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Impact of Scientific Agricultural Technologies on Livelihood Security of Tribal Farmers in Assam

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Abstract

The study was conducted during December, 2019 to December, 2021 at Assam Agricultural University, Jorhat, Assam, india with an objective to examine the impacts of scientific agricultural technologies on tribal livelihood security. Ex-post-fact research design was adopted to collect data from 400 tribal farmers from four tribal dominated districts viz., Chirang, Kokrajhar, Dhemaji and Karbi Anglong of Assam. Impacts weremeasured in terms of Livelihood Security Index (LSI) and Livelihood Endowment Status (LES) developed by Abadi (2010). When assessed on the basis of LSI, overall 31.00% shift was observed in case of beneficiary tribal farmers on before and after basis. LES was assessed comparing the beneficiary tribal farmers with non-beneficiary tribal farmers and the data revealed significant difference of 26.00% between the two groups. However, it was evident from the investigation that time gap in input supply, non-availability of suggested inputs locally after project period, high cost of inputs, lack of own capital to maintain the enterprises, difficulty in maintaining accounts etc. were the foremost problems faced by majority of the respondents.

Keywords: Livelihood endowment status, livelihood security index, tribal livelihood

1. Introduction

Tribe, a word to refer the twelve tribes of Israel, was first used in 12th century Middle English-literature. From old French tribu, meaning one of the three territorial groups that united to form Rome, the Middle English word for tribe is derived from Latin tribus. The term *tribe*, however, finds its way into use with various contexts in today's world. In India, a wide range of social groups and communities at different levels of the social formation are considered as *tribes*. Indian tribes are termed as 'Scheduled Tribes' (ST) for the first time by Simon Commission in 1928. STs of India have special notation as polities that have been granted legal recognition and limited autonomy by the constitution. The tribal population of the country as per the 2011 census, is 10.42 crore constituting 8.6% of the total population and 11.3% of total rural population. More than 87.0% of the country's tribal population is confined to 11 states of the country. In Assam there are as many as 23 tribal communities are found contributing 12.82% to the total population of the state (Census 2001). Tribes are marginalized segment of the Indian population (Roy, 1989) and in all indicators of living conditions and household assets, are placed at the lower end (Chaube, 1999; Hanumantha and Grover, 1979). Tribal livelihood continue to depend on agriculture, which is still underdeveloped due to factors like use of poor quality seed; conventional intercultural operations; poor harvest and post-harvest management; poor market intelligence and underdeveloped livestock sector etc. (Anonymous, 2015, Devi et al., 2015, Lawania and Gupta, 2015, Sharma et al. 2020, Medhi et al., 2020 and Patel et al. (2023). In order to make agri-based livelihood among tribal farmers stronger and more sustainable, there is a need to improve and accelerate the contributor variables of livelihood (Islam et al., 2015, Kumar et al., 2015). However, the need for targeted interventions to improve the livelihoods of tribal farmers and strengthen their agricultural activities has been focused by the challenges of modernity. Sustainable agriculture is one of the cornerstones of livelihood security and income generation in tribal communities (Patidar et al., 2018, Kumar et al., 2016).

In this context, the Tribal Sub Plan (TSP) emerges as a pivotal initiative, designed to address the unique needs and challenges faced by tribal communities in Assam. Improving tribal agriculture through technological interventions in order to provide more opportunities for livelihood is one

of the key areas within the TSP. Where interventions for promoting livelihood of tribal farmers refers to conscious effort by an agency or an organization to promote and support livelihood opportunities, the Assam Agricultural University (AAU), being the premier institution of Assam (India), has been assisting tribal farmers with need based and location specific technologies since long. One such initiative is the implementation of the projects "Promotion of Agriculture Centric Sustainable Livelihood Security for Tribal Farmers of Assam" during 2013–14 in 7 tribal dominated districts of Assam. This research paper aims on an exploratory journey, seeking to examine the impact of scientific agricultural technologies under the tribal agriculture development project on livelihood security of tribal farmers. Problems faced by the beneficiary farers in effective implementation of the project as well as adoption of the recommended technologies were also studied. This research employs a combination of qualitative and quantitative methodologies to comprehensively assess the impacts of the project. This study aims to provide useful insight into the discussion of integrated development policy through a review of the plan's effectiveness in raising agricultural productivity, boosting capacity and promoting sustainable farming practices among tribal farmers.

