ECONOMICS OF HILL FARMING SYSTEM WITH SPECIAL REFERENCE TO FEASIBILITY AND CONSTRAINTS IN PRODUCTION OF ORGANIC COMMODITIES IN MEGHALAYA, INDIA

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Abstract

Meghalaya is one of the most promising states within NEH Region as far as the organic farming potential is concerned. To transform the organic potential to reality, there is a need to conduct systematic study on the financial viability of growing these crops. Estimation of comparative economics between organic vs inorganic is essential to take rational policy decision to carry forward the organic farming movement in the hilly region of the state. Present study has been undertaken with the following objectives in Meghalaya; first, to examine the socio-economic characteristics of farmers practicing organic agriculture in Meghalaya, second, to examine and compare (organic vs inorganic) the economics of high value commodities that have potential to be grown organically; third,; identification of the factors that are influencing farmers to practice organic agriculture and finally, to examine the constraints of organic farming in the region. Results analysed in the present paper indicated that several crops has the right potential to be grown as organic as far as their financial viability is concerned. However, the practice of organic agriculture in Meghalaya is not demand-driven rather it is their compulsion or natural way of farming considering the difficult terrain in the hilly tract and very weak market linkages. Therefore, organic by default would not be sufficient to transform present farming system to organic farming system as desired. Organic food production should be promoted only for specific crop (turmeric, ginger, pineapple, khasi mandarin and cashew) in specific areas having favourable economics. The most important step required is to establishment of market linkages (which is the pre-condition for its success) with the farmers. Pricing policy of the organic product along with extending support of remunerative price and promotion of contract farming is essential either through public or public-private partnership.

INTRODUCTION

The definition of organic agriculture is proposed by the Food and Agricultural organization (FAO) as "…a holistic production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of on-farm inputs rather than off-farm inputs". More recently, the world retail market of organic products is growing very fast and the growth rate up to 10 percent in different countries of the world.

World-wide the area under certified organic agriculture has been estimated to be around 69 million hectares as of 2012. Global turnover with organic products was estimated to be over 63.8 billion USD (FiBL and IFOAM, 2014). In most major (developed countries) markets, the demand for organic products are far outstrips domestic supply, and therefore, imports are required to fill the gap. At present the highest market shareholder of organic product is USA (44 percent of the world market). The organic market in European countries accounted for nearly half (41 percent) of the world organic market and the same is only 15 percent in Asian countries.(FiBL and IFOAM, 2014). The smaller market share in Asian countries is attributed to the reason that the development of organic products has started in this continent in recent years.

India is one of the "Emergent Local Organic Sectors" in Asia. The country is ranked as 10th among the top ten countries in the world in terms of cultivable land under organic certification. In India, total area under certified organic production was estimated as 4.72 million ha during 2013-14. Further, the cultivable land under certified organic production has accounted almost 15 percent of the total certified organic area and rest 85 percent is the forest and wild area for collection of minor forest products. India produced around 1.24 million tonnes of certified organic products and generated almost 586 US$ as its exports earnings in 2013-14. (APEDA, 2015). The North Eastern Region, including Meghalaya is probably the most suitable area of India for organic agricultural farming because of its number of odd advantages. This region is said to be, by and large, organic by default or the farmers of this region are *de facto* organic producers. Farmers of this region are using very minimal or no inorganic inputs, fertilizer and pesticides. Almost in all the seven states of this region, farmers are practicing traditional agriculture since thousands of years. The Government of India task force on organic farming and several other reviewers also have identified rainfed areas and regions in north east as more suitable for organic farming in view of the low input use (GOI, 2001; Dwivedi, 2005; Ramesh *et. al.*, 2005).

Meghalaya is one of the most promising states within NEH Region as far as the organic farming potential is concerned. However, the state is comprised of typical hilly geographical terrain, which is the main hurdle of transportation of the produce. Several high value commodities such as orange (*khasi mandarine*), pineapple, cashew, turmeric, ginger, arecanut etc are widely grown in this state. Mostly these commodities are grown without applying any external synthetic inputs, favouring the opportunities of organic agriculture in the hilly tract of Meghalaya. To transform the organic potential to reality, there is a need to conduct systematic study on the financial viability of growing these crops. Estimation of comparative economics between organic vs. inorganic is essential to take rational policy decision to take forward the organic farming movement in the hilly region of the state. Besides, careful analysis is needed to identify the constraints or factors that are affecting the realisation of organic potential in the north east hilly region as a whole and the Meghalaya in particular. Keeping in view of the above said issues, the present study has been undertaken with the following objectives in Meghalaya; *first*, to examine the socio-economic characteristics of farmers practicing organic agriculture in Meghalaya, *second*, to examine and compare (organic vs. inorganic) the economics of high value commodities that have potential to be grown organically; *third,*; identification of the factors that are influencing farmers to practice organic agriculture and *finally*, to examine the constraints of organic farming in the region.

