



Farm Mechanization in Sikkim

(* Asif Beg¹, Shatrunjay Yadav¹ and Vishnu Ji Awasthi²)

¹Assistant Professor, Department of Agriculture, Agrawan Heritage University, Fatehabad Road, Bamrauli Katara, Agra U.P.

²Research Scholar, College of Technology, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

*Corresponding Author's email: asifbeg1996@gmail.com

Farm mechanization has greatly revolutionized agricultural methods in lowlands, while its influence is less in hilly areas. In hilly regions, where farmlands are generally tiny and terraced, manual labor and bullock power are common, although the bullocks are smaller and less strong than those in plains. The machines designed for plains are unsuitable for the hills because of the unique topography and smaller land sizes. Farmers are still using traditional method. Farm mechanization in Sikkim is virtually nonexistent. Tractor density in Sikkim is 0.11 per 1,000 hectares of agricultural land. Power availability is also quite poor. Power tillers are only appropriate for a limited range of applications. Large bullock-drawn equipment, such as three-row seed drills, cannot be used efficiently due to narrow and tapering terraces, as well as their weight.

Keywords: Farm Mechanization, Agriculture, Sikkim and Power

Introduction

The state of Sikkim has a total geographical area of 7096 sq. kms and is stretched over 112 kms from North to South and 64 kms from East to West. It lies in the North Eastern Himalayas between 27°00' N to 28°07' N Latitude and 88°00 to 88°55' E East Longitude (Sikkim, 2024). About 2500 sq km of the State is human habitable. Agriculture and associated sectors remain the most significant occupations and the foundation of the economy. The arable land covers 1.09 lakh hectares, or approximately 11% of the geographical area. The net cultivable area is 79,000 hectares, with 1.31 lakh cultivators and 16,939 agricultural labourers. Agriculture is primarily rainfed, as just 11% of the land is irrigated. The state receives enough rainfall from May to October. Though, the average size of operational holding is 3.9 ha against national average of 0.69 ha the entire holding cannot be used for agriculture due to rugged topography or high slopes. Population growth and consequent fragmentation of farm land has caused reduction in per capita holdings. Further, about 82% of the geographical area is under various types of forest hence, the arable land to agrarian (cultivators and agricultural laborer's) ratio is only 0.74 ha/person. Agriculture is still traditional. Cultivation is done in hill slopes with and without terracing (Rahman, *et al.*, 2008). Farm mechanization in Sikkim is almost nonexistent. Due to very steep slopes the terraces are narrow and at times with vertical interval of almost 6-7 ft. As such even the scope for use of power tillers is limited to a few pockets. The large sized bullock drawn equipment like 3 row seed drills also cannot be effectively used due to narrow & tapering terraces and the weight factor. The land preparation to harvesting is normally done manually with traditional methods. The traditional method of broadcasting or sowing along the furrows is

practiced all over the state. The Department has tried out some of the bullock drawn seed drills but it hasn't been found very effective. The topography also doesn't allow for construction of large irrigation channels and for use of large harvesting machineries (Sikkim, 2024).

Traditional Farm Implements used in Sikkim

Almost all farming communities have common traditional agricultural implements like sickle, plough, spade, khurpi, bamboo sieve and axe etc. but possession of modern agricultural equipment is completely absent (Das and Nag, 2006; Elzubeir, 2014). Traditional agricultural tools and implements are those that were developed in ancient times and have been utilised for a long time, either until recently or now (Sarkar et al., 2014). Traditional agricultural equipment and implements for self-sufficiency have evolved and been changed over decades of experience to address changing socioeconomic and farming issues. Traditional sowing methods include manual broadcasting, opening furrows with a country plough, and hand-dropping seeds into the furrow (Sikkim, 2024). Traditional agricultural tools and implements were produced from locally accessible materials such as stone, wood, and iron, and were either locally constructed or standardized factory-made. These tools and implements are cost effective in terms of labor, money, and time savings. They are very simple to operate, requiring no specific abilities. Each of these tools and implements is often employed in conjunction with a certain activity in the agricultural production sequence: land preparation, sowing, weeding, irrigation, harvesting, post-harvest operations, and transportation. The indigenous knowledge possessed by them is really worth and can be utilized as a base for modern gadgets.



