

Research Article

MECHANIZATION IN MORICULTURE

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ABSTRACT

In India, mechanization has emerged as the key component of modern agriculture because of factors like rising demand, declining production, a manpower shortage, etc. Improving farmers understanding of farm mechanization is crucial to maintain sustainability in the agriculture industry. The primary obstacles to farmers adopting mechanical alternatives are ignorance and limited resources, including land, labor, and equipment. The aim of this research is to examine the necessity and obstacles of agricultural mechanization, as well as the present advancements in this domain in India. According to the study's findings, India's agriculture produces 18.3% (2022-23) of the country's GDP. Nonetheless, 58% of people in the population make their living from agriculture. Tractor sales and demand, power tiller sales, and farm power availability are all rising year on year. This brings us to the conclusion that it is critical to use mechanical agricultural alternates. This report outlines some of the issues with agricultural mechanization as well as steps that should be made to raise awareness and promote farm mechanization.

Keywords: Mechanization, Tractor, Disc plough and Economics.

INTRODUCTION

India is the world's second-largest producer of silk after China, and it holds the exclusive right to produce the all four varieties of silk: mulberry, tasar, eri, and muga (FAO, 1988). Indian silk products are extremely valuable both domestically and globally (Bindroo and Kishur, 2011). Recent advancements have been made for the use of machinery in various domains of sericulture in order to boost the productivity level because of the potential of the sericulture business in India (Anonymous, 2003). The use of several tools and machinery in practically every area of the sericulture business, which maximizes high-quality production (Bali and Chanotra, 2019). Because it's a cottage industry, the high cost of installation limits the usage of machinery (Gowda *et al.*, 2011). The weaker segments of Indian society mostly engage in sericulture, and the high cost of its inputs makes it challenging to apply highly complex technologies (Ananthanarayanan *et al.*, 2012). "The use of farm tools, machinery, and equipment

for mulberry cultivation preparation, plant maintenance (pruning, training, harvesting leaves, storing leaves properly), disinfection equipment, silkworm rearing appliances, and primarily the industrial part, i.e., the post cocoon sector involving reeling, weaving, and manufacturing of silk fabric, constitutes mechanization in sericulture" (Dandin and Verma, 2002).

"The scientific application of mechanical aids for enhanced crop production and preservation at a low cost and with less labour-intensive work is known as mechanization," in the words of (Bindroo and Verma, 2014). Sericulture is a large industry with a great deal of job opportunity for both men and women (Dandin and Verma, 2002). It encompasses both farm and non-farm operations (Bharathi *et al.*, 2022). Technological developments raise the output of silk and, as a result, the wages of industrial workers and farmers (Mohandas *et al.*, 2010). Innovative technological developments and their broad adoption have made it easier to initiate and

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implement modern sericulture activities at the farm and industry levels, increasing the yield of silk (Verma, 2011).

MECHANIZATION IN MORICULTURE

Land preparation

Tractor operated mould board plough

To open the soil, a mould board plough attached to a tractor is utilized. It turns the soil inside out, buries waste, weeds, or green manure, and improves the soil so that weak roots can easily navigate through it. Mostly used to prepare land for the creation of new mulberry gardens. A mould board

plough requires 35–50 horsepower to draw. Approximate unit cost of tractor operated mould board plough is Rs.30,000/- and field capacity is 0.30-0.35 ha/hr.

Tractor operated disc plough

It works well on stony, rough, and rubbish terrain. In areas where the mouldboard plough is not effective, disc ploughs are utilized. Disc blades are a key component that performs soil penetration and ploughing. The discs are curved. A disc plough requires 35 to 50 horsepower to pull. Disc angle: 42°- 45°. Approximate unit cost of tractor operated disc plough is Rs 30,000-45,000/- and field capacity is 0.20- 0.25 ha/hr.

Table1. Cost of operation of disc plough.

Life of a tractor (years)	10
Annual use of tractor (in hours)	1000
Fixed cost : (per annum)	
Depreciation @10%	50,000/-
Interest on investment @10%	50,000/-
Insurance @1%	5,000/-
Total	1,05,000/-
Fixed cost per hour	1,05,000 / 1000 = Rs105 / hr
Variable cost	
Area covered (ha/hr)	0.2 ha/hr
Fuel consumption (litres/hr)	6.5- 7.5 litres / hr (Avg -7)
Hours required to cover 1ha	5 hrs
Fuel cost for 1ha	5*7*91=Rs 3185
Labour wages (Rs 500/ 8hr)	Rs 62.5/hr
	62.5* 5 = Rs 312.5
Total variable cost	Rs 3,497.5
Fixed cost per hour	Rs105 /hr
	5*105 = Rs 525
Cost of operation for 1 ha	3,497.5+525= 4,022.5

Table2. Cost of operation of mould board plough.

Variable cost	
Area covered (ha/hr)	0.3 ha/hr
Fuel consumption (litres/hr)	6.5- 7.5 litres /hr (Avg -7)
Hours required to cover 1ha	3.3 hrs
Fuel cost for 1ha	3.3*7*91=Rs 2,102
Labour wages (Rs 500/ 8hr)	Rs 62.5/hr
	62.5* 3.3 = Rs 206.25
Total variable cost	Rs 2,308.25
Fixed cost per hour	Rs105/hr
	3.3*105 = Rs 346.5

Table3. Cost of operation of cultivator.

