



Agricultural Mechanisation in the Hills of Uttarakhand

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ABSTRACT

Agricultural Mechanisation in India has completely changed the condition and direction of agriculture. After mechanisation India has emerged as one of the biggest producer of food grains and also net exporter. But the development of mechanisation has been very uneven some states like Punjab, Haryana and Uttar Pradesh are highly mechanized while the hilly states like Uttarakhand still struggling with traditional methods of farming. Farmers in Uttarakhand especially in hilly regions are still using outdated and old methods of farming which are not feasible with this modern and technically advance world where there is high demand of food grains due to increasing population. People are still doing subsistence farming manually which has made it drudgery prone occupation. Agricultural mechanisation will make agriculture less drudgery and more efficient for the farmers. It helps in increasing farm productivity and production. This paper highlights the existence of agricultural mechanisation in hilly regions and the issues faced in transformation of agriculture.

Keywords: Agriculture, Mechanisation, Uttarakhand, Hilly region, transformation

INTRODUCTION

Situated in the laps of Himalayas Uttarakhand state is blessed with natural resources and diverse agro-climatic conditions which is suitable for cultivation of large variety of agricultural and horticultural crops. The total geographical area of the state is 53, 48,300 hectare, out of which approximately 86% area comes under hilly regions and remaining 14% is plain area. Out of the total geographical area around 13% per cent of the area is used for agriculture.

Agriculture plays very prominent role in the economy of Uttarakhand by providing employment to large number of population, raw materials to secondary sector, ensuring food security and contributing in the SGDP (state gross domestic product). Majority of population is engaged in agriculture especially in the hilly regions as it becomes important source of livelihood for the hilly areas due to the limitations for major industrialization and other opportunities for employment. Agriculture is absolutely important sector of the state but it is still way behind in terms of growth and development. The main problem of this sector is traditional ways of practicing agricultural activities which makes it less productive and inefficient in modern times. In the plain regions of the state agriculture has mechanized in many ways the farmers use many machineries like Tractors, Harvester, Fertilizer Spreaders, Seeders, Balers and irrigation pumps etc. for the agricultural practices but in hilly regions of the state

farmers still use traditional methods and farm activities are performed manually with the help of animals.

Agricultural mechanisation means use of machinery for agricultural works. All the activities from soil preparation, sowing, manuring, irrigation, weeding, harvesting to storage etc is done with the help of machinery. The machineries used for various activities are tractor and power, soil cultivators, planters, fertilizer and pesticide dispensers, irrigation pumps, produce sorter and harvester etc.

Esmay and Hall (1972) defined agricultural mechanisation as the science application of mechanical aids for increased production, processing and storage of food with less drudgery and increased efficiency. Efficient machinery helps in increasing crop production and productivity. It also enables the farmers to practice multiple cropping system.

Agricultural mechanisation has changed the traditional agricultural practices in a better and effective way. The use of machinery, high yielding crop varieties, chemical fertilizers, insecticides, pesticides and development of irrigation facilities etc. has brought revolution in the agriculture sector but it hasn't reached the hilly regions of the state even in plain regions small farmers do most of the agricultural works manually.



Figure 1: Small and Fragmented Land Holdings.
Source: Field Survey

Subsistence farming is very prevalent in the hilly regions of the state. The complex topography with small size and scattered land holdings, difficult terrain, underdeveloped transportation facilities and lack of irrigation facilities makes agricultural activities difficult. The picture clicked by the researcher in figure 1 shows the small, fragmented and scattered land holdings

in the villages of hilly regions of Uttarakhand. The size of plots is so small that it's difficult to use any kind of machinery there.

The situation of agriculture sector is deteriorating year by year people are leaving agriculture and migrating to the urban areas for better living standard as agriculture is unable to provide them financial stability. The lack proper marketing facilities, transportation, cold storages and agro processing industries every year large share of crops, perishable food and fruit products get waste which causes huge loss to the farmers. The farming operations are performed manually with the help of animals and small wooden and iron instruments such as kudali, darati, khurpi, wooden plough etc. which makes the activities time consuming and physically exhausting for the farmers. The traditional methods also increases cost of production as they need more labour force, high maintenance of cattle etc. The below Figure 2 show the method of ploughing practiced by farmers in hilly regions.