METHODOLOGY

Sampling Design

This study pertains to Meghalaya, one of the hilly states of NEH Region, which comprises of seven districts namely, East Khasi Hills, Ri-Bhoi, Jantia Hills, West Khasi Hills, East Garo Hills, West Garo Hills and South Garo Hills. Selection of block was done by considering the higher net sown area and higher cropping intensity. The indicator like extent of organic farming was not taken into consideration because such data was not available at secondary source level. But it is imperative to state here that, farmers in Meghalaya as a whole (except only in few pockets) grow crops without using any chemical fertilizers or pesticides. Therefore, in most of the block agricultural land was by-default organic. At state level the average fertilizer use was as low as 18 kg/ha and use of pesticides is almost nil (except in few pockets of the state where vegetables are grown). Meghalaya is a state having very low population density (only 103 per sq. km.). The locations of villages are also very scattered and in each villages number of households are also less as compared to other parts of the plain-land India. Meghalaya is comprised of 3 distinctly different hilly areas i.e., Khasi, Garo and Jaintia hills. Yes, there are some village to village variations in agricultural practices when compared villages located in different hilly situations such as *Khasi* hills, Garo hills and *Jaintia* hills. But within these hills there are quite similarities (homogeneity) exists as far as agricultural practices are concerned. To overcome the heterogeneity problem among villages across the states, the sample survey has been conducted in all 7 districts covering 7 blocks and 15 villages. The topographical situation in Meghalaya is quite similar within these hilly areas (Garo, Khasi and Jainitia Hills) and also the agricultural practices are quite homogeneous. From each block two (2) villages have been selected randomly based on the list of villages obtained from the block office. However, from West Garo Hills districts three (3) villages were selected for obtaining required number of farmers. The selected villages were, Lad Nongkrem and Kynton-u-mon from Myllium block (East Garo Hills), Mawlasnai and Rytong from Umsning block (Ri-bhoi), Wahiager and Khliehtyrshi from Thadlaskein block (Jaintia Hills), Kynshi and Markyrsa from Mawthadshan block (West Khasi Hills), Rongap and Mikilsingra from Songsak block (East Garo Hills), Chitilongre, Debalgre, and Sandegre from Gambgre block (West Garo Hills), and Chittongre and Boigonkuna from Baghmara block (South Garo Hills). Thus, in total, 15 villages have been selected for this study. From each block the survey has been conducted on total 30 numbers of farm households. Therefore, the final sample size of the study constitutes with 210 farm households. After selection of villages, the farm households were selected purposively to obtain the adequate number of farmers and desired farming practices required for the study i.e. organic and inorganic farming practices. The reason of purposive selection was also to have accessibility to those villages. As the number households were very less in each villages each villages and therefore while sampling process it was looked for particular type of farming practices they followed. In Meghalaya, mostly farmers follow agricultural practices without any synthetic inputs and also combination of organic and inorganic practices depending on the choice of crops and land situations. Normally farmers follow organic practices for paddy and plantation crops and inorganic practices for vegetables cultivation. For the current study, a farmer growing 75 percent of his farm area through organic practices was considered to be organic farmers.

Types of Data

The present study is mainly based on the primary data collected from the farm households through personal interview method. The primary data on farm size, land use pattern, households' income, households' assets, livestock ownership, family size etc were collected from the sample farmers on pre-structured survey schedule through personal interview for the agricultural year 2007-2008. The background information of the study area was collected from District Statistical Hand Book (2006) of East Khasi Hills, Ri-Bhoi,

Jantia Hills, West Khasi Hills, East Garo Hills, West Garo Hills, South Garo Hills, Agriculture profile, Meghalaya (2002), Directorate of Meghalaya, Basics Statistics of NER (2006), Report of Directorate of Agriculture and Directorate of Horticulture, Government of Meghalaya, 17th Indian Livestock Census, Government of India (2003-04) and discussion with the scientists and KVK officers from ICAR-RC-NEH Region, Meghalaya and Block development officers of the respective districts. Relevant secondary data were also collected from State Focus Paper (Meghalaya) 2005-06 of NABARD, Meghalaya Regional Office, Shillong and Various reports of NABARD on Meghalaya, Reports of Indian Council of Agricultural Research Complex for NEH Region (ICAR-RC-NEHR), Umiam, Meghalaya. Ideally under organic farming system, farmers must follow certain rules and regulation as set by the National Programme on Organic Projects (NPOP). But Meghalaya is a by-default organic state and the organic practice under the present study has been referred as farming without application of any synthetic fertilizers and pesticides and the inorganic farming referred as vice-versa. However, it is to be mentioned here that most of the organic production of the state is not certified by accredited certifying agencies but it is under process to be declared as an organic state.

Analytical Framework

To examine the Socio-economic characteristics of the sample farmers, analysis such as averages, percentages, maximum or minimum has been used for the study. To examine and compare the major organic food crops with in-organic food crops of the Region, farm budgeting technique has been used to calculate the cost and returns of different crops produced organically and inorganically. To analyse the factors influencing the farmers to practice organic farming, the logistic regression has been used. Similar regression model is used to study the behavioral pattern of the binary variables or qualitative variables (Saleth, Maria, 1991; and Kumar, *et. al.*, 2007). In logistic regression, dependent variable is binary in nature. Here, if the particular was following organic practice, was assigned as 1, 0 otherwise. The organic farmers have been defined as the farmers who followed organic farming at least >75 percent of his cropped area. Mostly the farmers in Meghalaya are following by-default organic farming and some farmers following both organic and inorganic farming practices.

Logistic Regression Model

The behavioural model used to examine the factors influencing the farmers to practicing organic farming was a logit model based on logistic cumulative distribution function. The model can be specified as:

$$Y_i = g(Z_i) \quad (1)$$

$$Z_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \alpha + \beta_k X_{ki} \quad (2)$$

Here Z_i is an index variable (or vector of X_{ki} independent attributes) and formally can be written as: $P_i = F(Z_i) = F(X_i) = \frac{1}{1+e^{-z_i}}$ (3)

Once this equation is estimated, P can be calculated as

$$= \frac{1}{1 + e^{-(\alpha + \beta_k X_{ki})}} \quad (4)$$

Where, Y_i = Status of farmers (Y = 1 for farmer practicing organic agriculture and Y = 0 otherwise)

Zi = An underlying and unobserved response for the ith farmer. When Z exceeds threshold Z*, the farmer takes the decision to practice organic farming otherwise not.

