Journal of Social Sciences and Management Research,
ISSN: 2456-9879, Volume 03, Issue 02, December 2018

Journal of Social Sciences
and
Management Research

Factors Affecting the Sustainable Agricultural Practices by Farmers of Odisha: A Case Study of Nayagarh District

***Bibhuti Bhusan Pradhan**

****Prakash Kumar Sahoo**

Abstract:

The present study tries to examine the factors affecting sustainable agricultural practices by farmers in Odisha taking Nayagarh district as the case study. The results based on multiple regression models reveal a rupee increase in income from the agriculture brings about 17 paise increase on maintenance of soil health. The results also indicate that those farmers who have a sound knowledge about the soil health quality by doing soil test and farmers having more agricultural land under their possession are investing more on maintaining soil health by way of the use of organic manure, humus and cow-dung. On the other hand the share croppers as well as small farmers and marginal farmers are more dependents upon chemical fertilizers which are an alarming indicator for policy makers for safeguarding the livelihood of small and marginal farmers who are more prone to be affected by climate change and infertility of land. From the study, it has also been found that, the spread of sustainable agricultural practices is not successful and effective in case of Odisha due to the lack of funds, co-ordination, and proper planning. So, there is the need of provision for trainings, workshops, extension programs and financial assistance to the farmers for the better implementation of sustainable agriculture in Odisha as well as in India.

Keywords: Sustainable Agricultural Practices; Multiple regression; Soil health quality

* **Bibhuti Bhusan Pradhan**
Lecturer in Economics,
Rajendra (Auto.) College,
Bolangir, Odisha.

****Prakash Kumar Sahoo**
Lecturer in Economics,
Government College, Koraput, Odisha.

1. Introduction

Agriculture is a way of life, a tradition, which, for centuries, has shaped the thought, the outlook, the culture and the economic life of the people of any society. Agriculture, therefore, is and will continue to be central to all strategies for planned socio-economic development of a country. Agriculture affects the environment, human health, and even social order. Thus, any attempt to achieve sustainability must set as a priority for the attainment of a more sustainable agriculture.

The present agricultural system is dominated by conventional methods of production. This system was developed less than 50 or 60 year ago and has led to several environmental, human health and economic problems around the world. Conventional agriculture focuses on increased yields with excessive use of chemicals and nonrenewable resources. These goals are achieved through the use of subsidised farm inputs, non-renewable fossil fuels, thus carrying environmental degradation and promoting economically inefficient production systems in the long run. Recently the problems of climate change and food insecurity have became a cause of head ache for all the countries all over the world and the international organizations become more worried about these universal problems. These problems will cause a greater damage particularly in developing countries like India, as more than half of the total population is dependent on agriculture. The presently used agricultural technologies are more vulnerable to climate change and these technologies also have badly affected the life of marginal and small farmers of the country. Again as the case of Odisha is concerned in which the incidence of poverty is maximum and more than 60% of the people are dependent on agriculture, it is very much necessary to safeguard the life of the farmers by introducing an eco-friendly, economical and suitable farming system.

Despite the negative impacts of conventional agriculture, the current economic and pricing system continues to encourage farmers towards this type of production (Norman et al. 1997). Farmers have been forced to expand their operation, increase production, and depend on governmental price supports and subsidies that generally benefit large producers (Fazio et al. 2003). These economic pressures lead to concentration of production, forcing small farmers to abandon their farms (Horrigan et al. 2002).

Again the concept of sustainable agriculture has more relevance for a poor state like Odisha.

