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Research Article

Farm Mechanization And Rice Cultivation A Study Of Rangjuli Tribal Development Block In Goalpara District Of Assam

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Introduction

Agricultural mechanization can be conceptualized as a process of using mechanized work of agriculture, the objective being to increase farm input productivity. Mechanized agriculture presently, powered by machinery tools which have replaced many farm jobs carried out by manual labour or working by animals such as oxen, horses and mules. Mechanized agriculture includes the use of fertilizers, harvesters, hunkers and countless types of farm implements, even aero-plane helicopters of agriculture for aerial applications, computers for precision agriculture and satellite navigation etc. to increase yields. Agricultural mechanization is felt necessary for improving production efficiency, to encourage large scale and quality production, and to replace high proportion of farm labour. Contraction of agricultural land in one hand and imperative of increasing land productivity for feeding growing population on the other, necessitates farm mechanization, specially, to raise production of staples like rice. However, materialization of farm mechanization might have some challenges arising out from the rigidity of socio-economic structure of state like Assam.

The tools and implements used by the Indian farmers are obsolete as compared to the most up-to-date farm machinery used by the farmers of the west. Consequent to the adoption of improved technique in agriculture, i.e., mechanization, these countries have been able to experience an agricultural revolution during the 18th and 19th centuries. Mechanization of agriculture has resulted on the increase in agricultural production and costs reduction. There is a consensus that mechanized agriculture is only the alternative when agriculture has to encompass with contraction of arable land and the issue of food security.

Precisely, agricultural mechanization refers to the development and use of machines that can take the place of human and animal power in agricultural processes. "Agricultural mechanization is required to provide engineering input to agriculture, agro-processing and rural living for increased production and productivity with reduced cost of production; provide technology for efficient handling, transport and storage of agricultural produce, processed products and by-products; apply technology and management practices and value-added agro-processing industries that generate additional income and employment, assuming better quality of life to rural people, a life that is nutritionally healthy and hygiene-wise secured and free from arduous labour and drudgery" – (**Datta, and Sundharam, 2007**). For the convenient of discussion adoption of modern agricultural tools replacing animal in all activity confining to planting materials preparation, ploughing, sowing, rearing, weeding, harvesting and processing, particularly, in paddy cultivation is supposed to mean the agricultural mechanization. Hence, the use of power tillers, tractors, power pumps, hybrid seeds, chemical fertilizers, pesticides, harvester, hunkers and thrashers, etc. is termed as agricultural mechanization.

Scope of the Study

As the study relates to staple food crops of Assam such as paddy in relation to mechanization, it bears vast scope not only for future policy measures but also for farmers, scholars and concerned agencies. Multifaceted directions would come up since farm mechanization is a complex phenomenon particularly in a region where prevalence of small holding size and famers' illiteracy are prominently persisting. The present study would bring forth new ideas that would facilitate the policy makers for adopting area specific initiative, particularly Rangjuli Tribal Development Block in Goalpara district of Assam. Although the study would expose new directions for future study, it does not demand to be a complete one without any flaws arising from methodological and analytical aspects.

Statement of the Problem

Importance of agriculture not only lies on feeding industry and service sector but also to establish food self sufficiency and economic prosperity of farmers. Therefore, a process is necessary to develop by which

traditional low productivity farms are transformed into high-productive-commercial agro-farming. It establishes a theoretical base that technological change in agriculture, in other words agricultural mechanization is necessary to fulfill economic growth of any region.
The above perspectives necessitate an in-depth look into the issue of farm mechanization in general, and particularly rice cultivation in Assam, and to induct it to Rangjuli Tribal Development Block in Goalpara district so as to unearth the related pros and cons in the grassroots. Therefore, the concept of "Farm Mechanization and Rice Cultivation" is chosen and to search its status, prospect, lacunae, etc through a case study.

Objectives

The main objective of the study is to unearth the realities about farm mechanization in relation to rice cultivation that is customarily practiced in Assam. The specific objectives around this main objectives are-
i. To outline the overall scenario of agricultural mechanization
ii. To assess the present status of inputs used in agriculture in the block and the district.

