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ALTITUDE EXTENSION: THE DIFFERENTIAL AGRO-ECOLOGY FOR SHAPING EXTENSION STRATEGY

Victoria Devi Ch *., Adhikary M M and Acharya,S K

Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya, Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal

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A B S T R A C T

The onset and growth of extension strategy has so far been in a response to the socio-economic milieu across the World. Extension education, by becoming both system and function for technology socialization, can't go without geographical references. With a change of altitude and slope, the panorama of biology and sociology keeps transforming. What is happening since past and till today is a kind of blanket extension recommendations is being made to cover all geographical variations along and across the slope or terrains in a given hill ecosystem. The entire slice of the research in Manipur, a small state in North East India has divided the terrain into high, medium and low altitude in three selected districts to elucidate the altitude specific factors impacting on the crop stands, yield behavior, attitudinal behavior, technological options and market responses etc. With this innovative approach, Altitude Extension, the first of its kind in extension domain, has attempted to include the variations along with the altitude of a hill ecosystem in designing the extension approach. The altitude extension thus will add a new dimension of hill development by encompassing variations with altitudes in the livelihood, culture, biodiversities what we may term, as the Altitude Extension.

INTRODUCTION

The unique topography and terrain of North East (Manipur, in the study) have provocated the inquisitive minds to set off a study on altitude based extension approach and variability. While there have been changes of biodiversities with the change in altitude, there should have been a change of socio-cultural practices with the change of altitude too. It would critically analyse the unique flow of information, the texture of praxis, the curve of enthnobotanical configuration and the enterprise mixes including crops, animals and birds enterprises. However, due to hilly terrain, erratic climatic conditions and shortage of trained manpower, the full potential of these resources is underutilized. Also, severe soil erosion, water scarcity during dry season, fragmented land holding and sloppy terrains are some of the major bottlenecks for mechanized farming.

Extension education, by becoming both system and function for technology socialization, can't go without location specific references. With a change of altitude and slope, the panorama of biology and sociology keeps transforming and hence, the altitude of a hill becomes a major character itself in deciding on strategy of extension for a synergy of geography with extension policies. What is happening since past and till today is a kind of blanket extension recommendations is being made to cover all geographical variations and social scores, along and across the slope or terrains in a given hill ecosystem.

The North East Hill eco system of India is blessed with bounty of nature and is one of the hot spots of the World. Altitude extension, the first of its kind in extension domain, has attempted to study the variations along with the altitude of a hill ecosystem in designing the extension approach with social, technological, and cultural variants. In this research and with this innovative approach, an empirical study had been conducted to find out the variations with the change of altitude, for ultimately designing a both gross and subtle extension plan for desired changes in the agriculture of hill ecosystem.

Objectives of the Study

1. To study the biophysical and social characteristics with reference to differential altitude in hill eco-system.
2. A comparative analysis on the differential farming system as relevant to respective extension approaches, concepts and dynamics
3. To derive some policy application as applicable to make an altitude extension a reality of approach and a success to attain sustainability.

METHODOLOGY

The research work was based on three districts of Manipur, a small state in the North East India. Data were collected from the plain areas, medium lands and high lands, covering different districts in various aspects of agriculture, the social, cultural and traditional lives of different ethnic groups in these places were studied. The districts of Manipur selected for the study were Ukhrul district (high altitude, 3,114 m

above MSL), Tamenglong (medium altitude, 1,451m above MSL) and Thoubal (low altitude,790 m above MSL).Two villages from one sub-division from each of the district were selected. The particular study was given more emphasis on the farming system and enterprise the farmers practiced as a source of their income, as it is the only scope for self employment and sustainability possible with the present scenario of North East India.

Data were collected using two types of schedule i) Village Schedule and ii) Household schedule. **The village schedule** tried to gather authentic data regarding the village. Information such as basic population data, ethnic groups in the village, village organization, land use, soil fertility, festivals related to agriculture, biodiversities, ITK (Indigenous Technical Knowledge) and TEK(Traditional Ecological Knowledge), migration in the village, job and wage related information, information on individual beneficiary oriented programmes, data on education including physical facilities, health, different development programmes, common property resources, etc. Pilot study was done by Key Informant focused group Interview. And Village schedule were completed by transact walk, brainstorming session and participatory rural appraisal methods. **The household schedule** tries to capture different dimensions of socio-economic variables like age, current educational status, source of income, family income, employment, enterprise practice, occupation details, land and other assets, ownership of productive and other assets, livestock details, housing status, rural indebtedness, and expenditure, and skill training, participation, access to media and communication and some situational variables of the household like Biodiversity index, Carbon sequestration from the household garden etc.

Data on household schedule is collected by visiting the farmer's house or farmers' farms/enterprise site of the farmer by using personal interview method during their leisure time. All the collected data for the selected variables/parameters were compared. And the situations of these three altitudes were compared.

RESULTS AND DISCUSSION

Location specific, suitable and profitable enterprises were found out in all the three altitudes and further suitable recommendations were given for different situations according to altitudes involving agricultural crops, legumes, grasses, fruit plants, flowering and medicinal plants, vegetables, livestock, etc. With the support of local natural resources. Sericulture, apiculture, fishery, flowering and medicinal plants, vegetables as component of agro forestry systems have great potential in the selected study area because of its specific environment conditions and several micro situations.