2. Materials and Methods

Ex-post-fact research design was adopted for the present study. Under TSP, the Assam Agricultural University, Jorhat, Assam, India implemented the projects "Promotion of Agriculture Centric Sustainable Livelihood Security for Tribal Farmers of Assam" during 2013–14 in tribal dominated districts of Assam through Krishi Vigyan Kendras and Regional Research Stations. At first, data was collected from headquarter to see the number of extension activities conducted in each district under the project. From the available data, four districts viz., Chirang, Kokrajhar, Karbi Anglong and Dhemaji, where maximum numbers of extension activities were conducted in last three years, were selected for the present study. A total of 200 beneficiary tribal farmers from the four districts were selected following proportionate random sampling technique. Further, by following match sampling technique, 200 non-beneficiary tribal farmers were selected as control group of respondents from the same districts. The data were collected with the help of research schedule by personal interview method. Impacts of the project towards agriculture centric livelihood security of the tribal farmers was measured using Livelihood Security Index (LSI) and Livelihood Endowment Status (LES) developed by Abadi (2010). Livelihood Security Index (LSI) was measured on before-after basis in terms of seven (7) parameters i.e. Food security, Occupational / financial security, Habitat security, Educational security, Social security, Health security and Environmental security. And Livelihood Endowment Status (LES) was measured comparing the beneficiary and non-beneficiary tribal farmers in terms of six (6) parameters i.e. Natural capital, Human capital, Physical capital, Economic capital, Social capital and Financial capital. To examine the problems faced by the beneficiary tribal farmers in effective implementation of the project and adopting recommended practices an open ended interview schedule was used. Respondents were requested to mention atleast 10 major problems faced during and after the project. The responses were then edited for uniformity before analysis. Finally, problems were arranged in descending order on the basis of percentage of the respondents reporting.

3. Results and Discussion

Assistance were provided to tribal families through a variety of programmes including Front Line Demonstrations (FLDs), trainings and other extension activities like filed days, exposure visits, animal health camps. Custom Hiring Centres (CHCs) were also established as institutional arrangement under the project in respective districts to promote mechanization and modernization of tribal agriculture.

3.1. Impacts of scientific agricultural technologies on livelihood security of the tribal farmers

The impacts of scientific agricultural technologies under the project on livelihood security of the tribal farmers was measured in terms of Livelihood Security Index (LSI) and Livelihood Endowment Status (LES).

3.2. Livelihood Security Index (LSI) of beneficiary tribal farmers

The livelihood security parameters was assessed on before and after basis and overall 31.00% shift in 6 dimensions i.e. Food security, Income security, Habitat security, Educational security, Health security, Social security, Environmental security was observed in case of beneficiary tribal farmers (Table 1). The calculated "t" value for the shift was 50.499 and found significant at 5% level of significance. Among seven components of Livelihood Security Index (LSI), a significant shift of 68.00% was observed in Occupational/financial security after becoming beneficiary of the project among the tribal respondents. Financial security was assessed on the basis of income generating from sale of produces, reduction in cost of cultivation and increase in production and also whether the income was seasonal or regular basis. This indicated that the tribal farmers with low income from farming due to limited awareness on scientific agricultural practices, non-availability of quality inputs and technical assistance, are now having enough production and income on regular basis after getting assistance from the project in the study area. Second highest shift was seen in Social Security with a significant shift of 63.00% from 11.00% before participating as a beneficiary of the project. In case of Environment Security, significant shift of 23.00% indicates a positive impact of the project in this aspect. The index was 0.27 before participating in the project, which was found to be 0.50 after the project. Food Security aspect had shown existence of a satisfactory level in the study area. Food security was assessed on the

Table 1: Comparison of components of Livelihood Security Index (LSI) of beneficiary tribal farmers with mean index on before and after basis

Components	Mean index			"t" value
	Before (n=200)	After (n=200)	Shift	
Food security	0.53	0.65	0.12	9.693**
Occupational / financial security	0.12	0.80	0.68	34.249**
Habitat security	0.75	0.82	0.07	9.097**
Educational security	0.41	0.55	0.14	8.882**
Social security	0.11	0.74	0.63	25.103**
Health security	0.55	0.65	0.10	6.042**
Environmental security	0.27	0.50	0.23	24.150**
Overall	0.37	0.68	0.31	50.499**