Sikkim sickles








Animal drawn iron plough



Animal drawn wooden Plough

Farm Mechanization

The development of farm mechanization in hilly regions is a major step toward improving agricultural practices and productivity in difficult terrains. Farm mechanization is the process of doing agricultural work with the help of different tools and equipment in order to reduce labor costs and increase efficiency. Mechanization will be very beneficial in hilly areas where labor-intensive traditional farming practices are used. Farm machinery makes work like seeding, harvesting and plowing tasks easier and faster to complete. This increases output, improves time management, protects soil, and raises standards of safety. Farmers in hilly regions can accomplish sustainable agricultural practices and streamline their operations by implementing suitable agricultural machinery (Ramrao, *et al.*, 2024). Agriculture in Sikkim demands a set of machineries, which is small in size, light in weight and has the capability to do maximum possible operations. The machine should be such that it could be easily taken to uphill or down the slope by two or three persons. It must be able to operate in the narrow terraces where other bigger machinery is unable to reach or operate. The required machine should have more field efficiency and reduce drudgery (Rahman, *et al.*, 2008). Some gender friendly tools developed may be popularized among the farmers of Sikkim to increase the mechanization of Sikkim. Such as Pedal operated thresher, hand hoe, push-pull weeder, wheel hand hoe, manual dibblers, paddy weeder, improved knapsack sprayers etc.

		
<p>Pedal operated thresher</p>	<p>Push pull weeder</p>	<p>Wheel hand hoe</p>
		
<p>Paddy weeder</p>	<p>Knapsack sprayer</p>	

Constraints of farm mechanization in Sikkim

1. Sikkim has relatively small cultivated land.
2. The majority of farming is done on sloping fields or narrow terraces.
3. Terraces are typically narrow, with an average width of around a metre and vertical intervals more than 1 metre.
4. Terraces are not uniformly wide and taper on both sides, making them unsuitable for use with heavy machinery.

5. Large landowners do not always cultivate their properties.
6. These small farmers/tenants have a low investment capability.
7. Farming at the subsistence level. High input costs.
8. Almost all equipments are designed for flat terrain.
9. Tilling, intercultural, and sowing equipment are specialised to kind of terrain, and those built for plain areas may not necessarily fit Hill.

Farm mechanization is used for:

Agricultural mechanisation contributes to increased production, productivity, and profitability in agriculture by achieving timeliness in farm operations, bringing precision in metering and placement of inputs, reducing available input losses, increasing utilisation efficiency of costly inputs (seed, chemical, fertiliser, irrigation, water, etc.), lowering unit cost of produce, and improving profitability and competitiveness in operating costs. It also aids in the preservation of food and byproducts from qualitative and quantitative degradation; it allows for value addition and the formation of agro-processing firms to generate additional money and jobs from agricultural goods.

Conclusion

Farmers mostly use bullocks and traditional equipment for farming. Farm women handled the majority of farm operations. Sikkim's geographical restrictions prohibit the large-scale application of agriculture mechanization systems. In Sikkim, the majority of farmers have tiny and fragmented land holdings and continue to utilize indigenous tools and implements since they are cheaper, more affordable, and readily available in local communities. These indigenous tools and utensils must be standardized by combining them with contemporary scientific understanding to reduce drudgery. These machines should be constructed such that one or two persons can lift and carry them up or down a hill. It must be capable of working on narrow terraces where larger machines cannot reach and complete the process. Hill agricultural mechanization is critical for increasing the efficiency of several activities. The efficiency of human and animal energy has been improved by the development of better agricultural tools and machinery, which may assist to reduce farmers' drudgery. Farm mechanization will be critical to make hill agriculture competitive and successful.

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