Variable cost	
Area covered (ha/hr)	0.5 ha/hr
Fuel consumption (litres/hr)	6.5- 7.5 litres /hr (Avg -7)
Hours required to cover 1ha	2 hrs
Fuel cost for 1ha	2*7*91=Rs 1,274
Labour wages (Rs 500/ 8hr)	Rs 62.5/hr
	62.5* 2 = Rs 125
Total variable cost	Rs 1,399
Fixed cost per hour	Rs105 /hr
	2*105 = Rs 210
Cost of operation for 1 ha	1,399+210= Rs 1,609

Tractor operated cultivators

Before planting, it is used to break up clods and thin the soil. The minimal power needed to draw a cultivator is 25 to 60 horsepower. Approximate unit cost of tractor operated cultivator is Rs 25,000- 35,000/ and field capacity is 0.5-0.6 ha/hr.

Tractor operated bund former

Bunds are manually shaped and packed with a spade. This task requires a lot of labor and time. In order to alleviate the tedious nature of these tasks, a tractor-driven bund former/packer was created. At a tractor speed of 2.5 km/h, the field capacity using the equipment was 0.8-1.0 ha/h. The bund former/packer can lessen reliance on labor requirements for bund packing by approximately 96%.

Auger digger

The primary application of a tractor-operated auger digger is in the pit system of mulberry plantations. The 35 to 40 horsepower range is needed to draw an auger. Efficiency: 30-50 pits/hr. Approximate unit cost of auger digger is Rs. 8,000 -17,000 /-(Hand operated) and Rs.40,000-50,000 /-(Tractor mounted).

Mulberry cuttings preparation

A mulberry cutting preparation machine is used to create uniformly sized mulberry cuttings. Approx. unit cost: Rs.6,000 -8,000/- Efficiency of mulberry cutting machine is 1200 cuttings/hr and by manual operation 1200 -1500 cuttings /day can be achieved.

Irrigation equipments:**Sprinkler irrigation**

Advantages of using sprinkler irrigation is easy mechanization and automation used in undulating terrains,

affordable and easy to set up, high and frequent application, less interference with cultivation. Approximate unit installation cost was around Rs.25, 000-30,000 /- per acre.

Drip irrigation

Advantages of using drip irrigation are nutrient runoff minimized, reduce weeds, reduced water usage, and prevent soil erosion. Approximate unit installation cost was around Rs. 30,000-35,000/- per acre.

Intercultural operations:**Power Rotavator, Cultivator and Weeder**

Equipment such as power tiller (about Rs.20,000-60,000/-) and weeder (approximately Rs.90,000–1,30,000/-) can be used for intercultural operations. Very few modifications are needed for various mulberry plantation types such as pit, row, tree or bush plantations among others. Plant geometry such as the paired row system was created by CSRTI, Mysore to help automate activities and reduce labour costs.

Rates

Manual weeding: Rs 500/- Bullock plough (6h/day): Rs 600/ day Power tiller: Rs. 600/ hr Tractor : Rs 900/hr

Sprayers:**For use in mulberry gardens**

Sprayers that run on electricity and manual both are available. Will completely disinfect the raising chamber and the mulberry field by sprinkling chemicals. The most popular types of chemical sprayers used in mulberry gardens are the tractor-operated sprayers, knapsack power sprayer (Rs.10,000/-), hand operated sprayer (Rs.6,000/-) and backpack compression sprayers. Estimated cost per unit: Tractor mounted: Rs. 40,000/-

Table4. Cost of intercultural operation in mulberry garden.

Method of intercultural operation	Time/manpower required per hectare	Cost of operation (Rs/hectare)
Manual weeding	45 man days 45*500	22,500/-
Bullock ploughing	90 Bullock plough hours+ 20 mandays 90*100+ 20*500	19,000/-
Power tiller	18 Weeder hours + 30 Bullock plough hours+10 man days 18*600+30*100+10*500	18,800/-
Tractor operated cultivator in paired row	5 Tractor hours +45 Bullock plough hours+10 mandays 5*900 + 45*100+10*500	14,000/-

Harvesting tools & machines

Knapsack Mulberry Pruner cum Harvester

Used by farmers that raise sericulture plants to quickly collect mulberry leaves and prune them appropriately and quickly. Efficiency: 500 kg/hr. Approximate unit cost was around Rs.8, 000 – 14,000/-.

Secateurs

Secateurs were also referred to as hand pruners. They are employed in the pruning of stiff branches up to 2-3 cm thick on trees and shrubs without splitting the bark. Approximate cost of secateurs was around Rs.250-350 /-.

Pruning saw

Pruning saw is used for harvesting mulberry shoots. Approximate unit cost was around Rs.250/-.

Shoot crushing machines

Large volumes of shoot trash are generated in silkworm breeding operations for commercial use. In shoot rearing, the mulberry shoot waste is crushed using devices called shoot crusher machines. This waste can also be used to mulch mulberry gardens. Approximate unit cost of shoot crushing machine was around Rs.25000/- and efficiency was around 400-600 Kg/hr.

CONCLUSION

In India, labour wages across multiple industries amount for 50–65% of the total cost of the cocoon. The estimated amount of labour needed to maintain a mulberry garden is 800 man days per hectare annually. Consequently, in order to lower the cost of producing cocoons, it is necessary to decrease the reliance on labour. Implementing mechanization in mulberry farming has the potential to decrease mulberry leaf production costs by a minimum of 35-45% (Singh *et al.*, 2022). In sericulture, mechanization includes using farm tools, machinery, and equipment to prepare land for mulberry cultivation, maintain plants by training and pruning, harvest leaves and storing them properly, use disinfection equipment, rear silkworms, and primarily the industrial portion, or the post-cocoon sector, which entails reeling, weaving, and producing silk fabric.

The following are some elements that demonstrate the value of machines and their benefits to the sericulture sector: Reducing drudgery in many activities, Cutting down cost of production of silk cocoons, Getting more precise work in post cocoon sector where the core activities require machines, Improving the quality of silk, Timeliness in various mulberry cultivation and silkworm rearing activities, Increasing the productivity of land and labour.

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