X_{ki} = k^{th} explanatory variable for the i^{th} farmer

i = 1,2,3, …, N, where N is the number of farmers

K = 1,2,3,…, M, where M is the total number of explanatory variables

α = constant

β = unknown parameters, and e denotes the base of natural logarithim with a value approximately 2.718.

The logit model postulates that Pi, the probability of the i^{th} farmer to practice organic farming is a function of an index variable Z_i; summarizing a set of explanatory variables. In fact, Zi is equal to the logarithim of the odds ratio, i.e., the ratio of probability that a farmer practice organic farming and it can be estimated as a linear function of explanatory variables (X_{ki}). Within the logit framework to obtain the probability of farmers to practice organic agriculture, the independent attributes considered were, operational holdings or Farm size (OH) in ha, Educational status (ES) in years of education, Availability of irrigation (AOI) in ha, Distance from pucca road (DPR) in km, No of cattle (NC) in number, Area under Fruit crops (Cashew, Pineapple, Citrus) (AHC) in ha, Area under Vegetables (AV) in ha, Distance from city (DFC) in km, Area under Spices (Ginger and turmeric) (AS) in ha. These attributes were expected to affect the variable Z_i that indicates whether the farmer would go for organic agriculture or not i.e.,

$$Z_i = \text{CONSTANT} + b_1(OH) + b_2(ES) + b_3(AOI) + b_4(DPR) + b_5(NC) + b_6(AHC) + b_7(AV) + b_8(DFC) + b_9(AS) \quad \text{.....(5)}$$

Where, Zi is binary variable, 1 = farmer was practicing organic agriculture, 0 otherwise and

Financial viability analysis was carried out for perennial crops following the discounted cash flow measures, namely, IRR, NPV & BCR and un-discounted method, Pay back period. Change in cropping pattern , particularly under perennial cash crop such as cashew, pineapple and citrus is less likely, given the topographical situation (upland) of the farming areas. In financial analysis the constant prices has been assumed for input-output prices i.e., both input and output price changes are assumed to changing in same magnitude. If the price variability occurs, sensitivity analysis can be carried out for long term financial viability. Given the crop choice and crop varieties as practiced by the farmers, the financial analysis was carried out. Discount rate has been considered as 14% - this is the maximum interest rate charged by the bankers for agricultural loan. For the financial analysis economic life of the crops in the study area has been considered based on the existing practices followed by the farmers. Cashew is a perennial crop cultivated in the region in *jhum* land and its economic life considered as 20 years. Though pineapple is a perennial crop with an economic life of 5– 7 years, but most of the farmers in the northeastern region of Meghalaya cultivate it beyond 15 years by means of crop manipulation and traditional agronomic practices. Orange is also a perennial crop cultivated in the region in *jhum* land and the economic life considered as 20 years for the crop in the study area. In addition, the financial analysis has been done with the following assumptions:

(a) The cropping pattern and net incomes would not undergo any change over the years so as to alter the benefit stream.

(b) Full benefits from the investment would be realised in the seventh year for cashew, third year pineapple and seventh year for orange crop enterprises.

Constraints Analysis

Different constraints faced by farmers to practice organic farming in the study area were done with the help of Rank Based Quotient (RBQ) analysis. RBQ is a problem identification technique, which is mathematically represented as follows:

$$RBQ = \sum_{j=1}^{n} \frac{fi(n+1-i)*100}{N*n},$$

Where, N = Total number of farmers

n =Total number of ranks (there are five ranks altogether, so, n = 5)

i = The rank for which the RBQ is calculated (for a problem)

f = Number of farmers reporting the rank i (for the problem)

The problems/ constraints faced by both the farmers and researchers were listed in ten categories under each group. Each of the ten problems was asked to both farmers and researchers to rank on the basis of individual priority by giving number 1 to 5. The problem ranked as 1 is the most serious problem, followed by 2 as less serious problem than 1 etc. There were total 210 farmers interviewed for identification of the problems and 55 researchers/policy makers/social activist (includes scientists from Indian Council of Research Complex for NEH Region, Barapani, State Government Officials, Researcher in NGOs etc) were interviewed to identify the various problem faced by them to practice organic farming in the state.

Limitations of the Study

Data were collected by survey method by interviewing the sample farmers. Therefore, the objectivity of the data is limited to the extent the farmer was able to recollect from memory without recall bias as most of the farmers, except a few, did not maintain any farm records. Secondly, the varying age distribution of orchards (Cashew, pineapple and orange) unit used to simulate the cash flows stream on the basis of data for a single agricultural year.

RESULTS AND DISCUSSION

Current Status of Hill Farming System in Meghalaya

Socio-economic Characteristics of Sample Farmers

Socio-economic characteristics and existing livelihood pattern are important factors for adopting any new technology. The results of the study on some of the important Socio-economic characteristics such as family income, educational status, social status, occupational pattern, employment status etc. were discussed in this section. Out of the total sample size of 210 in the study area, 51 percent respondents were male and 49 percent respondents were female (**Table 1**). Female participation is found to be high in Meghalaya and in general females enjoy an elevated position in society (Ghosh, 2003). Traditionally, matriarchal society is prevailing in *Khasi* tribal community of Meghalaya, where women folk are usually have significant decision-making power. Therefore, in Khasi dominated districts of Meghalaya (Ri-Bhoi, East Khasi Hills and West Khasi Hills) the numbers of female respondents were more than the male respondents. The educational status estimated from the sampled households indicated that around 88 percent of the respondents were observed to be literate in the study area. Around 45 percent of the respondents were educated up to the primary level and nearly 36 percent of the respondents were educated up to the secondary level. Nearly 7 percent of the respondents were observed to be educated

above the secondary level. The average family size of the state has been estimated as 8.39 numbers of persons per family and this show the farm families are supporting a large number of family members.

