

REVIEW ARTICLE

Status of farm mechanization in Nagaland: A review

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Abstract

In Nagaland, 90% of the state's land is mountainous, and 70% of the population is engaged in agriculture. In 2022-23, 28.42% of the total reported area was used for crop cultivation, and 52% of the total land area was covered by forest. The majority of the landholding in Nagaland belongs to medium (4-10 ha), i.e., 37.7%, and the average landholding is more than 10 ha. Schemes like SMAM and RKVY were initiated in the state to promote farm mechanization in areas with limited farm power in agricultural fields and to meet the needs of small and marginal farmers. The level of farm mechanization remains poor at present, but there is great potential for growth with the help of the government and funding agencies by providing subsidies to the farmers. Also, the hilly topography of the region makes it impossible to operate heavy machines. Therefore, to mitigate the problem, prior importance has to be given to strengthening the research and development to develop small, lightweight, and portable implements and machinery. Providing frequent training and establishing more CHCs would contribute immensely to improving the level of farm mechanization in the state.

Keywords: Agriculture, Landholdings, Hilly and mechanization, etc.

Introduction

Nagaland is a state located in the northeastern part of India, which has a total geographical area of 16,579 km², of which 7225 km² (43.37%) is cultivable (Solo and Kikhi, 2020). It lies between latitudes 25°6' and 27°4'N and longitudes 93°20' to 95°15'E. The state's elevation spans from 111 to 3840 m above sea level, and it borders Assam to the west, Manipur to the south, Arunachal Pradesh and Myanmar to the east, and portions of Assam and Arunachal Pradesh to the north. Nagaland has a subtropical climate with heavy monsoon activity. The state is classified as a mid-tropical hill zone, with temperatures ranging from 4°C in the winter to 35°C in the summer. In addition, 90% of the state's land is mountainous, and its climate is thriving. The state receives 2000 to 2500 mm of rainfall annually during the monsoon and rains are a major part of its weather (Solo and Kikhi, 2020). Rainfall in the state averages 1500 to 2500 mm annually, with June through September seeing the most precipitation. In February and March, it also suffers from strong northwest winds. The average yearly temperature is 32°C at its maximum temperature and 21°C at its minimum temperature (Kumar and Konyak, 2023).

Agriculture plays a vital role in the daily life of the people of Nagaland as it helps to be self-sufficient for food and economic growth. The people are greatly shaped by traditional skills, indigenous knowledge, along with geographical variables, and meteorological and soil conditions, which lead to diversified cultivation. Agriculture has also been a major source of occupation

and income and conventional farming has been practiced since ancient times. This approach has taught the people how to grow crops and improve production regardless of variations in soil and climatic conditions, geographical topography, management approaches, etc., contributing to immense diversity in cultivation. Despite new ideas and technologies, people still follow traditional practices and knowledge because it is deeply rooted in society and has been practiced for generations. However, as time goes by, there is growth in population, which demands the need for more yield. Therefore, it is critical to raise the level of farm mechanisation in the state.

In the early stages, mechanization benefited large and medium farms, but over time, various schemes, custom hiring centres, and declining labour availability expanded access for small landholders, in which the Government

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support, R&D, training, and public-private partnerships played a vital role in sustaining farm mechanization. The recent trends demonstrate their positive impact on productivity, rural employment, and export-oriented growth in tractor and implement manufacturing. (Singh, 2015). The major barriers to farm mechanisation include small and fragmented land holdings, undulating terrain, limited access to farm machinery, and poor economic conditions of farmers. Therefore, there is a need for region-specific mechanisation strategies, especially selective mechanisation for hilly terrains and small fields, which promotes improved infrastructure, custom hiring models, and the development of appropriate animal-drawn tools to reduce drudgery and increase productivity (Raina *et al.*, 2018).

There is an urgent need for developing hill-specific technological solutions such as lightweight power tillers, ergonomic tools, and AI-based systems like drones and smart irrigation because heavy machinery is next-to-impossible to be operated in hilly terrains (Vatsa *et al.*, 2021). Hence, advocacy for establishing dedicated research centres to develop and disseminate appropriate machinery focusing on hilly regions is crucial in order to enhance sustainability, reduce drudgery, labour efficiency, and rural employment, particularly in challenging agro-climatic zones for hill farming. Strategies such as custom hiring centres, local manufacturing, and training programs are suggested to promote sustainable mechanization suited to hill farming conditions and expand mechanization in hill agriculture to enhance productivity and rural income (Vatsa, 2013; Singh, 2014 and Kumar *et al.*, 2018). Also, selective mechanization strategies are essential to meet various crop types and farm sizes to bridge the rural-urban income gap and enhance inclusive agricultural growth (Mehta *et al.*, 2014).

