one after the other. saves 50-55% of time required to prepare a seed bed.

(iv) Cost effectiveness: The operational cost per hectare of the CTI (RR + digging blade) designed by Kumar and Manian (1986) was reduced by 67.9% and 55.8%, respectively, when compared to MP+CL mould board plow + cultivator and MP+CL+DH mould board plough + cultivator + disk harrow operations.

Application of post-harvest mechanization implements

Common shelling and dehusking techniques include rubbing crop cobs against one another, rubbing on bricks, stone, and wire mesh with an iron cylinder. These methods are labor-intensive and time-consuming, and crop exposure to weather, animals, birds, and insects over time causes losses in grain quantity and quality.

Corn sheller/dehusker

- The maize dehusker/sheller was found to have a shelling effectiveness of 98-99.5 percent and 20% higher yield.
- 50–60% labour savings are achieved.

The main issue with groundnuts is the labour-intensive and time-consuming shelling procedure, which results in a large loss of earnings.

- (1) Nuts and husk (the outer covering of groundnuts) are mingled after crushing (shelling).
- (2) Low productivity and time-consuming.

Motorized groundnut sheller.

- Efficiency of 78% with minimum damage of 0.11%
- (1) Reduced waste from cracked or crushed groundnuts.
 - (2) Increased efficiency.
 - (3) Reduced the time required to shell the peanuts.
 - (4) A low-cost machine for use by farmers.
 - (5) Addresses the need of village residents to make additional money

Challenges Of Mechanization

1. Average land holdings of Indian farmers.
2. Initial heavy investment in machinery and limited ownership of farm electricity.
3. Design and construct cost-effective agriculture machinery for Indian circumstances.
4. Inadequate service centers for machine maintenance.
5. Policy Support

CONCLUSIONS

- Using mechanization can improve crops efficiency by allowing for timely sowing and quick turnaround.
- Improves energy productivity while reducing labor requirements and greenhouse gas emissions.
- Mechanization can enhance yields by 20-30% in irrigated dry crops, improving farmer profitability.
- Mechanization in Irrigated Dry Crops is crucial for India's food security and future farming sustainability.

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