Figure: 2 Ploughing
Source: Field Survey

These time consuming methods of agricultural practices can delay the planting and growing of crops which leads to decrease in crop yield as the cropping session is highly dependent on weather conditions. Also the continuous use of traditional plough negatively affects the soil formation and forms a hard layer which restricts the accumulation of water into the soil and negatively affects the proper growth of plants, it can cause soil erosion. The agriculture is largely rainfed in hilly regions only 10% of the agriculture is irrigated rest depends on weather. Even though the availability of natural water is very high in hilly regions but there is a lack irrigation facility.

All the problems occurring due to traditional farming techniques can be avoided by using modern machineries in agriculture. It will help in performing farm operations timely and more efficiently. Transforming traditional agriculture into modern mechanisation will make agriculture more profitable. We can take the example of other states of India like Punjab, Haryana, Uttar Pradesh and West Bengal etc. where almost all the agricultural activities are performed mechanically and there production and productivity level is quite high as compare

to Uttarakhand. Agricultural mechanisation has shown tremendous change in there agriculture sector.

The level of agricultural mechanisation is very low in Uttarakhand the below table 1 shows the number of different types of machinery or equipments used by farmers for agricultural activities in the state. It shows large number of farmer still use wooden plough. The number of tractors is very low which means still the work is done by manually. The lesser number of water pumps, tube wells and hand pump shows the lack of proper irrigation facility and farmer's dependence on rain water for irrigation.

Table 1: Machineries/ Equipments used in Agriculture in Uttarakhand

Name of machine/equipment	Number
Wooden plough*	897691
Iron plough*	2500
Tractor/Power tiller	144
Power operated machines	330
Zero till drill	60
Sprinkler sets	43
Water lifting pumps	50
Energised Pump Sets/ Tube Wells	24005
Hand pump	36980

***Estimated & Source: Directorate of Agriculture (2005-06) & Directorate of economics and statistics (2012-13), UK.**

Most of these equipments are used by the medium and larger farmers of the plain regions. They perform most of their farming activities with the help of modern machineries as it is easily accessible and affordable for them. Also in plain regions transportation of machineries to the farming field is easy while in hills it is difficult to take big and heavy machineries and equipments to the fields. However in foothills and valley regions farmers use small, low weighted and easily transportable equipments for farming.

Agricultural mechanization is likely to be more profitable on larger farms whereas more than 95% of the overall land holdings in Uttarakhand are marginal and small in size so it requires special attention for mechanization. Hence, the speed of agricultural mechanization needs to be accelerated through the establishment of the new Farm Machinery Training & Testing Institutes for remote areas (Anonymous, 2017)

There is ample scope for transformation of agriculture in Uttarakhand, especially in the hilly regions. Agricultural mechanisation will increase agricultural productivity and production by helping farmers to perform farming operations timely and more efficiently. Mechanisation also helps farmers to change their farming approach from subsistence to commercial and single crop to multiple cropping patterns. The development of small, less weighted, easily available,

affordable and farmer friendly (which they can easily operate) tools and machines for hilly regions according to their requirements will be beneficial for the farmers. The previous studies of farm mechanisation have shown positive relationship between agricultural mechanisation and crop production. So, we can say, it will make farming more efficient and productive. The positive change in farming will also stop farmers from leaving agriculture and migrating from hills to plain regions for employment.

The importance of hill agriculture in the economy of Uttarakhand and the alarming situation of this sector makes it important to study about the problems faced by hill agriculture. At present, when the agriculture in other states is practicing modern farming methods Uttarakhand is still stuck with the traditional methods of farming. This chapter on agricultural mechanisation in the hills of Uttarakhand highlights the status of mechanisation in hilly regions. It covers the aspects of mechanisation and explains the availability and impact of mechanisation of hill agriculture.