Data base and Methodology of the Study

The objectives of the study suggest that it is a descriptive as well as analytical and evaluative kind of research. Therefore, to achieve the results, it requires both secondary and primary information. Secondary information will be gathered from the published sources such as books, journals, reports, periodicals, magazines, bulletins, etc. including a host of web pages.

Sources of Secondary Data

Following are the main sources of secondary data-
i) District Agriculture Office, Goalpara
ii) Krishi Vikash Kendra, Dudhnoi
iii) District Irrigation Office, Goalpara
iv) Community Development Offices Rangjuli

Selection of Sample Area and Sample Units

Since main focus of the study was to unearth the ground realities about Farm Mechanization and Rice Cultivation; A Study of Rangjuli Tribal Development Block in Goalpara District of Assam, therefore, the study required primary information from the field level. For this purpose, a multistage purposive random sample survey was adopted following a specific statistical procedure. The survey was conducted in two phases comprised of identifying location of sample district, Tribal Development (TD) Block, villages and the sample units i.e., heads of households in a systematic manner. In the first stage of the first phage Goalpara district of Assam was chosen purposefully in the ground that it was one of famous rice producers in the state and about 90 per cent people live in rural areas and practice rice cultivation. It was followed by a random selection of the Rangjuli Tribal Development (TD) Block from a total of eight Community Development (CD) block of the district. In the third stage of the first phase, 19 villages from selected TD block randomly were chosen followed by random selection of 107 small holders (farmers possessing less than 2 hectares) and 18 medium (farmers possessing 2 to 4 hectare) farmers from the selected villages. Proportion of small and medium farmers according to farm size was justified because incidence of small farmers was comparatively higher in the district. In regards to the classification of farm category, small farm size includes both medium and small category under one head, and semi medium farm size was merged with medium category, thereby, the study proposed to analyze the cases of two farm categories. Due to merely absence of large farmers in the selected TD block, discussion of large category was excluded from the study.
In the first stage of second phase of the survey, selected sample units were directly interviewed with pre-tested question schedules to collect required information. To locate the sample units, selected TD block and selected villages several field trips were conducted with research tools like- notepads, pen, and papers along with scheduled questions during February, 2022. This pilot survey gave special attention to finalize the prepared question schedule so as to cope the collected information with computer application.
In the second stage of the second phase of the survey during the month of June-July for autumn and summer rice, and during the month of December 2023, the selected sample households were interviewed for collection of information. Throughout the survey, farmers ware enquired how much they harvest and dividing by how much land they sown. Money value of the physical yield of rice was estimated by the harvested volume taking the average price prevailing in the market. Further, the variety wise price difference was adjusted for getting average price as per the market price reported by the farmer themselves. In regards to input cost estimation two types of approaches were adopted. For durable machineries, average cost per hectare was estimated on the basis of the prevailing rates of hire of machines per hour and was aggregated for the entire sowing and harvesting periods. Secondly, the cost incurred for seeds, fertilizers, irrigation, pesticides, fencing, weeding, etc. ware calculated on the basis of market prices as reported by the farmers. Throughout the survey, farmers were enquired how much they harvested, dividing how much land they had planted and how much they spent for various inputs. Money value of the physical yield of paddy was

estimated by the harvested volume and by the average price the farmers receive during the period. The variety wise price differences were, however, adjusted for getting average price as per the market prices reported by the farmers themselves. Further, input prices for machineries, other tools and labour were gathered on the basis of farmer's own estimates and researcher's observations.
Finally, simple statistical tools such as rates, ratios, tables, figures, etc. were used to achieve results of the study.

