



Organic Farming for the Development of Agricultural Sustainability: A Study on Pakyong and Rhenock Area of East Sikkim

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ABSTRACT

Background: The role of organic farming as a promoter of agricultural sustainability is undisputed. Sikkim government has declared the state as an organic state since 2016. Sikkim is one of the few states in India that is pioneering the adoption of organic farming. That is why, the study bears utmost significance. The study tries to assess the role of organic farming in the development of agricultural sustainability in Pakyong and Rhenock division of Sikkim State.

Methods: The study was conducted in Pakyong and Rhenock areas of East Sikkim during (March to November) 2021. The respondents of the study were organic farmers (practicing organic farming not less than 3 years) with land holding more than 2 acres. About 850 questionnaires were administered, with 700 completed questionnaires considered for analysis.

Result: The study concluded with a very encouraging result for the prospects of organic farming in the state of Sikkim in general and the study area in particular. The study proves that the organic farming initiative is beyond doubt as a driver of sustainable agricultural development in the state of Sikkim.

Key words: Assessment, Attitudes, Organic farming, Sustainable development, Stakeholders.

INTRODUCTION

As an all-encompassing approach to production management, organic farming minimises air, soil and water pollution, maximises the yield and health of interconnected ecosystems of plants, animals and humans and shuns the use of chemical fertilisers, herbicides and genetically modified organisms Parajuli *et al.* (2020). Over 70% of Indians rely on agriculture as their primary source of income, making it the backbone of the country's economy. The FAO World 2010 states that in the production of several fresh fruits and vegetables, staple crops, fibre crops and seed oil India ranks first in the world and second in the production of rice and wheat was reported by (Mishra *et al.*, 2019).

Organic farming is not a new concept in India; it has been practised for ages. The nation was able to improve not only its surplus of food but also its environmental pollution, pesticide toxicity and sustainable agricultural output by fusing organic resources with high-yielding varieties and technology (Gugalia, 2021). The primary goal of this method of agriculture is to maintain healthy soil through the use of organic wastes and additional biological components, as well as beneficial microbes (bio-fertilizers) to release nutrients to crops for increased sustainable production in a free of contaminants and environmentally friendly setting. Chemical fertilisers, herbicides, growth regulators and additives for animal feed are all avoided in an organic agricultural system. The core tenets of organic farming are social, environmental and economic sustainability. But The usage of organic manures has decreased yearly, possibly as a result of their limited

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availability and lack of awareness of their long-term advantages (Chaudhary and Thakur, 2021).

According to (United States Department of Agriculture (USDA), organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives *etc.*) and to the maximum extent rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral graderock additives and biological system of nutrient mobilization and plant protection National Program on Organic Production (NPOP), India also described it as "Organic Farming is a system of farm design and management to create an eco-system which can achieve sustainable productivity without the use of artificial external inputs such as chemical fertilizers and pesticides".

Although unsustainable agriculture causes food insecurity, hunger and environmental devastation for roughly

a billion people in poor nations, switching to organic farming might boost productivity in these regions (American Chemical Society, 2006). So, organic farming is fundamentally based on sustainable practises (Tiraeyari *et al.*, 2014). According to recent research Badgley *et al.* (2007), organic farming in underdeveloped nations may generate nearly the same amount of food as conventional farming. They looked at a worldwide dataset of 293 cases to compare the yields of conventional and organic agricultural practises. The findings indicated that organic farmers produce 80 percent more than traditional ones in poor nations. Additionally, they stated that without cultivating new land, organic farming could provide enough food and fibre to support the world's present population.

From the above definitions and descriptions, it is clear that, philosophically speaking, organic farming means farming in the sense of an ecological relationship. In this system everything is connected to everything else. Because organic farming means placing agriculture in a holistic relationship with all essential components and the totality of these relationships is the foundation of organic farming.

Statement of the problem

Organic farming is presently on the rise across the world. Significantly people are concerned about the health and sustainability of agriculture. With the increase in population our compulsion would be not only to stabilize agricultural production but to amplify it further in a sustainable manner.