Table 1. Socio-economic profile of the sample farms in the study area

Particulars		***Meghalaya***
Households	No of sample farmers	210
	% of Male Respondents	51
	% of Female Respondents	49
Educational Status (%)	Illiterate	12
	Primary	45
	Secondary	36
	Others	7
Family composition (Average no)	Male	2.71
	Female	2.54
	Children	3.12
	Total	8.39
Operational holding (ha)	Up land	0.71 (145)
	Jhum land	0.60 (91)
	Low land	0.75 (142)
	Total	1.25 (210)
Irrigation Status (%)	Irrigated area	19
	Un irrigated area	74
On Farm Income (Rs./year/per Household)	Crop	12360
	Livestock	5818
	Total	18178
On Farm Expenditure(Av. Rs.)	Crop	6188
	Livestock	3408
	Total	9596

Note: figures in parentheses indicates no of farmers owned,
Source: Primary survey (2007-08) by author

Operational Holdings and land situation

The economy of Meghalaya is primarily a rural based agricultural economy. Majority of the people depends on agriculture for their livelihood. There is a little concept of ownership of landholding in Meghalaya under traditional land tenure system. The operational holding of the sample household of the state (Meghalaya) has been estimated to be 1.25 ha. The land situations in Meghalaya comprised of three distinctly different types, such as upland, *jhum* land and lowland. Out of the average operational land holding (1.25 ha) around 0.71 ha is characterized by upland situation followed by 0.60 ha *Jhum* land and rest are lowland (0.75 ha).

Uplands are considered as lands on which agriculture is practiced in non-irrigated fields that do not hold impounded surface water. The uplands agriculture has remained predominantly subsistence with rural communities practicing shifting cultivation or *jhum* cultivation (Umdor, 2008). Thus Upland is the land on the top of the hilly terrain, where the farmers use less /no fertilizer and irrigation. The average area under *jhum* land was estimated to be 0.60 ha of the sample households. Besides *jhum* cultivation practices, *bun*

cultivation method is widely preferred and followed by the farmers in Meghalaya, particularly under upland condition. Before monsoon, bund is made by raised soils along the slope with varied length and breadth, depending on magnitudes of slope, to cultivate a number of crops together. The *bun* cultivation practices can be considered as relatively settled cultivation method and relatively improved practice over *jhum* practices. Usually, in the first year several high value and soil exhaustive crops (Ginger, Chilly, and Turmeric etc) are taken in the *bun*. Lowlands are the most fertile land situation in Meghalaya where mainly Paddy cultivation is taken up. These lands are situated in valley area between the hills and therefore, water is available for cultivation. Top soils being washed off from the uplands also increase the fertility status of these lands. The productivity of crops (Paddy or Vegetables) under this land situation is higher than the upland situation and also more sustainable. The average Lowland estimated to be 0.75 ha in the study area.

Irrigation Status and it's sources

Nearly 19 percent area of the sample farms was estimated as irrigated in Meghalaya (average 0.21 ha). River is the major source of irrigation water in Meghalaya. Nearly 20 percent of the respondent farmers had their access to river water for irrigation. Irrigation through stream water consisted of 5 percent respondent and other sources of irrigation used by the respondent farmers are *Nala*, *Ponds* and *Spring water*, which estimated to be only 3 percent of the respondents of the sample farmers. It was estimated that nearly 72 percent of the respondents in the state were operating under rainfed condition.

Agricultural Income and Expenditure

Nearly 80 percent of the population in Meghalaya depends on agriculture for their livelihood. Crop and Livestock enterprises are major sources of farm income in Meghalaya. As per the estimation from the sample households at state level the on-farm income has been observed to be Rs 18,178 per year per household. The composition of on-farm income indicated that crop enterprises accounted for generating income almost double (Rs 12,360 per year per household) as compared to the income from livestock (Rs 5,818 per year per household) enterprises. The off-season high value crops are also cultivated during summer season, which usually fetched more market prices in local as well as in distant market as compared to the vegetable grown in winter season. The on-farm expenditure also showed the same trend as the income pattern i.e expenditure on the cropping enterprises is almost double than the livestock enterprises. Overall the on-farm expenditure is calculated as Rs 9,596 per year per household from the sample household, in which the expenditure on crop enterprises (Rs 6,188 per year per household) is almost double than the expenditure on livestock enterprise (Rs 3,408 per year per household).

Livestock Ownership Pattern and availability of dung (organic input)

Livestock plays an important role in Meghalaya where farming is characterized by low input – low output, subsistence nature and lack of advanced technology in the mixed farming system. Buffalo, Cow, Goat, Pig and Poultry are the major livestock reared by the farmers in Meghalaya. Among the various factors of organic farming, availability of manures particularly from livestock within shortest distance is one of the important factors. The total availability of the dung which is the most important input for organic farming system, estimated from livestock of the sample farmers was 1127.46 ton per year in Meghalaya. The number of animals owned by the sample households were cows 210 (33 percent farmer own), Goats 136 (21percent of the respondent own), Pigs 334 (74 percent of the respondent own) and Poultry 1987 (55 percent of the respondent own). The estimated

result showed the availability of dung from livestock per hectare of Net Sown Area was 4.46 ton. Whereas overall status of manure availability in Meghalaya has been estimated as 8.25 t/ha/year (Mandal, *et. al.*, 2007).