***, ** and * are (p=0.01), (p=0.05) and (p=0.1) level of significance, respectively

basis that whether sufficient and quality food were available to the family throughout the year. Queries were also made to assess whether balanced food for the family is affordable with the income throughout the year. Data reveals that before getting assistance from the project the index was 0.53, which become 0.65 on after getting associated with the project as beneficiary. Facilities for a standard living were considered under the Habitat Security and found a small but significant shift of 7.00% on after situation than before. Beneficiary tribal farmers were found to have basic facilities like electricity, water supply, sufficient dwelling space, transport facilities before the project with an index of 0.75 which was found to become 0.82 after the project. The project under study was assumed to have indirect impact on Educational Security of the tribal households. Under the Education security component queries were made to assess whether respondents had positive attitude for need of educating their children. Also to assess whether education was affordable to the household with existing income. Data revels that there was a significant shift of 14.00% in this aspect after the project. As per the report, the profit earned helped the beneficiary tribal farmers to ensure education for their children. The project under study was assumed to have indirect impact on Health security of the tribal households. Hence, health security was another component with a positive shift of 10.00% from score of 0.55 before to 0.65 after situation of the beneficiary tribal respondents under study.

3.3 Comparison of components of Livelihood Endowment Status (LES) of beneficiary farmers with non-beneficiary farmers

Livelihood Endowment Status (LES) was assessed comparing the beneficiary tribal farmers with non-beneficiary tribal farmers in the study areas. To test the significance of difference between mean Livelihood Endowment Status (LES) scores of beneficiary and non-beneficiary tribal farmers, Z-test for independent sample means assuming the populations to be normal was used. The distribution of beneficiary households on LES revealed that 59.00% of tribal household under each component attained a high level of Endowment Status compared to non-beneficiary (33.00%). Data reveals that there was a difference of 26.00% in overall Livelihood Endowment Status (LES) between two groups in the study areas (Table 2). The calculated Z value was 27.361 and found significant at 5% level of significance. Land was considered under Natural capital. Whether new land was purchased or existing land was improved for farming was considered in this regard. Significant difference (24.00%) was seen between beneficiary and non-beneficiary group of respondents in this aspect. Physical capital formation shown a significant difference (7.00%) between beneficiary and non-beneficiary group of respondents with mean LES score 0.51 and 0.44, respectively. Regarding Financial capital, the beneficiary group of respondents were found to have a mean score of 0.67 compared to non-beneficiary tribal farmers with a mean score of 0.31. The difference between the groups of respondents i.e. beneficiary and non-beneficiary was 36.00%. Beneficiary tribal farmers were found to have year round income generating activities with profit that could be invested for another enterprise or up scaling the existing enterprise. This was might be due to the fact that cost of production reduced with judicial use of inputs and also due to input *i.e*.

Table 2: Comparison of components of Livelihood Endowment Status (LES) of beneficiary farmers with non-beneficiary farmers with mean index

Components	Mean index			Z value
	Non-Beneficiary (n=200)	Beneficiary (n=200)	Difference	
Natural capital	0.18	0.42	0.24	8.969**
Physical capital	0.44	0.51	0.07	6.817**
Financial capital	0.31	0.67	0.36	17.849**
Human capital	0.67	0.86	0.19	14.727**
Social capital	0.34	0.65	0.31	18.039**
Political capital	0.02	0.41	0.39	12.382**
Overall	0.33	0.59	0.26	27.361**

***, ** and * are (p=0.01), (p=0.05) and (p=0.1) level of significance, respectively

seed, piglet, chicks produced for next year production. Basic facilities for a standard living i.e. access to education, health and hygiene provision, electricity, safe drinking water were considered under Human capital component. The index was found to be 0.67 for non-beneficiary and 0.86 for beneficiary tribal farmers. There was a significant difference of 19.00% was found in this respect. Social Capital formation was also on higher side in case of beneficiary tribal farmers (LES=0.65) compared to non-beneficiary tribal farmers (LES= 0.34). This was might be due to the fact that beneficiary farmers were organized in groups for inclusion in the project in most of the cases. Political capital formation evaluated whether tribal farmers were empowered to take part in planning, implementation and monitoring-evaluation of development projects in their locality. The index was found very low in case of non-beneficiary farmers (LES=0.02) indicating negligible participation of non-beneficiary farmers in any project meant for tribal agricultural development. Whereas, in case of beneficiary farmers, the index was 0.41 indicating comparatively good status of participation in project planning, implementation and monitoring-evaluation.