So in this context it is very much essential to think about the issues like whether the present type green revolution technologies is suitable for the poor and marginal farmers of Odisha? Why they are not following the adoption of sustainable agricultural practices specifically Organic farming? Again what are the factors affecting more for the adoption of sustainable agricultural practices? Whether the Orgnic Farming is more sustainable than the modern agriculture in respect of economic profit and ecological security? Do the government agricultural programs inducing the farmers towards the sustainability of agriculture? So the objectives of this Study are: To examine the socio-economic background of the sample village and its impact on sustainable agricultural practices, to assess the impact of the size of farm land and ownership on the practice of sustainable agriculture and to assess the impact of government agricultural schemes on the practice of sustainable agriculture. This paper has been organised as follows: the first section is the introduction; the subsequent section starts with a brief background of the present research, followed by a discussion on the existing literatures for getting a theoretical insight into the concept of Sustainable Agriculture. Section-3 explains econometric methodology and data source. Section-4 analyses the results and section-5 concludes the study.

1.1. The Concept of Sustainable Agriculture

In the past three decades the concept of sustainable agriculture has evolved as an answer to the negative impacts of conventional farming .There remains disagreement among farmers, the general public, and even agricultural professionals about what the concept means (Ikerd et al. 1997). However, most proponents of the concept will agree that sustainable agriculture is a long term goal and not a defined set of agricultural practices (Ikerd et al. 1997) Sustainable agriculture is more frequently defined utilizing its three main aims: environmental health, economic profitability, and social and economic equity (Horrigan et al. 2002).

The environmental component refers to the promotion of environmental stewardship, including: protecting and improving soil quality, reducing dependence on non-renewable resources, and minimizing adverse impacts on safety, wildlife, water quality and other environmental resources (SARE, 2003). In short, sustainable agriculture improves the environment and natural resources upon which agriculture depends. Sustainable agriculture

furthers environmental sustainability by emphasizing the efficient use of on farm resources, non-renewable resources, and the integration of biological cycles (Ikerd et al.,1997)

The social component has been interpreted in different ways, all of them equally valid. According to SARE, the social component refers to the promotion of stable, prosperous farm families and communities (SARE, 2003). The preservation or enhancement of quality life for farmers and society as a whole through supplying human food and fiber needs are the primary social goals of sustainable agriculture (Ikerd et al. 1997). That means it is more concerned about a stable, healthy and long term food security of the larger group of people.

In the case of economic component as Ikerd et al. (1997) explains, quality of human life also refers to the increase of income and employment opportunities in agricultural communities, particularly self employment opportunities. Sustainable agriculture must provide people with the opportunity to have a productive and successful life. Thus, sustainable agriculture promotes the maintenance or increase in the number of small- and mid-size operations.

Some authors point out that sustainable agriculture is time and place specific, and thus represents a dynamic concept. Because farming systems vary greatly across geographical areas.

2. Review of Literature

There are many literatures available regarding the issue of sustainable agriculture and its practices. As the concept of sustainable agriculture is dynamic, so it is not easy to assimilate all the concepts.

2.1. Limitations of the Green Revolution Technologies

Many researchers from time to time tried to study the characteristics of the modern green revolution technologies and find out the various bad impacts of the technology such as the destruction of wild life habitats, environmental pollution, risks to human health, water logging, soil salinity, pollution of drinking water and due to high dependence on external inputs there is increasing indebtedness resulting in agrarian distress and farmer suicides(Rao,2003; Rigby et,al,2001; Patil et,al,2012). Lee (2005) has criticized the green revolution technologies and in place of that given his support for the sustainable agriculture. He has raised the issues like high cost of external inputs, environmental effects

of modern agriculture and unequal distribution of the benefits of green revolution productivity. Gopikrishna (2012) has studied the case of the vitality of Indian soils and the resultant threat to food security due to massive use of chemical fertilizers and pesticides by Indian farmers. Again the author has criticized the government policy of extending more subsidies for chemical fertilizers neglecting the case of ecological fertilization programs.