OBJECTIVES

The present study is based on the following objectives:

- To analyse the existence of agricultural mechanisation in hilly regions of the state
- To analyse the effect of agricultural mechanisation on production and productivity
- To find out the problems of mechanisation in the hilly regions
- To assess the role of government towards agricultural mechanisation in hilly regions

REVIEW OF LITERATURE

According to Economic Survey, Farm mechanization and crop productivity has a direct correlation as farm mechanization saves time and labor, reduces drudgery, cut down production cost in the long run, reduces post-harvest losses and boosts crop output and farm income. Use of improved implements has potential to increase productivity up to 30 per cent and reduce the cost of cultivation up to 20 per cent.

Farming machineries and equipments can perform the functions of levelling, land preparation, deep turning and deep scarification (Aslan et al., 2007), which can improve land quality better than the traditional manual and cattle operation methods, especially in transforming the medium- and low-yield fields into high yielding fields (Zhou et al., 2019; Peng and Zhang, 2020). Agricultural machinery can increase the degree of multiple cropping systems to provide the potential for multiple crop cycles per year, thus improving production capacity and land output rates (Peng et al., 2020; Ji et al., 2021).

Irrigation and drainage through machines, dry farming machinery and mechanical spraying can effectively reduce the risks of drought, floods, weeds and insect pests (Berdnikova, 2018). Mechanical sowing and field management can make crop distributions more uniform and promote growth (Hu and Zhang, 2018), while the use of standardized agricultural machinery can reduce agricultural losses by performing farming operations timely and improve product quality (Qu et al., 2021).

Chen and Zhang (2021), Xu and Song (2021) believe that strengthening the promotion of advanced agricultural machinery technology is one of the ways to increase the level of green and high-quality agricultural development.

There is so much research on the impact of agricultural machinery on agricultural production (Deng et al., 2020), which has two main aspects: cost savings and improvements in quality and efficiency. Firstly, rising labour costs are an important cause of the decline in agricultural profitability (Li et al., 2017). Farmers using agricultural machinery can significantly reduce labour costs (Yao, 2009; Luo and Qiu, 2021). Second aspect is to improve quality and increase efficiency it includes increased agricultural production and product quality.

The level of farm mechanization in the state is very poor with respect to mechanical power, efficient implements, water management, renewable energy and post harvest technology sectors. The undulating topography, small and irregular sized fields, lack of skilled manpower, poor facilities of repair & maintenance, poor purchasing power of farmers and non-availability of improved farm implements and machine are some of the main reason for low level of mechanization in the hilly region of the state. (Sukhbir Singh, 2014).

The technological improvements in Indian agriculture since mid-sixties have brought about revolutionary increase in agricultural production. Interestingly, the growth rate of food grain production particularly in case of wheat and rice was much higher than the growth rate of population. The country was facing acute food shortages till eighties has now become not only self-sufficient but also a net exporter of foodgrains (Debashis Sarkar et al., 2013)

According to Sectoral paper on Farm Mechanisation by NABARD¹, it is also important to note, that several activities are highly time-bound and unless executed as per schedule, the farmer is likely to suffer loss. Agriculture mechanization is an appropriate answer to such challenges. Farm mechanization, more appropriately agriculture mechanization will also let off the wage labour as also the farmer of the drudgery involved in manual operations, besides enhancing manpower productivity since skills are integral to machine based operations.

According to an article on “Sustainable Agricultural Mechanisation”, mechanization is an important input for crop production which historically has been neglected in the developing countries. The lack of availability of farm power decreases the ability to cultivate large share of land efficiently and have long been recognized as a source of poverty, especially in the sub-Saharan Africa. Increasing the power supply to agriculture means that more tasks can be completed timely and greater areas can be farmed to produce more quantities of crops while conserving natural resources. Applying new technologies that are environmentally friendly enables the farmers to produce crops more efficiently by using less power. Lack of access to farm power is one of the primary reasons for slow uptake of farm mechanization and hence non-intensification of farm productivity, particularly among small and marginal farmers. There is a direct correlation between having access to farm implements and impact on efficiency, timeliness of the farm operations. It proves to be completely unviable for a small or marginal farmer to purchase farm equipment and without its usage the farmer can never sustain positive returns from agricultural output.