Significance of the study

After reviewing many literatures on organic farming, it has been observed that not many studies have been found on Sikkim in general and East Sikkim in particular. Hence, this study will fulfil the research gap on this topic. It has also been observed that there are some studies about organic farming and sustainable development but they dealt with some parts of India and other parts of the world. It can be said that even a single study has not been found especially on Assessment of organic farming for the development of agricultural sustainability in eastern parts of Sikkim. Hence, this study was taken up to examine the role of organic farming for the sustainable development in East Sikkim.

Sikkim organic mission

"Sikkim Organic Mission" an ingenious flagship project of Government of Sikkim was introduced to millions of Indian viewers through 'Satyamev Jayate', a popular talk show hosted by Aamir Khan in 2012. The mission wants to convert Sikkim into a totally Organic State by 2015 whereby any agriculture produce from the State is grown using organic fertilizers and healthy for consumption. Agencies accredited by Agriculture and Processed Food Products Export Development Authority are certifying the organic process in Sikkim in three phases.

Organic produce of Sikkim, mostly vegetables, would not only fetch more value for the Sikkimese farmers but also offers multiple benefits to the State. Tourism stakeholders

of Sikkim are convinced that Organic Mission when connected with ecotourism would be a double attraction for tourists particularly at homestays.

The Government of Sikkim stepped into Organic Mission process from 2003, the year when it stopped imports of chemical fertilizers in the State. Sikkim Organic retail stores have been started by Government of Sikkim in New Delhi.

Policy vision and mission

- Frame policy of organic farming in the state.
- To make farming profitable, sustainable and environmentally acceptable.
- To develop and explore markets of Organic commodities.

Objectives of the study

1. To understand the role played by organic farming in sustainable development of agriculture in the Pakyong and Rhenock divisions of East Sikkim.
2. To analyse the importance of traditional knowledge and understanding of the farmers for sustainable development of organic farming.

Hypothesis

It is hypothesized that organic farming and sustainable agricultural development are positively correlated and organic farming improves soil fertility and maintains ecological balance.

MATERIALS AND METHODS

This work is an empirical inductive investigation grounded on the theme of organic farming and its impact on sustainability of agriculture development. This can be stated as follows-

Pre field work

- Step 1- The study area of the research work was identified and demarcated.
- Step 2- Relevant literatures were studied.
- Step 3- A pilot survey was conducted upon the study area.
- Step 4- Questionnaire was prepared to generate field data for understanding the impact assessment of organic farming on sustainability of agricultural development.
- Step 5- The sample size and sampling methods were supposed to be after preparation of questionnaire.
- Step 6- Sample villages were selected for meticulous study.

Field work

- Step 7- Questionnaire survey was conducted upon the parameter of culture, life style and socio-economic aspects of organic farmers in the study area.
- Step 8- Questionnaire survey was carried out about the thinking, believe, aspiration of organic farmer on development of agriculture.
- Step 9- Relevant secondary data from different centres/offices were collected.

Post field work

After the field work primary and secondary data were collected from different offices. Those tabulated data were

compiled by using appropriate statistical technique. Result was analysed to understand the pattern and relationship between different variable. The report was finally prepared by analysing and interpreting data, information.

Data base

The primary sources for accumulating data are published literature which is available. It has already been mentioned in aforementioned work and most of the data was generated through filed investigation. Hence, it is a pioneering work about the assessment of Organic farming on sustainability of agricultural development.

Scope and limitations of the study

Organic farming has many advantages. But still there are some basic limitations. The Indian government's "Organic Green" certification is a must for selling any organic product (this regulation is effective as of July 2018). When using organic fertilisers instead of chemical ones, the soil will take longer to recover its nutritious content. Comparatively speaking to chemical fertilisers, the nutritional level of organic fertilisers varies depending on the materials utilised. Content is fixed in chemical fertilisers. Soil cannot be precisely treated with nutrients. It's difficult to find organic fertilisers in big volumes. Organic fertilisers have bad odour, scarce and, if acquired together with organic inputs, may prove to be more costly in terms of plant nutrients than chemical fertilisers. The average Indian farm is not familiar with the regulations around organic cultivation, certification, shipping, *etc.* Despite the aforementioned drawbacks, organic farms can yield significantly better prices than ordinary ones if there is sufficient market demand, expensive, organic producers lack appropriate knowledge, low yields. Also, small and marginal farmers have difficulty adjusting to this strategy because they lack awareness and the necessary information.