Agricultural Scenario in the Block Areas

The agricultural structure of Goalpara district particularly in the block areas Rangjuli exhibits a dualistic character with the co-existence of both traditional and modern technology. Adherence to the age-old tradition, advent of partial use of modern tools only for plough, use of improved seeds, pesticides, chemical manures and mere use of irrigation facilities have shaped the agriculture structure to a blending of mono cropping and rotation cropping. Mono cropping of rice consists of only '*Sali*, i.e., winter rice. However, a trend of precision farming, i.e., SRI (System of Rice Intensification) has been introduced by few farmers. It is a system of rice cultivating with organic manure, less water, young seedlings, wide space and frequent weeding with ensuring higher yields and it is a viable option for small and marginalized farmers[1]. On the other hand, rotation cropping is practiced in those areas which are topographically low lying in character. It includes '*Boro*' cultivation which uses comparatively higher level of modern tools such as power tillers, tractors, diesel pump-sets, electric motors, harvesters, hunkers, manual weeders, chemical fertilizers, pesticides etc. The diverse structure of rice cultivation is inherent to this agricultural scenario is seen in Goalpara district, particularly, in the block area.
Despite population explosion and contraction of arable land, technologies in agriculture have turned to be a boon for the farmers. Presently, by dint of government's support to acquire inputs, credit, crop insurance facilities and dissemination have impacted on the farmers' self sufficiency and surplus product. The traditional rice production has been replacing by the introduction of modern technique of production amidst the presence of traditional practices. Presently, the development block is in a pace of crop rotation, i.e., the practice of growing different crops in succession in the same plot of land mainly to preserve the productive capacity of the soil, to feed growing population and to compensate the land contraction.

Profile of Rangjuli TD Block

The geographical area of Rangjuli Tribal Development Block is 56700 hectare and its population is 109094 and they inhabit in 13964 numbers of households in 125 revenue villages, and its density of population is 550 per square kilometer (**census 2011**). The boundary of the block is Kamrup district in the East, Kuchdhowa development block is in the west, the river Brahmaputra and Kamrup district in the North and Meghalaya is situated in the South. Topographically, it is a blending of sub-hills of the foothills of Meghalaya and plains adjacent the Brahmaputra with soil type of red sandy and loamee.

Farming Practices and Average Yields of Rice

Since the size of operational holdings and cropping patterns have impact on average yield, so it is pertinent to make an insight to know the average yield of rice according to the distribution of operational holdings by the farmers for three categories of farming patterns. Table 1, shows the distribution of operational holdings, levels of technology used and average yields of rice produced by the sample households.

Table 1 Distribution of Operational Holdings, levels of technology used and Rice Production of Sample Households (Sample 125)

Block	No of farmers		Operational Area (ha)	Average size of holding	Area under mono cropping (ha)	Area under Rotation Cropping (ha)	Area under Traditional Cropping (ha)	Total output of rice (q)	Average yield (kg)
Rangjuli TD Block	Small	107	108.7	1.01	98.06	6.34	4.3	4332.26	3985.52
	Medium	18	45.9	2.55	34.08	11.82	00	2115.62	4609.19
	Total	125	154.6	1.23	132.14	18.16	4.3	6447.88	4170.69

Source: *Field Survey*

The table depicts the average size of holding of the households in the sample area and it is at 1.23 hectare and it is higher than the state average size of holding which is at only 1.1 hectare (**Agriculture Census Data, 2015-16).** The total operational holdings of the sample households of Rangjuli blocks are 154.6 hectare and the total product of rice is 6447.88 quintal. Out of the total sample area 132.14 hectare, 18.16 hectare and 4.3 hectare are under mono cropping, rotation cropping and traditional cropping practices respectively as seen in

the table with average yields of 4170.69 kg in Rangjuli TD blocks. The average yield of rice is higher than the state average yield of rice which is at 2176 kg per hectare[3], and even higher than the national average yields of rice at 2713 kg per hectare[4]. Higher levels of the use of technology including irrigation potentials, improved seeds and fertilizers used by the medium farmers resulted higher yields.

Use of Modern Implements: Farm Power Availability

Cropping patterns and allocation of operational holdings in association with the use of modern implements are crucial in raising productivity. Since, agricultural farm productivity depends on farm power availability; initiatives are taken by both state and central governments to increase farm power availability. Agriculture workers, drought animals, tractors, power tillers, diesel engines and electrical motors, solar powered motors, etc. are used as sources of farm power in agriculture. However, despite the initiatives such as Sub Mission on Agricultural Mechanization (SMAM) under the aegis of National Mission on Agricultural Extension and Technology in all states and Chief Minister Samagra Gramya Unnayan Yojana (CMSGUY), farm mechanization is in a very slow pace as seen in the field level. The aim of these schemes is to increase farm power availability, and presently, the state of Assam achieved farm power availability at only 0.97 kw/hectare, whereas, for India it is at 1.841 kw/hectare (**Govt. of Assam, 2023**). Table shows the status of farm power availability, i.e., the levels of the use of modern implements in the sample area.