Material and methods

A study was carried out to find out the level of mechanization in Nagaland, as 90% of the land is mountainous and 70% of the population is engaged in agriculture. The state falls in the hilly region; therefore, a large fraction of the population still adopts traditional means of cultivation since there are very few machineries and implements available for hill farming. The study will provide the state's overall analysis of the gap in farm mechanization.

Data on land utilization and land holdings

The varied environment of the state, which varies from tropical to frigid, has a wide variety of flora and wildlife despite its small size and remote location. Nagaland has a population density of 120 persons/km², meaning that almost 70% of its 2.19 million residents are employed in agriculture, making it mostly an agricultural economy. In 2022–2023, 470669 ha (28.24%) were used for crop cultivation and 862930 ha (52%) are covered by forests of the total reported

Table 1 : Land utilisation pattern in Nagaland

<i>Classification of land</i>	<i>Nagaland ('000 ha)</i>	<i>All India ('000 ha)</i>
Total reported area	1657	306650
Forests	863	72021
Non-agricultural area	122	27845
Barren & unculturable land	2	16554
Grazing lands and permanent pastures	--	10248
Land under Misc. tree Crops	68	2992
Culturable Wasteland	61	11659
Fallow land	121	11128
Current Fallow	588	13498
Net Area Sown	361	140705
Cropped Area	471	219357

Source : Land Use Statistics at a Glance 2022-23, Economics, Statistics & Evaluation Division, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

area (Table 1). The inhabitants of the state have long enjoyed their control over the land and its resources because of the abundance of agrobiodiversity there. Therefore, the state is known for having a holding area that is more than 10 hectares on average.

The operational land holdings of Nagaland are shown in (Table 2), along with the percentage of the average size of holdings. The average size of land holdings of the state is 4.87 ha, which is significantly larger than the national average, i.e., 1.80 ha for individual holdings. Approximately 4 to 10 ha of land is owned by the majority of farmers in the state and falls under medium land holdings.

Level of Farm Mechanization in the State

The major challenges faced by the farmers in Nagaland are the remoteness of the region, as the farmers do not get easy access to advanced technologies, transportation, markets, etc. The topography further complicates the farmers' challenges, as a significant portion of the state features hilly terrain, making the implementation of large farm machinery impractical. As for this, the use of improved tools, implements and advanced farm machinery is very limited as compared to other parts of India. Farm operations like ploughing, seedbed preparation, sowing, harvesting, etc., are still mostly practised manually using traditional methods, which causes drudgery and is time-consuming.

To improve the productivity and boost farm mechanization in the state there is an increase demand for food due to population growth, in this regard, the Department of Agriculture, Government of Nagaland initiated a program during the annual year 2016-17 under the Sub-Mission on Agricultural Mechanization (SMAM) and

Table 2 : Operational land holdings in Nagaland

Group	Operational holdings ('000)		Area operated ('000 ha)		Average size of holdings (ha)	
	Nagaland	India	Nagaland	India	Nagaland	India
Marginal (<1 ha)	8	100251	5	37923	0.56	0.38
Small (1-2 ha)	30	25809	37	36151	1.24	1.40
Semi-medium (2-4 ha)	63	13993	169	37619	2.68	2.69
Medium (4-10 ha)	74	5561	431	31810	5.84	5.72
Large (>10 ha)	21	838	314	14314	14.67	17.07
All size groups	196	146454	956	157817	4.87	1.08

Source : Agriculture Census 2015-16, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

Rashtriya Krishi Vikas Yojana (RKVY) which has benefited farmers to a great extent.

According to the latest available data collected from the Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, it has been found that 3,932 agriculture machinery were distributed under SMAM in 2023. In 2022, the highest number of agricultural machineries was distributed, i.e., 4,600 nos., as shown in (Fig. 1.2) between 2018-2023. Nagaland has only two custom hiring centres (CHCs) and zero Hi-Tech Hubs (Fig. 1).