Review of literature

After learning to use fire, the other major development for humanity was the history and genesis of agriculture. In order to produce agricultural commodities in an environmentally benign manner, organic farming utilises a more sophisticated crop management system that is based on robust on-farm nutrient cycling, including crop rotation and biological nitrogen fixation, boost the fertility of the soil according to Mishra *et al.* (2019).

Recent research conducted on 286 agricultural projects across 57 nations revealed that organic farming enhanced yields by an average of 79 percent while simultaneously protecting the environment (American Chemical Society, 2006). Traditional agricultural methods that emerged over millennia in several villages and farming communities are the source of organic farming. India is a leading producer of premium commodities, including rice varieties, tea, spices and medicinal plants. Since pesticide use in agriculture is not as extensive in many parts of India, particularly in hilly and tribal regions, the switch to organic farming is simpler.

It has been demonstrated that using organic farming methods, especially in the humid tropics, may provide yields that are on par with or even higher than conventional farming on marginal soils. As long as adequate yields are obtained, the shift to less input-dependent but more labour-intensive manufacturing processes is encouraged by India's comparatively cheap labour costs. India has a sizable non-governmental organisation (NGO) sector that supports organic farming by offering farmers marketing, extension, information and training services was reported by Singh *et al.* (2019).

The definition of sustainable development is growth that meets the demands of the current generation without overusing resources, so preventing the needs of future generations from being jeopardised (Visser and Brundtland, 2013). Agriculture needs to become more sustainable and the only way to do it is through environmentally responsible farming. It highlights the significance of gardening, which ought to establish a healthy ecological equilibrium and a microenvironment that is conducive to the growth and health of soil microflora plants, animals, farm workers and ultimately the large population that consumes the farm produce, in addition to advocating for the cessation or restriction of pesticide use (Singh, 2021). The three primary goals of sustainable agriculture are social equity, economic profitability and environmental health. By protecting natural resources, it guarantees sustainability over the long run. Chemical pesticides and fertilisers contaminate soil and water supplies, harming the ecosystem and food chain. Chemicals in dairy products might cause health issues. These methods are avoided in organic farming, which results in wholesome food and the restoration of ecological equilibrium. In order to mitigate the negative effects of chemical-based farming on the environment and society, organic farming must be encouraged (K.M., 2015).

Organic farming is a type of sustainable agriculture that focuses on producing food without the use of synthetic fertilizers, pesticides and genetically modified organisms (GMOs). Sustainable agriculture, on the other hand, is a broader concept that encompasses various farming practices that aim to protect the environment, promote social responsibility and ensure economic viability. Organic farming is one of the many sustainable agriculture practices that can help achieve these goals by (Tiraeyari *et al.*, 2014).

According to a 2011-12 survey conducted in Mizoram, 80% of farmers engage in organic farming, which has a 20.4% lower yield than conventional farming. They generate twice as much money from traditional farming by growing a variety of crops. According to the report, the area's organic farming needs to be supported by appropriate technology (Kumar *et al.*, 2024).

A study conducted by Mishra *et al.*, (2019) discussed about the positive impact of organic farming on sustainable agriculture. Organic farming is an advanced crop management system that aims at eco-friendly production of agriculture commodities and relies on strong on-farm

nutrient cycling such as biological nitrogen fixation and crop rotations, which enrich the soil fertility with more organic matter. Organic farming also reduces the use of off-farm inputs, which minimizes investment costs. The objective of organic farming is to protect the environment through organic management practices and consumer health protection through organic products. Organic farming is preferred in more than 130 countries, which is about 0.65% of the world's total land. However, small-scale farmers in developing countries still face challenges when trying to switch to organic systems due to the extra labour required, which can be expensive.

Organic farming positively impacts Sikkim's rural areas and standard of living, while increasing exports in Indian markets contributes to prosperity, health and hygiene. However, farmers find conventional methods easier and consumers find organic products expensive (Buragohain, 2020). The issues of agriculture and food security in Sikkim have been discussed.