Mechanization at the system level is one of the most important aspects required to reform agriculture. The whole world has made significant progress in field preparation by using tractors with matching implements for ploughing and puddling. The green revolution in India

¹ National Bank for Agricultural and Rural Development

began in the mid-1960s resulted in a surge in labour demand and showed notable growth in agronomy of India. It led to increased seasonal and permanent migration, primarily from Eastern India and the initiation of the use of tractors and threshers (Binswanger, 1986; Gupta et al., 2017).

Farm mechanisation has reduced use of animal power by 60 to 100%. As a result of the manufacture, maintenance, servicing, and sales of tractors, mechanisation increased human labour employment for on-farm and off-farm activities, and improved productivity. Agricultural mechanization led India towards, growth of food production, food power availability and has a remarkable impact on Indian Economy. It leads towards quality and quantity of agricultural production and productivity. Various equipment and methods has been introduced to enhance the yield. Numerous employments are provided in several agricultural industries such as management and supervisory employments on the one hand and driving, servicing, repairing of the machines on the other. Many farmers received subsidy without much struggle. (Acharya Balkrishna et al., 2021)

The most significant effect of mechanisation has been a massive improvement in productivity per farm worker, overall production and production per hectare have increased significantly.

The assessment research of Uttarakhand revealed that the mechanization has been limited to the plain regions of the state the hills are still struggling with the traditional and outdated methods of farming.

RESEARCH METHODOLOGY

Study Area

Sult block of Almora district was selected for primary data collection. Out of 11 development blocks of Almora district Sult is one of the biggest block in terms of number of people engaged in agriculture. According to the census of 2011, Sult block has a total working population of 28,129 of which 18,894 people are engaged fulltime in farming or cultivation while 18,894 persons pursue farming for less than 6 months in a year. The total villages in the block are 259 of which 10 villages namely; Saknara, Kunidhar, Thatwarar, Dangkarakoti, Tolyo, Punakot, Malla Garhkote, Gular, Rankuna and Bankota were selected from the block to collect the samples.

Data collection

The study was conducted on the bases of primary and secondary data. The primary data was collected from the Sult block 10 villages with highest number of cultivators were selected from the block. 20 samples of farmers were collected from the each selected village through random sampling method. Thus all total 200 farmers were selected to form the ultimate sample size of the study. The secondary data was collected from various government and non- government sources such as Agricultural Statistics at a glance, State agriculture Plan Uttarakhand, Agricultural census and various research journals on agriculture etc. Tabular analyses, Frequency, percentage and mean etc. was used to analyse the various objectives of the study.

RESULTS AND DISCUSSION

The outcomes of the research are summaries according to the objectives of the study as follows:

Demographic Profile of the Samples

Total 200 samples were collected from the 10 villages of Sult block. Mean age of the farmers was 55.25. Most of the farmers belong to the age group of 50 to 70 as the young members of the family have been working on another sector. The younger age group does not prefer agriculture as their means of livelihood in the hills. They are migrating to plain regions for employment.

83.5 % samples were male as most of the females had gone to work in their farming fields. When enquired about them not working they told some interesting things like most of the farming activities are done by female in the hills and males only help with heavy works like ploughing, harvesting, taking crops to the market etc.

Most of the farmers had attained elementary education only 6% farmers were illiterate. 30% farmers had taken high school and 27 % were intermediate while only 9.5% were graduate or post graduate out of which most of them were already retired from other jobs and now doing farming. So we can conclude that agriculture is not the choice of employment in hilly regions for a well educated person.

The income earned from the agriculture is not monthly it is seasonal as farmers sell their crops seasonally. So when enquired about agriculture being their main occupation we found that most of the families have other alternate options for earning like having a shop, one of the family member working on government sector, working on private sector or doing daily wage labourer etc. According to the farmers they are doing subsistence farming. First they keep the produce for their domestic consumption and if something is left then they sell it. Around 80% of the farmers earn 10 to 20 thousand from selling their agricultural produces and this income is also uncertain.