2.2. Superiority of different types of Sustainable Agricultural practices

As the concept of sustainable agriculture is dynamic, there is not a single system which can be termed as sustainable practice. Regarding this issue there are multiple opinions by various researchers regarding the various types of sustainable agricultural practices. Lee (2005) has tried to explain 39 types of sustainable agricultural practices such as: - intercropping, organic farming, agro-forestry, System of Rice Intensification (SRI), Integrated Pest Management (IPM), Home gardens etc. Patil et.al (2011) have tried to assess the sustainability of both Organic Agriculture as well as the conventional agricultural practices in Karnataka by using the model TechnoGIN and they have concluded that the Organic Farming can be a more sustainable farming practice in Karnataka depending on regional conditions and the crops cultivated. Caviglia and Harris (2003) have given importance to agro forestry and inter cropping instead of slash and burn farming.

2.3. Factors Affecting the Sustainable Agricultural Practices

Comer Ekanen et.al (2008) shows that there is a significant difference in the use of sustainable agriculture system practices by conventional and sustainable farmers. They used the Probit coefficient to show the positive relationship between farmer's education and sustainable agricultural practices. Again they show that the sustainable farmers are younger and have more off farm income than the conventional farmers and affiliation of farmers groups with different or organization does affect the farmer perception towards SAP. Arellanes et.al (2003) examined the adoption of minimum tillage, a form of sustainable agricultural practices, among the resource poor agricultural households in villages in central Honduras. They have used Logistic regression to analyze the determinants of adoption of minimum tillage among a sample of 250 agricultural households. They have found that plots with irrigation, plots farmed by their owners, and plots with steeper slopes were more likely

candidates for minimum tillage adoption. On the other hand household characteristics are not generally found to represent significant influence on adoption. D'Souza et.al (1993) have made a study on the extent to which the individual factors influence the adoption of sustainable agricultural practices by using a logit model and data from a primary survey of West Virginia producers. They found that four out of eight variables such as age, education, employment and awareness about groundwater contamination are significant at 10-percent. Again they have concluded that among the significant variables, age and off-farm employment are negatively correlated with the SA adoption decision where as education and groundwater contamination have positively related with SA adoption. Tavrnier and Tolomeo (2008) draw relationship between the size of the firm and sustainable agriculture. Again they say that non-agricultural incentives may be adversely impacting SAP decisions of farmers. Reddy (1995) focuses on literacy, market forces, technology and institutional changes in terms of agrarian reforms affecting the adoption of sustainable agricultural practices by farmers. Caviglia (2003) have found the major determinants of the adoption of sustainable agriculture as the union or co-operative membership, knowledge of sustainable agriculture and the number of years that a family has lived in a place.

3. Methodology

Study Area

For this study a village named Bakalabandha which comes under the Badagotha gram-panchayat of Nuagaon block of Nayagarh district has been taken into consideration. This village is about 6 kilometers away from the block head-quarter and about 12 kilometers away from the district head-quarter. There are totally 135 households residing in this village and majority of the households are depending on cultivation.

Database and Methodology

This study envisaged various types of primary as well as secondary data related to the socio-economic condition of farmers and the agricultural practices adopted by the farmers in the sample village Bakalabandha. The primary data was collected during 12th November 2012 to 20th November 2012 by surveying 100 farmer households in Bakalabandha for the cropping year 2011-12 using pre-tested questionnaire. On the other hand, to support this study secondary data were collected from various sources such as:-Directorate of

Economics and Stastistics, Govt. of Odisha, District Statistical Handbook of Nayagarh, Economic Survey of Odisha-2011-12,Economic Survey of India-2011-12 and Department of Agriculture and Co-operation, Govt. of India.

Sampling Design for Selection of Study Area

Purposive sampling was used to select the block Nuagaon as well as the village Bakalabandha from the Badagotha Grampanchayat. The village Bakalabandha was selected for this study as all the households of this village primarily depends on agriculture. There is the cultivation of paddy, pulses, vegetables as well as sugar-cane. Again there is the system of lift irrigation facilities in this village and village is about 6 kilometers away from the block head quarter. 100 households were selected using the method of simple random sampling.