The findings of the study are in line with works reported by Kamaruddin and Samsudin (2014), Datta et al. (2017), Barela et al. (2018), Girish et al. (2020), Mishra and Debata (2021), Mir et al. (2023), Manikanta and Satpathy (2023) and Gautam and Jha (2023), Patel et al., 2023, Sangpuii and Malhotra (2016). These studies opined that Livelihoods Indices are useful tool in assessing the livelihood elements of the rural poor households with special reference to tribal farmers. Studies reported positive impact of different interventions for agricultural development on tribal livelihood security. Thus, to meet the tribal agriculture development goals, respective agencies should bring more vulnerable people into the development network to ensure options for livelihood security.

3.4. Problems faced by the tribal farmers in adopting recommended practices

The project aimed at improving livelihood of the tribal farmers by encouraging them to take agriculture on commercial scale. The change in livelihood security and wellbeing may be attributed to the efforts made by the project so far in the study areas. Numbers of beneficiaries are turning into successful entrepreneurs and also creating employment opportunities for others. The project could give good profit to many beneficiaries, but as per expectation, the momentum for entrepreneurship development is yet to come in those areas. Even though the project imparted skill trainings and demonstrations for improving the capabilities of the tribal farmers on scientific farming, the enterprises could not provide them year round income in some cases. Tribal households with limited resources and skill were found to earn less. Farmers were found to adopt crop varieties and animal breeds, but in some cases lack of interest for planting material, seed, piglet and chicks production has been observed. Some farmers with entrepreneurial zeal and spirit could manage to upscale their enterprises and now running units for selling piglets, chicks, paddy seeds etc. While the causes of not cent per cent success were evaluated, one of the major causes was found as poultry and pig breed given by the project side reported to have comparatively less market demand in tribal areas (Table 3). This is due to size and meat quality of the animal or bird, as per report of the respondents. Likewise, lack of interest of tribal farmers on planting material/ seed/ piglet/chicks production is due to the fact that seeds, chicks and piglets need to be maintained for a specific period to get market which demands time, space and maintenance cost. As a result, shortage of quality planting materials especially in case of fruits, improved breeds of livestock in case of Pig, Goat, Poultry etc. and quality fingerlings were felt every year. Hence, every year the project had to rely on outside agencies for input supply causing time lag in input supply to the farmers. Beneficiaries further reported non-availability of suggested inputs e.g. varieties/ breeds locally once the project period is over. And these factors all together affect their adoption decision.

Again, in most of the cases it was seen that amongst other critical inputs, feed for animal was reported to be not available after the project period. At the same time, it becomes costly to procure feed from town areas in small qualities (Table 3). The

Table 3: Problem faced by the beneficiary tribal farmers in effective implementation of the project and adopting recommended practices

Sl. No.	Problems	Frequency (Percentage)
1.	Input supply was not timely for most of the cases	198 (99.00)
2.	Non-availability of suggested inputs e.g. varieties/ breeds locally after project period	197 (98.50)
3.	Dominance by few local individuals	196 (98.00)
4.	Lack of irrigation facilities	195 (97.50)
5.	High cost of inputs like feed for animal and birds	190 (95.00)
6.	Difficulty in maintaining accounts	180 (90.00)
7.	Comparatively less market demand in local markets for poultry/pig breed given by the project side due to size and meat quality	150 (75.00)
8.	Less technical assistance after the project period	145 (72.50)
9.	Uncertain return from agricultural enterprises	98 (49.00)
10.	Transfer of the scientific staff from KVK/RARS creating problem in rapport building	97 (48.50)

cases of success, on the other hand it could be seen that tribal farmers producing feed at their own farm with available raw materials for the animal and birds and thus could successfully upscale their units. Another major problem faced by the project staff was excessive dependency of the tribal farmers on free aid from project and lack of awareness among the farmers regarding developmental projects operating under participatory mode like project under TSP. This issue is again related with non-availability of active farmer's organization at village level creating problem in implementation of the works and also causing conflicts during decision making in groups constituted for project implementation purpose.