The main crops grown in the study area were wheat, chilly, barley, millet, urad, bhat, madua, soyabean, sarsaun (mustard), and seasonal vegetables. They were farming variety of chillies for selling according to them its production is better than other crops also they get nice price for the crop. They also grow ginger, garlic, onion and various pulses for commercial purpose but the production is not high due to the various challenges they face. Sometimes weather conditions do not support and for past few years they have been facing the problem of wild animals that destroys their crops.

Availability of agricultural mechanisation

In the study area the farmers perform all their farming activities manually with the help of domestic animals. They use wooden plough, kutla or kudali, darati, khurpi etc. as shown in figure 3 all these are the local hand tools used by farmers and we can't consider them as machines. So basically the agriculture is far from being mechanized in hilly regions.

Figure 3: Tools used for farming



source: Field Survey

farmers were unaware about it only 12.5% farmers had the knowledge about these machineries. Out of which only 3 % of the farmers were using any kind of equipment for agricultural activities the figure 4 shows a farming cutting his crop with the help of a small machine known as crop cutter or grass cutter it is quite handy and easy to carry but the problem is diesel which is used as fuel to operate and it is also not easily available in the villages. The farmer told he have to go more than 20km to get fuel for his machines.

Figure 4: Agricultural Machinery Used for Cutting



Source: Field Survey

Effect of agricultural mechanisation on production and productivity:

The previous studies on agricultural mechanisation and agricultural production and productivity have shown positive relationship between transformation of agriculture and its growth but in the study area when the farmers were questioned about the effect of mechanisation on their crop production they didn't give any proper reply due to lack of use of modern machineries in farm operations. The 6 % of the farmers who were using machinery told it has made their farming more efficient and timely and it has reduced their labour power to some extent.

Problems of mechanisation in the hilly regions: the main problems observed in the study area are:

- The small and scattered land holdings in the hilly regions which are also located far from each other.
- The lack of transportation facilities available in the villages
- The small and medium farmers were not much financially stable
- Markets being far from the villages

- The lack of proper knowledge about agricultural machineries and equipments among farmers
- Farmers' passive attitude towards changing farm practices. They were happily using traditional methods
- They have no awareness about government schemes for agricultural mechanisation.

All these problems make mechanisation difficult in the hilly regions of the state. Most of the farmers in the hilly regions were not very fond of new machineries and technologies according to them they are extra costly and burdensome for them as they don't even know how operate them or repair them if machine is not working. Also the market area being far from the villages is a big reason for backwardness of agriculture in hills.

Incentives by government for agricultural equipments

State government provides subsidies on various farm machineries/ equipments so that farmers can easily afford them. The equipments/ machineries are tractor, thresher, brush cutter or grass cutter, power tiller, power weeder, thresher and water pumps etc. all these equipments make agricultural work timely and easy but in the hills most of the farmers don't have any knowledge about these equipments also they are not affordable for the small and marginal farmers. Many of these machineries are difficult to take to the farm land without proper road connectivity so they are not feasible for hill regions. The farmers in plain regions have awareness and reach to these machineries so large and medium farmers use these machineries/ equipments for farming operations. Government needs to make more efficient schemes for hill regions so that agriculture can transform from being traditional to technical.

CONCLUSION

The study on the hills shows that the agricultural mechanisation is still far from the reach of farmers. The traditional agricultural practices are being used for farming which has worsened the situation of agriculture in hill regions of Uttarakhand. From the study we can conclude that farmers are wasting their manpower in performing farm activities because neither the farm productivity nor the crop production is increasing. Which is the main demotivating factor for farmers in these hilly regions.

There are so many obstacles in transforming agriculture in hilly regions so immediate attention of the state government and other agricultural agencies is required to strengthen the technological department in the hilly regions of Uttarakhand to handle the farm mechanization problems and make handy, gender friendly tools for agriculture. Especial focus should be given to the weight and size of the equipment as more females are engaged in agriculture. The machineries should be affordable for the small and marginal farmers and should be easy to carry as the landholdings are scattered.