Potential Farm Mechanization in the State

There is a great scope for farm mechanization in Nagaland because it has poor farm power availability, which is only 0.447 kW/ha in comparison to the nationwide which is 1.73 kW/ha (*Source: AAR, Department of Agriculture, Govt. of Nagaland*). The hilly topography of the region necessitates the development of small-lightweight implements and tools for multiple farm operations such as seedbed preparation, harvesting, tillage, threshing, and more. This is due to their cost-effectiveness and ability to meet farmers with small and marginal land holdings. Lightweight power tillers (80–100 kg) are a good source of power for performing various kinds of agricultural tasks, as they can be lifted from one terrace to another with the assistance of two to three men (Singh, 2014). There is also an urgent need to establish

Table 3: Data of the first SMAM implemented in Nagaland during 2016-17

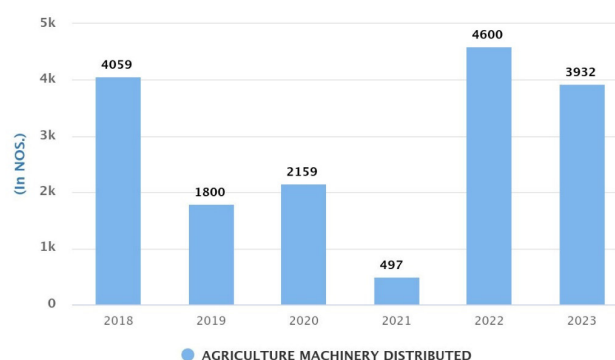
Sl. No.	Component	Physical
1.	Farm machineries demonstration	30
2.	Farm machineries trainings	Trained 625 farmers
3.	Subsidies sale of power tillers distributed	90 Nos.
4.	Farm Machinery Banks established for Custom Hiring	5 Nos.
5.	Farm machinery bank (FMB) established with 8 farmers minimum per Bank	7 Nos.

Source : Department of Agriculture, Government of Nagaland.

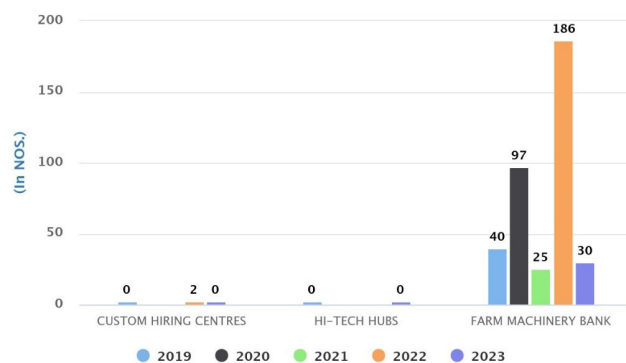
Table 4: Data of first RKVY implemented during 2016-17 in Nagaland.

Sl. No.	Component	Physical
1.	Subsidies sale of power tillers distributed to the farmers	22 nos.

Source : Department of Agriculture, Government of Nagaland



Source : Direct Benefit Transfer in Agriculture Mechanization, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India

Figure 1 : Agriculture machinery distributed to Nagaland under SMAM from 2018-23

Source : Direct Benefit Transfer in Agriculture Mechanization, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India

Figure 2 : Established CHCs, High-Tech Hubs and Farm Machinery Bank in Nagaland

more custom hiring centres (CHC) in the rural areas of every district of the state to benefit the farmers to hire farm machinery at a nominal hiring rate, thereby promoting the use and benefits of machinery in the region. This will greatly promote uplifting the livelihood in the hills of the rural areas of Nagaland, as well as add to a huge scope for power tillers (250-400 kg weight) in CHC for income generation as well (Singh, 2014). Efficiency in farm machinery and power can improve land yield and agricultural production. Custom hiring can increase entrepreneurship within the state and improve the level of farm mechanization. Also, establishment of small-scale agro processing centres and food enterprises has a great potential and will contribute to a great extent to the growth of the economic condition of the farmer and generate state revenues as well, because agriculture is the backbone of the economy.

Farm mechanization suggestions

The hills of Nagaland have a relatively low level of farm mechanisation, so the government and agencies must pay attention to this by giving farmers frequent training and subsidies. Strengthening research and development for hill farming is necessary in order to carry out the development of small hand tools, implements, and portable, lightweight machinery. To make farm equipment more accessible in rural regions, more Custom Hiring Centres (CHC) must be built. Entrepreneurship must also be promoted, and service centres for maintenance and repair facilities must be established.

Conclusion

It is concluded from the study that Nagaland has the majority of operational land holdings belonging to the medium category, i.e., 37.7% of the total available data of the state, and the average land holdings are more than 10 ha. The initiation of SMAM and RKVY schemes has contributed to a great extent to improve the status of farm mechanization in the state. However, there is a lot of scope in the research and development of portable, small, and lightweight tools and implements for farming in hilly terrain, and there is a great potential for farm mechanization in Nagaland.

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