Data Analysis

Due to its descriptive nature the simple tabular analysis like crosstab and frequency distribution has been used to analyse the data.

To determine the factors affecting sustainable agricultural practices by farmers in the study area a **Multiple Regression** model is estimated.

The Multiple Regression model is defined as:

$$Y = \beta+\beta_1X_{1+}\beta_2X_2+\beta_3X_3$$

Where,

Y= Investment on maintenance of soil health
X_1= Price of Total sale of the products
X_2=Area of own agricultural lands
X_3=Knowledge of soil health

4. Results and Discussion

Pattern of Agricultural Inputs Utilization

Table-5 and table-6 show the case of fertilizer and pesticides use by the farmers of Bakalabandha village. Majority of people (69%) are using fertilizers of 200-300kgs in a farming year and 22% farmers are using fertilizers of 300 kgs. and above. Generally majority of farmers are using fertilizers to increase their productivity without knowing the effects of these chemical fertililizer and pesticide on the environment. The farmers of this village as a whole are using a total of 176.18 quintals of chemical fertilizers comprising 101.58 quintals Nitrogen, 42.68 quintals Phosphate and 34.08 quintals Potassium. The average chemical fertilizer use is 1.77 quintal per farmer in this village. Again

if we take the per hectare use of chemical fertilizers, it is about 103 kgs. Comprising 59.76 kg N , 25.11 kgs.P and 20.1 kgs. K. On the other hand the total use of organic manure by farmers is 2100 ton with the average use of 21 ton per farmer. The per hectare use of organic manure is only 12.35 ton per hectare.

Table -5: Use of Total Chemical Fertilizers by Farmers

	Total fertilizer level (N+P+K)	No of farmers	Percent	Cumulative Percent
	0	6	6.0	6.0
	(100-200 kgs)	3	3.0	9.0
	(201-300 kgs)	69	69.0	78.0
	(301-above kgs)	22	22.0	100.0
	Total	100	100.0	

Source: primary data

Again the farmers of this village are using a total of 19000 grms. of chemical pesticides in a year with average use of 190 grms per farmer. The per hectare use of chemical pesticides is 110 grms. per hectare. On the other hand the farmers of this village are unaware of the the use of organic pesticides and they are using no organic pesticides for the protection of crops from the pests.

Table -6: Pattern of Use of Fertilizers

Items	Total quantity (in quintals)	Average household use(in quintals)	Per hact. Use (in kg.)
Total amount of N	101.58	1.1	59.76
Total amount of P	42.68	0.43	25.11
Total amount of K	34.08	0.35	20.1
Total fertilizer (N+P+K)	176.18	1.77	103.64
Organic manure	2100 ton	21 ton	12.35 ton/hact.
Chemical pesticides	19000grms	190 grms	110grms/hact.
Organic pesticides	0	0	0

Source: primary data

Again if we make an analysis of the expenditure by farmers on fertilizers and pesticides, we will find that the farmers are making more expenditure on the purchase of chemical fertilizers and pesticides in comparison to the sale of organic fertilizers and pesticides. The per-hectare expenditure for chemical fertilizers and pesticides is Rs 1749.43/- whereas the same for organic fertilizers and pesticides is Rs 971.89/-. From this above discussions we can say that the farmers are totally depending on the chemical fertilizers and pesticides to increase the productivity of agricultural outputs.

Table-7: Expenditure for Fertilizers and Pesticides

Items	Total price (in Rs)	Average household expenditure (in Rs)	Per hact. Expenditure (in Rs)
Chemical fertilizers and pesticides	297402	2974.02	1749.43
Organic fertilizers and pesticides	165220	1652.20	971.89