Background information about indian and sikkim organic farming

In India, 2.78 million hectares of cropland were farmed organically as of March 2020; this represents 2% of the nation's total net planted area of 140.1 million hectares. Half of this region is made up of the top three states, Madhya Pradesh, Rajasthan and Maharashtra.

Organic farming coverage in states and union territories

70% of India's organic land is covered under the National Programme for Organic Production (NPOP), with the remaining 30% being converted. India leads the world in the number of organic farmers, despite having a limited organic acreage. States with the goal of achieving complete organic or natural farming include Sikkim andhra Pradesh, Himachal Pradesh, Kerala, Uttarakhand, Mizoram, Nagaland and Arunachal Pradesh. Rajasthan has covered a significant region, indicating that the conversion could have begun before to the policy's adoption.

RESULTS AND DISCUSSION

The hypothesis framed by the researcher is tested with the help of statistical tools and results are interpreted.

Table 1, shows that 60.3% of farmers are male and 39.70 per cent of farmers are female. It reveals that, majority of the farmers are male. Age data shows that more farmers are above 45 years of age and then 25 to 45 years old and a few farmers are below 25 years old. Education-wise information also shows that more farmers have intermediate education then graduation 25.40 percent and others 24.0 percent and few farmers are having post graduate degree i.e. 0.30 percent.

In years of experience of the farmers in organic farming, majority of the farmers are having 5 to 10 years of experience (38.60 per cent) and then 11 to 15 years (32.60 per cent) and less than 5 years (21.10 per cent) and few farmers are above 15 years of experience (7.70 per cent).

Sustainable farming

The data gathered on sustainable farming through descriptive analysis are presented in Table 2. For sustainable farming, nine statements were asked to the respondents. Out of all, the mean value of the statements "Adoption of sustainable agriculture will be easier for farmers who have both cropped and livestock enterprises" 4.71 and "Whether respondents have heard of sustainable agriculture" 4.38 is higher. Further, the combined average of the scale "sustainable farming" is also 3.86~4 (agree). This reveals, farmers are very well understood that organic farming is sustainable farming. Also, they have understood that adoption of sustainable farming is easier for farmers those have both cropped and livestock enterprises. They can use the wastage and by-products of livestock enterprises for organic farming.

Analysis of internal homogeneity of the items by factor analysis (Sustainable farming)

The factor analysis was applied to nine variables related to sustainable farming through organic cultivation. The KMO value of factor analysis is 0.736 which indicates that Factor Analysis is reliable to be done for the 9 variables. And also, the significance value is 0.000 which also relates the same. Accepting values greater than 0.5 (values below this should lead to either collect more data or rethink which variable to include). Furthermore, values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great and values above 0.9 are superb. For these data the value is 0.769, which falls into range being good. So, we should be confident that factor analysis is appropriate for these data.

Table 1: Demographic profile of the respondents (N=700).

Particulars	Frequency	Per cent	Cumulative per cent
Gender			
Male	422	60.3	60.3
Female	278	39.7	100.0
Age			
below 25 yrs	48	6.9	6.9
25 - 45 yrs	260	37.1	44.0
Above 45 yrs	392	56.0	100.0
Qualification			
Intermediate	352	50.3	50.3
Graduation	178	25.4	75.7
Post-graduate	2	0.3	76.0
Others	168	24.0	100.0
Exp. on agriculture			
<5 yrs	148	21.1	21.1
5 to 10 yrs	270	38.6	59.7
11 to 15 yrs	228	32.6	92.3
Above 15 yrs	54	7.7	100.0

Source: Developed from the survey data.

The factor analysis was done for all the 13 variables. All these variables have reduced to five different factors which explained around 71.750% of the total variance. The first factor with their loading pattern indicates that a general factor is running through out all the items explaining about 19.146% per cent of the variance. The second factor explains about 17.447%, third factor explains 14.328%, the fourth factor explains 10.932% and fifth factor explains 9.897%. The entire five factors explain about 71.750% of the total Variance.