Cropping Pattern

Farmers in Meghalaya grow several crops including cereals, spices, vegetables, plantation and fruits. Rice is the most important crops and grows widely by the farmers across all districts of Meghalaya.

Table 2. Cropping Pattern on Sample Household in Meghalaya

Name Of the Crop	Percent Area
Cereals	21.39 (62)
Rice	20.13
Maize	1.26
Oilseed	0.05
Spices	16.80 (49)
Ginger	8.29
Turmeric	7.25
Vegetables	36.98 (107)
Tomato	4.71
Potato	13.84
Cabbage	4.18
Cauliflower	6.55
Cashew nut	10.59 (31)
Fruits	14.19 (41)
Citrus	10.67
Pine apple	1.96
Strawberry	1.55
Gross Cropped Area (ha)	100 (289)
Net Sown Area (ha)	262.76
Cropping Intensity (%)	110.12

- Figures in parentheses indicates gross cropped area (GCA) of the sample farmers
- Source: Primary survey (2007-08) by author

Out of the total estimated cropped area of 289 ha, the area under vegetable was 107 ha, followed by Cereals (62 ha), Spices (49 ha), Fruits (41 ha) and Cashew nut (31 ha) (Table 2). In Meghalaya, the estimated cropping pattern indicated that 37 percent of the total gross cropped area (289 ha) was under Vegetables (including potato), followed by Cereals (21 percent), Spices (17 percent), Fruits (14 percent) and Cashew nut (11 percent). Farmers in Jaintia district were observed to be cultivating more area under spices and that was much higher than the rest of the six districts of the state. In Jaintia, farmers were growing turmeric that contained very high percentage of *cucurmin,* considered to be best quality in the World and are having very high export demand. In addition, Meghalaya produces a superior quality of ginger in terms of aroma and less fiber in India. The climatic condition and geographical diversity of Meghalaya, favours growing of a number of fruit crops. Citrus, Pineapple and Strawberry are the three most important fruit crops in the study area. Among the fruit crops Citrus was accounting for maximum area followed by Pineapple. Strawberry was a newly introduced crop in the state, which has been gaining popularity

among the farmers. The net cropped area of the sample farmers in the state was estimated as 262.75 ha. The cropping intensity was estimated to be very low at 110 percent only. In spite of having favorable climatic condition, the cropping intensity of the state is very low primarily due to difficult hilly terrain and acute shortage of irrigation water storage during lean season. Though Rice is the predominating crop in the cropping pattern of Meghalaya, but vegetables as a group emerged to be dominating in terms of percentage to total cropped area based on sample estimation. The reason being many vegetable crops are grown in two seasons in a year (off season), therefore accounted for major area under Gross Cropped Area.

Economics of food crops grown under organic vis-à-vis in-organic system

Economics of organic vis-à-vis in-organic cultivation practices of important crops grown by the farmers in Meghalaya have been summarized and reported in Table 3. Among spices, Ginger and Turmeric have the high potential to be grown as organic in Meghalaya as far as the required input availability status is concerned. For these crops, market demand is already existing (domestic as well as international) fulfilling the demand-side requirement and also has the favourable economics to be grown organically in Meghalaya. However, vegetables, such as cabbage, cauliflower etc which have also favourable economics but should be considered to be grown organically at later stage only after attaining suitable institutional and market linkages because of their perishable nature. Most importantly, the synergy between comparative advantage and price-competitiveness has to be achieved to ensure the success of organic agriculture in a greater scale. Mixed farming is another popular method of cultivation in Meghalaya, which is known as *bun* cultivation followed under upland condition, where land preparation is being done following *slash and burn* method. This cultivation practice is a kind of *jhum* cultivation. Farmers grow more than 5 to 6 crops (e.g., Sweet Potato, Radish, Pea, Pumpkin, Chilly and Yam/Colocasia) in a patch of land together on raised bed. Usually the *Bun* cultivation is managed by family labours. Peas, Pumpkin, Sweet potato, Yam, Chilly, Radish and Ginger were the major crops observed to be taken by the sampled farmers in the field. The total cost incurred for labour employment has been distributed over all crops included in the mixed farming, because under mixed farming system same labour used to work for management of all crops, thereby calculation of labour employment for individual crop is very difficult. No external input was used for this cultivation. All traditional crop varieties are used and these crop varieties are well suited with the local climatic condition and also incidence of disease and pest attack is less as compared to improved crop varieties. This farming system gives economic yield and also suited to existing socio-economic condition of the farmers in Meghalaya. This system can be considered as organic farming system except the *slash and burn* method of land preparation, which is not permitted as per the set guidelines of NPOP (National Programme on Organic Production). If this cropping system is modified (controlled burning) in compliance with the regulation of NPOP or if the guidelines of organic farming for hilly region are slightly modified, this farming system can emerge as one of the most potential for organic farming system.

Table 3: Economics of selected crops grown under organic vis-à-vis inorganic practice Meghalaya

Crops	Yield (Kg/ha)		Net return (Rs/ha)		Output / Input ratio		Cost (Rs/kg)	
	Organic	In-organic	Organic	In-organic	Organic	In-organic	Organic	In-organic
Cereals								