Table 2 Use of Modern Implements in two Selected Blocks

Block	Farmer	Use of Power Tiller/Tractor (ha)	Use of Pump-Sets/Deep Tube wells/Solar powered Sources/powered Motor for Irrigation (ha)	Use of Simple Harvester (ha)	Use of Manual Sprayer (ha)	Use of Manual Weeder (ha)
Rangjuli	Small	103.84	15.76	2.81	98.34	27.63
	Medium	45.9	12.68	7.47	42.27	7.52
	Total	149.74	28.44	16.93	140.61	35.15

Source: *Field data*

Table shows the extent of the use of modern agricultural implements by the sample households. It is seen that modern tools like power tillers and tractors are used of the total sample area, whereas, comparatively, a higher coverage of area under these two items is seen in Rangjuli T.D. block. The government subsidy provisions for high value agricultural implements are higher in tribal blocks than the other counterparts. Rangjuli is itself a Tribal Development (TD) block. Therefore, the higher availability of such tools leads to low price causing higher use of machineries in Rangjuli TD block and a higher coverage of land indicates that the sample households have left the tradition of using drudgery of human beings and draught animals.

In regards to the use of irrigation potentials, the table shows that only 28.44 hectare area is under the use of pump-sets, deep-tube wells, solar powered sources or electric motors. These sources are only associated with the rotation cropping patterns which are usually planted in the seasons when rainfall is very low. Prevalence of the least rotation cropping patterns, adherence to the tradition of winter rice i.e., *Sali* cultivation is among the reasons for the low levels of the use of irrigation potentials. The meaning of rotation cropping has to confine to the patterns where *Sali* and *Boro* cultivation is practiced in two distinct seasons in the same plot of land in a year. Only 18.16 hectarel cultivated area is under rotation cropping patterns in the sample area. Further, this low level of the use of irrigation potentials is due to their association with watering seedbeds and summer rice, i.e., *Boro* cultivation only. Harvester machines are used only for 16.93 hectare area of cultivated land and the absence of large farm size is the reason behind the low use of harvester machines.

To know the input productivity of rice, the following section intends to analyze the production of rice in relation to the modern implements, i.e., in relation to the farm power availability. Table 3 shows the levels of the use of technology, equipped with the use of different machines, water, seeds, fertilizers, pesticides, etc. and physical output of rice and its money values in rupees of the farmers in the field level.

Table 3 Physical Output of Rice and its Money Values in Rupees

Block	Farm Size	No of household	Operational area (hectare)	Physical Output of rice (Quintal)	*Total Money value (Rs.)
Rangjuli TD Block	Small	107	108.7	4332.26	9206052.5
	Medium	18	45.9	2115.62	4495692.5
	Total	125	154.6	6447.88	13701745.0

Source: *Field data*

**The Money value was estimated by multiplying the physical output by the market value as reported by the farmers.*

The following shows that the input cost of (HL, MI. ISP, FP and MS) and total money value (Rs.) of rice production of 12292.07 quintal of 125 households from the area of 154.6 hectare valuing at Rs. 13701745/- only.
Cost of inputs of small and medium farmers of the block shown in the below table 4

Table 4 Inputs used and returns in terms of money in the sample area

Block	Sl no	Name of Input	Money Spent (Rs)				
			Small	Medium	Total	% of Total	Average Cost(Rs/ha)
Rangjuli Block	1	HL	1459622	616344	2075966	19.43	13428
	2	MI	1168236	513621	1681857	15.74	10879
	3	ISP	324057	142472	466529	4.37	3018
	4	FP	476753	223083	699836	6.55	4527
	5	MS	395826	171206	567032	5.31	3668
		Total	3824494	1666726	5491220	51.40	35519

(Figures in the bracket indicate the per cent of the total)

HL: Human Labour
MI: Tractor, Power tiller, Pump set, harvester, Hunker, Weeder, Sprayer, etc
ISP: Improved Seeds and Planting materials- like Planter, Liner and plainer tools, seed drill, etc
FP: Fertilizers and Pesticides
MS: Miscellaneous, like Fencing, watching, weeding, bamboo materials, carriage etc.