The ANOVA technique was used to test the variation in net income on different enterprises due to difference in the altitudes as shown in the following table:

Table 1 Anova technique to test the variation in net income of rice cultivation in the three altitudes viz. High, medium and low

Net income on rice					
Source	**SS**	**df**	**MS**	**F**	**Sig.**
ALTITUDES	3021000000	2	1510000000	71.88	0.00
Error	1492000000	71	21010000		
Total	25260000000	74			
Corrected Total	4512000000	73			

Here, **SS** - Sum of Square, **df**- Degree of Freedom, **MS**- Mean sum of Square, **F**-F test

Duncan Multiple Range Test

Altitudes	**N**	**Subset**				
		1	**2**	**3**		
High, Hill	18	7499.06				
Medium	19		1.39E4			
Low, Plains	37			2.27E4	**B (middle)**	13900 (medium altitude
Sig.		1.000	1.000	1.000	**C (lowest)**	7499.06 (high altitude)

Ten different enterprises were seen to be practiced in the three different altitudes as shown below:

Table 2 Range of highest income of each enterprise and their suitable altitude

Enterprises	**Highest income in which altitudes**	**Range of income in the highest income area(Rs)**	**Maximum farmer practicing**
V1- Rice	Low land	15,512-35,600	37 in Low land
V2-Vegetable	Low land	15,004-35,167	53 in Lowland
V3-Fishery	Low land	13,700-45,359	14 in Low land
	High land	69,00-17,937	14 in High land
V4-Cattle	Low land	12,300-35,256	19 in Low land
V5-Poultry	Low land	12,700-30,700	27 in Low land
V6-Piggery	High land	15,783-34,891	40 in Medium land
V7-Beekeeing	Medium land	6,234-9,562	10 in Medium land
	High land	10,794-15,964	10 in High land
V8-Sericulture	Low land	4,759-10,000	7 in Low land
V9-Horticulture	Medium land	20,458-56,432	26 in Medium land
V10-Forestry	High land	29,603-38,952	23 in High land

Special focus should be given on Farming System Approach (FSA), Agro forestry, Agri-horticulture, Silvipasture, Animal husbandry, etc for livelihood security and sustainable agriculture in the selected area particularly and in North East as a whole. Tree based multistoreyed agro forestry, sericulture based agro forestry, apiculture based agro forestry, horticulture based agro forestry involving agriculture crops, legumes, grasses, fruit trees, flowering and medicinal plants, vegetables, livestock, etc. have great potentials for employment generations.

Efforts should be made to formulate an area specific differentiated strategy taking into account the agronomic, climatic, socio-economic practices as well as the resource worthiness of the farmer as one most important challenge to policy makers is to understand the environment in which the farmer operates and the incentive to which he responds.

Altitude extension, the first of its kind in extension domain, has attempted to study the variations along with the altitude of a hill ecosystem in designing the extension approach with social, technological, and cultural variants.

The goal depends on creative and innovative conservation, restoration and production practices that provide farmers with economically viable and environmentally sound alternatives or options in their farming system.

Differential Indigenous Farming System Modules with Spatial Reference to Altitude

Some techniques and practices which can enhance production by modifying and utilizing the existing practices without disturbing the ecology are given in the Table No.3 Special focus should be given on Farming System Approach (FSA), Low External Input Sustainable Agriculture (LEISA), Agro forestry, Agri-horticulture, Silvipasture, Animal husbandry,

Table 3 Some indigenous integrated farming system module that can be applied in the three studied areas, high altitude, medium altitude and low altitude for profitable and sustainable agriculture