Paddy	2002	3019	3642	10112	1.25	1.57	7.38	5.85
Maize	2895	-	19668	-	2.8	-	3.77	-
Spices								
Turmeric	5600	6100	17830	18622	1.66	1.62	4.82	4.95
Ginger	7859	8000	24857	21184	1.65	1.49	4.84	5.35
Vegetables								
Tomato	20400	28543	72472	108064	3.45	4.12	1.45	1.21
Cabbage	17032	26004	41941	76373	2.21	2.88	2.04	1.56
Cauliflower	17076	25989	44902	78633	2.41	3.05	1.87	1.47
Radish	17000	23000	39964	60140	2.43	2.89	1.65	1.39
Capsicum	-	12118	-	78069	-	2.81	-	3.56
French bean	3718	8001	11012	33911	1.97	3.41	3.04	1.76
Peas	17000	25009	75397	117933	3.83	4.67	1.56	1.28
Tuber crops								
Potato	15700	21981	36994	58214	1.89	2.13	2.64	2.35
Sweet Potato	18006	-	33196	-	2.11	-	1.66	-
Mixed crop								
Pea	2214	-	8073	-	3.69	-	1.35	-
Pumpkin	6000	-	15048	-	6.10	-	0.49	-
Sweet Potato	5228	-	12018	-	2.91	-	1.20	-
Yam/colocassia	3900	-	11569	-	6.56	-	0.53	-
Chilly	490	-	8607	-	4.96	-	4.43	-
Radish	5005	-	14179	-	5.25	-	0.67	-

Note: '-'indicates crop does not grow under that particular (organic or in-organic) condition,
Source: Primary survey (2007-08) by authors

Financial viability analysis has been carried out for perennial crops such as, pineapple, cashew nut and citrus (*Khasi* mandarin) and all financial criteria (IRR, BCR and NPV) have been estimated to be favorable for growing these crops organically (Table 4). Therefore, besides spices, these fruit crops are also can be considered as most potential crops for organic farming in Meghalaya with favourable economics. Few crops were being grown purely as organic (e.g., spices, fruit crops), therefore, economics of those crops under in-organic method have not been calculated. In contrast, few crops were being grown only by in-organic way (e.g., capsicum, tomato etc) therefore, economics under organic practices have not been included in the table. Under mixed (locally known as *bun*) farming system all crops were grown following organic practice only, which has been the most potential areas for organic farming. Comparative economics indicated that spices (turmeric and ginger) and crops under mixed cropping system are the most potential crops can be considered for organic farming.

Table 4: Financial viability of organic fruit cultivation in Meghalaya

Crops/Parameters	**Pineapple**	**Cashew**	**Citrus (*Khashi* Mandarin)**
	Organic	Organic	Organic
Yield *	13807	6182	74112
Net return (Rs/ha)	37933	94423	71441
IRR (%)	54	33	27
NPV (Rs)	150351	290849	133275

BC Ratio	1.97	2.58	2.08
Payback Period (Years)	2.5	6	7.5

- Yield of orange and pineapple in no of fruits/ha, yield of cashew in kg/ha on fresh wet basis,
- Source: Primary survey (2007-08) by authors

Factors Affecting the Farmers to Practice Organic Farming

The result of the logistic model suggested that the most significant factors affecting the decision to practice organic farming were the farm size, educational status, availability of irrigation, distance from the pucca road, number of cattle owned, area under horticultural crops, area under vegetable, distance from the city and area under spices (Table 5). Farm size, educational status, availability of irrigation, area under horticultural crops and area under spices were the five variables found to be significant out of the total nine variables considered in the model. Area under spices and area under horticultural crops were the only two variables found to be significant at 5 percent level with positive sign in the regression model implying that as the area under spice and horticultural crops increases the probability of practicing organic farming by the farmers also increases. Farmers of Meghalaya would prefer to cultivate spices and horticultural crops in organic way instead of cultivating all the crops. These crops have added comparative advantage in terms of demand, preference and also fetch higher market prices. The farm size, educational status found to be significant at 1 percent level and availability of irrigation were found to be significant at 10 percent level with negative sign implying that the farmers would be less willing to go for organic farming when their farm size increases. The reason might be that the farmers with larger size of farm intend to allocate land mainly for Paddy, the staple food crop. Significant with negative sign in relation to educational status (whether the farmer is literate or illiterate) the coefficients implied that the probability of practicing organic farming was lower among the literate farmers than illiterate farmers. It could be further explained, as the farmer become literate the probability of practicing organic farming also decreased. Negative sign of regression co-efficient were notable corresponding to educational status. The reason being farmers in Meghalaya followed organic farming practice is a natural way of farming and often farmers were ignorant to use the modern inputs or these inputs were not available to them. Increased education level likely to enhance the farmers' knowledge and awareness level for modern agricultural practice and thereby tend to use the inorganic inputs for crop cultivation. Therefore, level of education was negatively correlated with the probability of adoption of organic farm practices. This can further be validated with the existing farmers' practice of intensive vegetable cultivation nearby Shillong and other main cities of the state who were normally better equipped with knowledge of using inorganic inputs.

Similarly, negative coefficient for availability of irrigation indicated that as the availability of irrigation of the farmer was high the probability of practicing organic farming tending to be less. The farmers will more likely to go for paddy cultivation under more assured irrigation condition following inorganic practices. However, in contrary to the expectation, the distance from the pucca road, number of cattle, area under vegetables and distance from the city were not significantly affecting the decision of the farmers to go for organic farming. Farmers in Meghalaya are ignorant about the profitability of organic farming. The way of cultivation, which they are practicing now, is their age-old method of cultivation. There is lack of systematic market for the organically produce goods in Meghalaya and the production of organic commodities are not demand-driven also. Mixing of organic produce with in-organic produce is another serious constraint of marketing of organic produce in the region. Farmers in this region are less profit motive due to difficult topography, having low

risk bearing ability with limited investment capacities. So they practiced farming only to meet their daily needs and it is their natural way of farming. Thus the farmers would rather go for their staple food Paddy when the farm size increases and availability of irrigation increases. Organic method of cultivation is practiced in Meghalaya, was not by choice but by compulsion. The traditional method of cultivation with least dependence on external input was due to the lack of input delivery system as well as low socio-economic status of the farmers. Given the opportunity of following in organic method of cultivation, the farmers are more likely to adopt improved method of cultivation by using synthetic fertilizer and pesticides. However, constraint with difficult terrain, low profitability and lack of input supply compels the farmers to follow the traditional method of cultivation, thereby this farming system also sometime termed as organic-by-default. The upland situation in Meghalaya is more suitable for growing a number of high value crops, which are most potential for organic agriculture. Special efforts are essential to convert this upland farming system into organic production system by following rules and regulation set by NPOP (National Programme on Organic Production). Creation of mass awareness and linking these farmers to the markets will ensure the remunerative prices of these produce, which in turn will facilitate organic movement in a state.