All the 11 variables are reduced to four factors. We have extracted the factors through varimax method and through principal component analysis where the Eigen value should be greater than 1. The extracted four factors are defined as: factor 1 constitute variable 2, 4 and 10 is defined as *Adoptability*, factor 2 constitute variable 1 and 8 is defined as *Practices*, factor 3 constitute variable 7 and 11 is defined as *Innovations*, factor 4 constitute variable 3 and 6 is defined as *Ease of farming*.

Attitude->feasibility->sustainable farming

H1

Organic Farming and sustainable agricultural development have a paramount positive correlation.

AT1

Health conscious; AT2: Higher profit; AT3: Positive image; AT4: Consultancy; AT5: Environment friendly. SF1: Adoptability; SF2: Practices; SF3: Innovations; SF4: Ease of farming.

The above Table 3 shows the correlation matrix between Attitude towards organic farming (AT) and Sustainable farming (SF). The reduced five factors of attitude towards organic farming have a significant and positive correlation with four factors of sustainable farming. Since significant value of correlation is coming 0.000 (<0.05). This shows null hypothesis is rejected and alternative hypothesis is accepted i.e., Organic Farming and sustainable agricultural development have a paramount positive correlation.

Table 2: Descriptive statistics (Sustainable farming).

Items	Statements	Mean	Std. deviation
C1	Whether respondents have heard of sustainable agriculture	4.38	0.678
C2	Whether respondents have had any training on sustainable agriculture	3.10	1.244
C3	Environmental balance is one basis for sustainable agricultural practices	3.95	0.561
C4	Sustainable agriculture discourages and stop usage of chemical fertilizers and pesticides.	4.03	0.542
C5	The adaptability percentage of sustainable farming practice is less because of its short-term losses and long-term risk associated.	3.67	0.659
C6	Sustainable agricultural practices may require additional management beyond conventional practices	3.39	0.626
C7	There is no any readily available attractive market for high-risk bearers of sustainable agriculture adaptors/retainers.	3.51	0.680
C8	Homemade Innovations inspired from traditional and Vedic sciences are important tools to encourage sustainable agriculture.	3.99	0.760
C9	Adoption of sustainable agriculture will be easier for farmers who have both cropped and livestock enterprises	4.71	0.634
	Combined average (Sustainable farming)	3.86	

Source: Developed from the survey data.

Table 3: Organic farming and Sustainable farming.

Organic farming w.r.t to Sustainable farming		SF1	SF2	SF3	SF4
AT1	Pearson Correlation	0.287**	0.203**	0.370**	0.169**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
AT2	Pearson correlation	0.348**	0.234**	0.294**	0.221*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
AT3	Pearson correlation	0.231**	0.453**	0.239**	0.111*
	Sig. (2-tailed)	0.000	0.000	0.000	0.003
AT4	Pearson correlation	0.254**	0.192**	0.263**	0.176**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
AT5	Pearson correlation	0.119**	0.022**	0.118**	0.266**
	Sig. (2-tailed)	0.002	0.004	0.002	0.000

Source: Developed from the survey data; **. Correlation is significant at the 0.01. Level (2-tailed).

The majority of farmers sell their products to retailers (64.30%) and then go directly to consumers (19.10%) and wholesalers (14.0%). This shows that farmers do not derive any direct benefit from end consumers. To measure the above construct, respondents were asked nine statements. The combined average is 3.86 to 4, showing a positive opinion of sustainable agriculture. Overall, the mean of the statements "Introducing sustainable agriculture will be easier for farmers who have both crop and livestock operations" 4.71 and "Whether respondents have heard of sustainable agriculture" 4.38 rise higher.

CONCLUSION AND SUGGESTIONS

The study came to a very encouraging conclusion for the prospects of organic farming in the state of Sikkim in general and the study area in particular. The study proves that the organic farming initiative is beyond doubt as a driver for sustainable agricultural development in the state of Sikkim. The study suggests involving more women farmers in the organic farming initiative to achieve sustainable development of the state. The study shows that comprehensive inclusive training is being provided to farmers at regular intervals for the overall development of organic farming in the state.

Conflict of interest

All authors declared that there is no conflict of interest.

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