Similar results were also found by Devi et al. (2015), Onyekuru et al. (2020), Barela et al. (2018) and Barua (2013) stating that scarcity of quality seed, its timely unavailability, non-availability of quality seed of adopted varieties, high input price, involvement of the middle-man in input distribution, huge capital required for the investment, inadequate extension services, high cost of feed, poor farm management, insufficient credit facilities and subsidies etc. were the challenges before tribal farmers in process of adopting recommended technologies under study.

4. Suggestions

The study revealed that Assam Agricultural University had strong policy intent and planned investments for development of tribal agriculture in Assam under the project. However, strategies need to be formulated for further refinement of projects aimed at tribal agriculture development in the study areas.

• The impact of the project in terms of livelihood security and capital formation reveals that after getting assistance from the project, a significant proportion of the beneficiary tribal household under each livelihood dimension attained a high level of livelihood security. Further interventions may be given in tribal areas for capital formation and infrastructure development for self reliance.

• Individualized programming for crop production and livestock rearing as per scale of operation to ensure the efficiency in use of resources may be encouraged. Further capacity building on farm management including accounting and farm budgeting is recommended.

• Promotion of registered farmers companies for production of seeds and piglets/chicks may be done. Adoption of a new variety and breed by farmers is mostly determined by supply of seeds/piglets/chicks in adequate quantities from reliable sources. Hence production of critical inputs through farmer producer's groups at sub-division level or district level, at maximum, may be institutionalized.

• The tribal areas, under study used to face the problem of the non availability of quality DOC of poultry breeds and seeds for fisheries at the right time every year once the assistance is withdrawn. Hence establishment and capacity building for hatcheries with power supply for both poultry birds and fish is recommended for self reliance and sustainability.

• Capacity building on balanced feed production at farm need to be done. In pig and poultry production, one of the major constraints faced in tribal areas is the unaffordable price and non availability of feed in local areas. Successful cases revealed that piggery for piglet production and meat purpose were successful where balanced feed was produced locally at farm level with available raw materials. Therefore, capacity building of tribal farmers on balanced feed production along with providing starter feed along with the piglets and chicks may be a step for self-reliance.

• Popularization of low value crops. Tribal people have special affinity towards traditional crops and livestock breeds. Hence, traditionally grown low-value crops, local animal breeds may be conserved, studied and demonstrated for up scaling. Therefore, policy interventions may be given to develop package of practices of those low value crops, value addition and create market.

• Insurance of crops and animals. Limited awareness and zero benefits from crop and animal insurance were seen in the study area demanding a policy intervention in this regard.

• Focused vertical expansion as well as horizontal expansion of the technologies. There were limited farmers who continued and expanded the recommended enterprises for commercial production when compared with efforts made by the project side. Successful individuals with entrepreneurial spirit need to be identified first and then has to be trained on management skills for further development. Hence, this number can go up with stratified targeting. With horizontal expansion of new and new areas, more such individuals may be identified and trained. Then those successful entrepreneurs may be grouped, irrespective of village or sub-division, in to FPC on particular enterprise. Next level assistance may be provided to the groups so that farmers feel that there are significant benefits due to adoption of recommended enterprises. Focus on vertical expansion of the seed production of varieties and piglet/DOC production of pig/birds in tribal areas where input procurement after the project period is a constraint, along with than horizontal expansion of technologies in new areas may help in self sustainability of such efforts in tribal areas.

• Recognition of scientific minds among tribal farmers. It was observed that some of the tribal youths reinvented the technologies to make them user friendly and also in some cases to support the main technology while up scaling their enterprises. These may be new machinery, modification in the machineries, incubator with locally available materials, an instrument and/or a scientific process. These innovations may be validated for betterment and the scientific minds may be recognized to encourage the innovative minds.

5. Conclusion

The project aimed at improving livelihood of the tribal farmers

is benefitting many beneficiaries to ensure livelihood. Both LSI and LES of beneficiary tribal farmers showed a significant shift. Thus, the project has improved the livelihood parameters of beneficiary tribal farmers over the non-beneficiaries in the study area. However, time gap in input supply, non-availability of suggested inputs locally after project period, high cost of inputsetc. were the foremost problems faced by majority of the respondents..

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