Table 5: Factors influencing farmers to practice organic farming in Meghalaya

Factors	Co-efficients	SE value
Constant	1.628***	0.473
Farm Size	-0.115***	0.410
Years of education	-1.315***	0.534
Availability of irrigation	-0.210*	0.012
Distance from pucca road	0.014	0.110
No of cattle	0.109	0.084
Area under horticultural crops	0.151**	0.098
Area under vegetables	-0.173	0.178
Distance from city	-0.002	0.015
Area under spices	0.420**	0.038
-2 Log Likelihood	156.518	
Correct prediction (%)	66.50	
No of observation	220	

***, ** and * indicates significant at 1%, 5% and 10%, respectively.
Source: Primary survey (2007-08) by author s

Constraint analysis of organic farming

Constraints were analysed through using RBQ (Rank Based Quotient) technique for the ranking (Table 6). Based on the RBQ score, the constraints were ranked. In general, lack of input availability and challenges to control pest and diseases without application of synthetic chemicals were the most limiting factors for promotion of organic farming in Meghalaya. High cost of organic certification and variation in yield of crops (across the topography) were observed to be next important constraints for organic farming practices in Meghalaya. Other most important constraints for promotion of organic farming in Meghalaya were, lack of awareness about the organic food production, lack of institutional credit facilities for organic cultivation, selling of organic foods in the same marketing channel of conventional foods (competition with the conventional food), lack of market linkages for both input supply and output disposal and cultivation without following the organic farm practices (mixing with inorganic inputs) and thereby not formally certified. Lack of information on process of organic farming in compliance with the set NPOP

guidelines and lack of availability of accredited certification agency is the major constraints, which required special attention from the government level. Also it is needed some policy support to make the certification affordable to the growers. The management process of organic farming is also required special training and keeping of records is essential. Management of organic farming system is also a challenging task and several constraints faced (or perceived) by the researchers and practitioners.

Problem in marketing of the organic produce, lack of awareness about the organic produce and lack of knowledge about the complete package of practices of the organic method of cultivation were the major constraints faced in the study area. Control of pest and diseases, instability in the crop yield and responsiveness of the soils to the use of bio-fertilisers were the next most important limiting factor of practicing organic farming in Meghalaya. Besides these, the other important concern of organic farming promotion in the study area were the apprehension among the policy makers that organic farming cannot sustain food security, therefore, its promotion should be in specific areas and for specified crops only without affecting the production of food crops. Non-availability of sufficient on-farm organic inputs were another hindrance for promoting organic farming in a larger scale and varying responsiveness of biofertilisers to different kind of soils also raised the question about the efficacy of these nutrients to supplement the inorganic inputs. Farmers in Meghalaya produce very low level of marketable surplus, which is also a limiting factor for efficient marketing. Finally, doubtfulness regarding the nutritive value of organic product was also other factors for slow promotion of organic farming in Meghalaya.

Table 6: Constraints analysis of production and promotion of organic agriculture in Meghalaya

Constraints	RBQ	Rank
Lack of availability of adequate on-farm input	43.33	1
Lack of awareness about organic product demand	31.62	5
Lack of Institutional credit facility for organic production	30.48	6
Variation in crop yield is very high	32.10	4
High cost of organic certification	34.86	3
Competition/mixing with from conventional food	26.38	7
Mixing with inorganic input	21.90	9
Weather risk in farming (frost, chilling, landslide, hailstorm, heavy rain etc)	19.71	10
Control of pest and disease without use of inorganic is challenging	24.19	8
Lack of supply chain management: Input output delivery	35.43	2
N	210	

Source: Primary survey (2007-08) by authors

CONCLUSION

Practicing organic agriculture in Meghalaya is not demand-driven rather it is their compulsion or natural way of farming considering the difficult terrain in the hilly tract and very weak market linkages. Therefore, organic by default would not be sufficient to transform present farming system to organic farming system as desired. The most important step required is to establish proper market linkages with the farmers. Realization of organic farming potential would mainly determined by the demand-driven forces like price, product positioning, niche market etc., rather than the supply-driven forces such as variety of seeds for organic farming or agronomic practices etc. Specific initiative and strategies are

essential to take forward the organic farming movement and to capitalize the real organic farming potential of Meghalaya. From the present research study following specific recommendations has been suggested for making the organic farming movement towards a favourable direction; *first,* Organic food production should be promoted only for specific crops (turmeric, Ginger, Pineapple, Khasi Mandarin and Cashew) in specific areas having favourable economics, *second,* Formation of organic growers group in all seven district based on the most potential crop of the district such as turmeric in Jaintia, Cashew in Garo hills, Pineapple in Ri-Bhoi district, Ginger in Ri-Bhoi, Jaintia, West Khasi Hills district. This growers group would be helpful to reduce certification cost of organic farming; *third,* In each district, a model organic farm may be established in public-private collaboration for demonstration-cum-training site' *fourth* For pricing of organic food product the estimated costs and return can be used as presented in this study. Creation of mass awareness among the producer for production of certified organic food might be promoted; *fifth* Wide awareness campaign may be promoted for popularization of organic food in the country and also special campaign was needed to clear the confusion of consumers regarding the organic food; *sixth* Initially, State Government of Meghalaya may promote the food products branded as 'a product from Meghalaya' emphasizing the popularization of 'a food produced from clean environment of Meghalaya' rather campaigning for the formal 'certified' organic product. After realizing the market potential of such product and successful product positioning, the certified organic product may be promoted through large-scale production; and *finally*, the pricing policy of the organic product along with extending support of remunerative price and promotion of contract farming is essential either through public or public-private partnership.