Table, shows input costs for five items, say HL, MI, ISP, FP and MS used by small and medium farmers in an area of 154.6 hectares Rangjuli blocks. The table shows that the cost incurred the total money spent for input like HL, MI, ISP, FP and MS are Rs. 5491220/-
Total profit of the farmers in Rangjuli TD block = 13701745 – 5491220
= Rs. 8210525/- only, it indicate that there is a positive relation in between mechanization and rice productivity in Rangjuli Tribal development Block. Agricultural mechanization leads to increase farm productivity.

Summary

i) Field study carried out almost all of the sample farmers used HYV (High Yielding Variety) seeds i.e. small and medium both of the farmers used HYVs.
ii) Farm size is very small, there is no large farmer. In the small size of land it is difficult of use of machines for farm practices. There are 107 small farmers and 8 medium farmer out of 125 of sample farmers in the block.
iii) The effective utilization of the potentials of these varieties has in general remain fairly limited so far on the other hand awareness among the farmers of the necessity of soil testing for batter farming has been found to be lacking in the general.
iv) Among the various media of the transmitting agricultural innovation, the agricultural extension services has been found to be most effective like radio, T.V. broadcasts.
v) Adoption of HYV seeds doesnot seem to have included large scale mechanization of farm operations in the block. Combine harvesting have not been found in the study. Mechanization of ploughing has also not made by significant in-road in the small farmers.
vi) Significant variation has been observed in the pattern of use of high yielding rice variation by sample farmers in the different rice growing season of the block.
vii) The farmers used the irrigation, specially, water pump set only for perpetration to seed bed widely in the winter rice (*Sali)* cultivation. During the summer rice (Boro) cultivation they fully used the pump sets and the deep tube wells.
viii) It is also found the few farmers in Rangjuli block used Boro seeds from locally (Traditional), which productivity is low compare to HYV seeds.
ix) The farmer produces rice to meet their own demand (consumption) not produce to commercial purpose. Sometimes they sold it to purchase their necessary commodities.
x) 97 per cent of the sample farmers used the modern implements in their farm practices i.e. tractor, power tiller, pump set, sprayer, weeder, harvester, etc. and 3 percent of the sample farmers used animal power, human labour, wooden plough etc. They prefer traditional methods.
xi) The sample farmers borrow money from non-institutional sources like, rich man, neighbors, and their relatives at high rate of interest. A lion share of their product has to pay as their loan amount.

Suggestions

1. Training in agricultural practices has an important role to increase agricultural productivity, use of modern implements and employment. A person receiving training in agriculture is less likely to be employed as unpaid family worker in agriculture.
2. In order to check further subdivision and fragmentation of agricultural land holding, law of inheritance should be received in such a way that non-cultivating inheritors of the family are debarred from owing the equal share of land with the cultivating inheritors of land.
3. The educated employed youth still in the rural area should be trained in innovating techniques of agriculture and also in processing the agricultural commodities to produce secondary output, transporting and selling such products in the market. The government should provide all necessary infrastructures like that of irrigation, roads and communication, marketing facilities, credit facilities etc. to develop small farmers.
4. Extension agriculture training programme should be lunched in order to train up all farmers literate or educated.
5. Necessary financial assistance should be provided to the actually needy farmers.
6. Lastly, rural integrated strategy for agricultural development should be formulated to develop the rural economy.

Note and References

Notes

1. www.agritech.tnau.ac.in>rice.....
2. Korhali- is a local term, means borrowing of cultivable land in certain terms and conditions and it is synonymous to contract farming but not for large scale of farming.
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