For High Altitude, Ukhrul District (temperate zone)	Brief Description
Agri-silviculture:	
1. Pine trees with field vegetable crops.	Pine (Pinus *kesiya*) with pea, radish, potato, sweet potato, cabbage, turnip, cauliflower, mustard and maize.
2. Vegetables as main crop and trees	Poplar, Willows, *Ailanthus, Salix* with maize, tomato, chilly, knolkhol, peas, cabbage, onion, cauliflower, garlic, ginger, turmeric, etc.
Horti-agriculture:	
3. Plums and vegetables.	Plums with pea, radish, cabbage or cauliflower. Trees scattered on field bunds
4. Apple with field vegetable crops	Apple+ potato, apple+ vegetable, apple+tomato
Horti-silviculture:	
5. Fruits as main crop and trees.	Poplar, willow, *Robina, Ailanthus,* apple, cherry, peach, almond, walnut.
Horti-agri-pasture	
6. Pears with vegetables/broom grass	Pears with cabbage, cauliflower, beans or broom grass
Horti-silvi-agriculture	
7. Fruits with grass and vegetables	Poplar, willow, Ailanthus, apple, cherry, peach, pear with potato, beans, knolkhol, onion, cabbage, cauliflower, peas, garlic, turmeric.
FOR MEDIUM ALTITUDE, TAMENGLONG DISTRICT (semi temperate zone)	**BRIEF DESCRIPTION**
8. Horti-silviculture:	Alder (*Alnus nepalensis*) and Chilloni (*Schima wallichi*) with large cardamom
9. Chilloni +pineaaple	Chilloni (*Schima wallichi*) with pineapple
Agri-silviculture	
10. Chilloni with crops	Chilloni (*Schima wallichi*) with ginger and turmeric
11. Jhum and bun cultivation	In shifting cultivation, selected trees are left to grown and vegetables and crops are grown in intimate mixture as intercrops and on raise bed(buns)
12. Agriculture with alder	Alder on field margins with maize, potato, chillies, Colocasia,etc.
13. Muti-purpose trees on crop lands	MPTS such as *Prunus cerasoides, A. nepalensis, Ficus, Schima wallichii, Artocarpus, bambusa, Gmelia arborea, Morus alba,* banana,etc are scattered on bunds, terrace risers and field boundaries.
Silvi-pasture:	
14. Chilloni/pine with broom grass	Broom grass are cultivated under the trees of pine and Chilloni
Agri-silviculture:	
15. Apiculture with trees	Tasar silkworm rearing on the leaves of oak(*Quercus spp*.) and mulberry plants on terrace risers, muga on Som(*Machllus bombycins)*
Horti-agriculture:	
16. Oranges with field crops	Intercrops such as maize-wheat; maize+ ginger+ buchwheat +pulses + rice beans: maize+sweetpotato+ radish+beans are grown in orange orchards.
17. Oranges with pineapple and vegetables	Oranges with pineapple, beans, radish, turmeric, cole crops
Multi-storied:	
18. Arecanut based system	Arecanut + pineapple+ betelvine+ blackpepper. This can be done on degraded soi with bamboo drip irrigation
Tree garden and homestead:	
19. Fruit trees in kitchen garden and farm boundaries	Tree tomato(*Cyto maddra betacea*) guava, banana and Moringa grown in kitchen garden and farm boundaries.
FOR LOW ALTITUDE, THOUBAL DISTRICT(semi temperate to subtropical zone)	**BRIEF DESCRIPTION**
Horti-silvi-pastoral:	
20. Mixed land use	Arecanut+ blackpepper+pineapple, Bamboo+ broom grass+ *Schima wallichi* , Broom grass+ tapioca+ sweet potato
Horti-sitviculture:	
21. Fruit trees on degraded land	Jackfruit + pineapple, arecanut+ jackfruit+ betelvine
Home gardens:	
22. Intensive integration of MPTS	(Albizia, Jackfruit, Banana, Papaya, Arecanut) with annual crops and livestock.
Small production systems:	
	Silkworm rearing, livestock, honeybee and fish-production in and around homestead
	Livestock + Poultry+Fodder is very profitable in plains of Manipur including Thoubal. Poultry + Groundnut is a very profitable enterprise in Thoubal district.

etc for livelihood security and sustainable agriculture in the selected area particularly and in North East as a whole. According to Leagans, 1980, "Technology has no inherent value in itself and no value to society until it is applied for the purposes for it was created.

The central question is what kind of delivery systems and policies are needed to bring positive impacts." And what is happening since past and till today is a kind of blanket extension recommendations is being made to cover all geographical variations and social scores, along and across the slope or terrains in a given hill ecosystem. While there have been changes of biodiversities with the change in altitude, there should have been a change of socio-cultural practices with the change of altitude too. So, same application of technology should not be done without studying the livelihood pattern and situation of the place.

The fact that traditional farmers have little education does not mean that they are unintelligent. So, in order to understand the livelihood pattern and the situation of a place, efforts should be made to involve the farmers and extension plan for application/transfer of any new technology should be planned. Moreover, anything drastic will not be accepted by the farmers. So, new approaches should synergize with the local traditional knowledge. One most important challenge to policy makers is to understand the environment in which the farmer operates and the incentive to which he responds.

Planners and implementers need to decide which path to follow. Rational conclusions are based on determining whether local traditional knowledge would contribute to solve existing problems and achieving the intended objectives. In most cases, a careful amalgamation of indigenous and scientific knowledge would be most promising, leaving the choice, the rate and the degree of adoption and adaptation to the clients.

In this research and with this innovative approach, the altitude variances were being associated with change in farming system, options of indigenous technology, the income and livelihood generating from a micro farming system. The altitude extension thus will add a new dimension of hill development.

CONCLUSION

After realizing all the inappropriate planning, deforestation, improper cultivation on hill slopes, over exploitation of available natural resources and the prevalent shifting cultivation are all collectively responsible for land resource degradation. As a result there will be no other option but to intensify agricultural activities on lands with lower soil fertility levels which are highly vulnerable to degradation. The major challenges would be to develop agricultural practices and devise management strategies for optimizing productivity without resource degradation on such lands with due consideration of the social, economic and cultural aspects. The priority should be given to techniques and practices that can enhance production without damaging the environment. Existing practices/systems which degrade the land and the newer management practices would need to be integrated holistically to improve the living standards and economic status of the low, medium and high altitudes people and arrest the land degradation.

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