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Note on *jhum*

Jhum cultivation is also called shifting cultivation which is one of the prevailing agricultural practices in Meghalaya since ages and considered to be causing severe land degradation. This j*hum* cultivation practices also known as *slash-and-burn* method of cultivation, which destroy biodiversity in a great extent. The j*hum* cultivation is an extensive type of cultivation, raising of crops on a given plot of land more than once during a year and is intensive in nature. Commonly under *jhum* cultivation practices, forests are cut, cleaned and burned during the month of March and April. The land is prepared for sowing a number of crops manually. Mixed crops are being followed and crops are sown either through direct seeded or dibbling method. Usually the j*hum* cultivation is practiced for an average of four consecutive years, which is known as the *jhum* cycle. Then the land is kept fallow for regeneration of natural vegetation and natural fertility of the soil. If sufficient time is permitted (more than 10 to 15 years) the forestland is regenerated and soil regains its fertility. However, the concern for *jhum* cultivation practices are that the lowering of fallow period (*Jhum* cycle has been reduced to 6-7 years) due to high population pressure. But in spite of being naturally degraded cultivation practice *jhum* still remains significant among the farmers in Meghalaya, particularly in remote areas.

DETAILS OF CALCULATION OF FINANCIAL ANALYSIS

Financial analysis of Pineapple in the study area (Rs/ha)

Srl No	Particulars	1st Year	Average of 2nd to 15th Year
A	Human Labour		
A	Male	16000	7543
B	Female	9900	4003
B	Manure	5950	5750
C	Seed/ Seedling	35000	0
D	Total Cost	66850	17296
E	Yield (No of fruits/ha)	0	13807
F	Gross Return	0	55229
G	Net Return	-66850	37933
J	Financial viability		
A	IRR (%)	54	
B	NPV (Rs)	150351	
C	BC Ratio	1.97	
D	Payback Period (Years)	2.50	

Note: IRR: Internal Rate of Return, NPV: Net Present Value, BC Ratio: Benefit Cost Ratio

Financial analysis of Citrus (*Khasi* Mandarin) in the study area (Rs/ha)

Sr No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year	Average of 6-10 Year
A	Fixed cost						
	Clearing of jungle	36000	0	0	0	0	0
	Burning of jungles	400	0	0	0	0	0
	Clearing of fields, debris	480	0	0	0	0	0
	Digging pits	560	200	0	0	0	0
	Cost of seedlings	5300	1800	0	0	0	0
	Cost of cow dung	994	650	0	0	0	0
	Cost of FYM	11250	2500	0	0	0	0
	Planting of seedlings	1600	600	0	0	0	0
	TOTAL	56584	5750	0	0	0	0
B	Variable cost						
	Weeding, cleaning of jungles	4800	4800	4800	4800	4800	4800
	Harvesting	0	0	0	0	0	12693
	TOTAL	4800	4800	4800	4800	4800	17493
	A + B	61384	10550	4800	4800	4800	17493
C	Return						
	Production of citrus (no)	0	0	0	0	0	74112
	Gross return from selling of citrus	0	0	0	0	0	111168
	Extent of damage	0	0	0	0	0	59289
	Gross Return after damage	0	0	0	0	0	88934
D	Net Return						
	Selling of citrus	-61384	-10550	-4800	-4800	-4800	71441
E	Financial Viability						
A	IRR (%)	27					

B	NPV (Rs)	133,275
C	BCR	2.08
D	Payback Period (Years)	7.5

*IRR: Internal Rate of Return, ** NPV: Net Present Value, *** BC Ratio: Benefit Cost Ratio

Financial analysis of Cashew nut in the study area (Rs/ha)

Sr No	Activities	1st Year	2nd Year	3rd year	Average of 4-20 Year
A	Fixed cost				
	Clearing of jungle	40000	0	0	-
	Burning of jungles	400	0	0	-
	Clearing of fields, debris	600	0	0	-
	Digging pits	2000	300	0	-
	Cost of seedlings	17550	2600	0	-
	Cost of cow dung	4219	650	0	-
	Cost of FYM	15000	2000	0	-
	Planting of seedlings	4000	600	0	-
	TOTAL	83769	6150	0	-
B	Variable cost				
	Weeding, cleaning of jungles	6000	6000	6000	6000
	Harvesting	0	0	0	15158
	TOTAL	6000	6000	6000	21158
	A + B	89769	12150	6000	21482
C	Return				
	Production of cashew nut (fresh wet basis)	0	0	0	6182
	Gross return from selling of cashew	0	0	0	154539
	Extent of damage	0	0	0	38635
	Gross Return after damage	0	0	0	115905
D	Net Return				
	Selling of cashew	-89769	-12150	-6000	94423
E	Financial Viability				
A	IRR (%)			33	
B	NPV (Rs)			290849	
C	BCR			2.58	
D	Payback Period (Years)			6	

Note: IRR: Internal Rate of Return, NPV: Net Present Value, BC Ratio: Benefit- Cost Ratio