Despite various constraints, there is a vast scope for agriculture in hills we just need to make better policies and proper implementation. It provides employment to large number of people in hills and also meets the need of food.

References

- Adams, Brian T (2019). "Farm Machinery Automation for Tillage, Planting Cultivation, and Harvesting".
- Anonymous : Agricultural Mechanisation in Uttarakhand <https://agrimachinery.nic.in/>
- Anonymous. 2013. Uttarakhand at A Glance 2012-13, Directorate of Economics and Statistics, Govt. of Uttarakhand, Dehradun.
- Anonymous. 2014. Agriculture Census 2010-11, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India.
- Aslan, S. T. A., Gundogdu, K. S., Yaslioglu, E., Kirmikil, M., and Arici, I. (2007). Personal, Physical and Socioeconomic Factors Affecting Farmers' Adoption of Land Consolidation. *Span J. Agric. Res.* 5, 204–213. doi:10.5424/sjar/2007052-240.
- Chen, J.W. (2019). The Influence of the New Farmer's Professional Identity on the Income of Agricultural Management: Based on the Analysis of Tendency Value Matching Method. *Dong Yue Tribune* 40, 162–173.
- Farm Sector Policy Department NABARD Head Office, Mumbai (2018). "Sectoral Paper on Farm Mechanization".
- Hu, Y., and Zhang, Z. H. (2018). The Impact of Agricultural Machinery Service on Technical Efficiency of Wheat Production. *Chin. Rural Econ.* 5, 68–83.
- Khalequzzaman ,K. M. And M. A. Karim (2007). "Study of Agricultural Mechanization and Its Impact on Rural Environment".
- Luo, M. Z., and Qiu, H. L. (2021). Agricultural Machinery Socialization Service Adoption, Endowment Difference and Alleviation of Rural Economic Relative Poverty. *South. China J. Econ.* 2, 1–18. doi:10.19592/j.cnki.scje.381027.
- Luo, B. (2020). Small Farmers and Modern Agriculture. *Issues Agric. Econ.* 1, 28. doi:10.13246/j.cnki.iae.2020.01.003.
- Nam, K., Suk, S. D., and Byeong-il, A. (2021). The Empirical Analysis of Production Cost Reduction Effects from the Agricultural Machinery Rental Policy. *J. Rural Dev.* 44, 51–78.
- Peng, C., and Zhang, C. (2020). Assessment of Agricultural Mechanization on Farmers' Grain Aggregated Production Efficiency. *J. South. China Agric. Univ.* 19, 93–102. doi:10.7671/j.issn.1672-0202.2020.05.009.
- Peng, J., Zihao Zhao and Dingning Liu (2022). "Impact of Agricultural Mechanization on Agricultural Production, Income, And Mechanism: Evidence From Hubei Province, China". School of Economics, Jiangxi University of Finance and Economics, Nanchang, China.
- Rajkhowa, P. And Zaneta Kubik (2021). "Revisiting The Relationship Between Farm Mechanization and Labour Requirement in India.
- Roy, P., B. S. Hansra, R. R. Burman, Sangeeta Bhattacharyya, T. N. Roy And Rouf Ahmed (2022). "Can Farm Mechanization Enhance Small Farmers' Income? Lessons from Lower Shivalik Hills of The Indian Himalayan Region".
- Sarkar, D., Debajit Roy and Kali Shankar Chattopadhyay (2013). "Effect of Farm Mechanization on Agricultural Growth and Comparative Economics of Labour and Machinery in West Bengal".
- Singh, S. P. And Verma H. N. 2001. Scope of Farm Mechanization in Shivalik Hills of India. *Agricultural Machinery, Asia, Africa And Latin Am (AMA)*, Japan.. 32(1): 59-64.
- Singh ,S. (2014). "Farm Mechanization in Hills of Uttarakhand, India - A Review"
- Sustainable Agricultural Mechanisation <https://www.fao.org/sustainable-agricultural-mechanisation/overview/why-mechanisation-is-important/en/>