Source: primary data

Awareness about Sustainable Agricultural Practices

Table-8 shows the awareness of farmers regarding various sustainable agricultural practices in Bakalabandha village of Nuagaon Block. As the case of soil test is concerned, only 15 farmers are doing soil test in government laboratories and a majority of 85 farmers are not doing soil test. Likewise about 52 farmers have knowledge about soil health whereas 48 farmers have no knowledge about soil test. Again 45 and 3 farmers have compost pits and earthworm culture respectively whereas 55 and 97 farmers have no such facilities. About 64 farmers are using chemical pesticides to protect the crops from pests. At the time of use of chemical fertilizers and pesticides only 33 farmers are taking advice from the gram-sevaks whereas 67 farmers are using it from their own. Again only 10 and 19 farmers are aware of the farming practices like SRI (System of rice intensification) and Organic Farming respectively. On the other hand 90 and 81 farmers have not aware of these two types of farming practices respectively. Likewise 19 farmers are aware of the system of mixed farming. But no farmer is aware of the system of inter-cropping. So we can say that the farmers of this village are not so aware of the system of sustainable agricultural practices.

Table -8: Awareness about Sustainable Agricultural Practices

Categories	Yes	No
Soil test	15	85
Knowledge of soil health	52	48
Compost pit	45	55
Earth-worm culture	3	97
Use of pesticides	64	36
Consultation with gram-sevak	33	67
Govt.facility for soil health/adoption of SAPs	11	89
Knowledge of SRI	10	90
Knowledge of organic farming	19	81
Knowledge of mixed farming	45	55
Knowledge of inter-cropping	0	100

Source: primary data

Table-9 shows the various ways of maintaining soil health by the use of different types of fertilizers and manures. It was found that out of the total farmers 48 farmers have no knowledge about soil health and these people are included as missing cases. On the other hand out of the total farmers having

knowledge about soil health,20% use manure,30% use both manure and humus and only 2% use humus for enhancing the fertility of soil.

Table-9: Maintenance of Soil Health

Maintenance of soil health		Frequency	Percent
	Chemical fertiliser	48	48.0
	Use of manure	20	20.0
	Humus	2	2.0
	Both manure and humus	30	30.0
	Total	100	100.0

Source: Primary Data

Factors Affecting the Sustainable Agricultural Practices by Farmers

As it has been explained in the preceding section, there are various factors affecting the sustainable agricultural practices, given the explanatory variables is captured by running a multiple regression model.

Table-10: Factors Affecting the Sustainable Agricultural Practices by Farmers

Independent Variables	Coefficient	t-Statistics	p-value
Constant		-4.416	.000
Total Income from Agriculture	0.173*	2.258	.026
Educational Status of Household Head	0.016	0.389	.698
Availability of Irrigation	0.006	0.069	.945
Knowledge of Soil Health	0.221**	2.741	.007
Area of Own Agricultural Land	0.467**	6.363	.000
Soil Test	0.160*	2.306	.023

The results (given in Table-10) reveal that all the variables, except education of the household head and availability of irrigational facility are significant. It explains that a rupee increase in income from the agriculture brings about 17 paise increase on maintenance of soil health. The results also indicate that those farmers who have a sound knowledge about the soil health quality by doing soil test and farmers having more agricultural land under their possession are investing more on maintaining soil health by way of the use of organic manure, humus and cow-dung. On the other hand the share croppers as well as small farmers and marginal farmers are more dependents upon chemical fertilizers which are an alarming indicator for policy makers for safeguarding the livelihood of small and marginal farmers who are more prone to be affected by climate change and infertility of land.

5. Conclusion

Sustainable agriculture has now gained massive popularity in the developed countries in place of the green revolution technologies. In India also the policy makers have tried their level best to introduce the concept of sustainable agriculture in place of the intensive green revolution technologies. For this purpose

the government of India has made a commission under the National Commission of Climate Change named as National Commission of Sustainable Agriculture (NCSA). Likewise in case of Odisha the government also has taken some steps to spread the system of SRI, Organic Farming through the National Food Security Mission. But as this study shows the farmers in the grass root level are not getting these facilities properly. On the other hand the spread of sustainable agricultural practices is not successful and effective in case of Odisha due to the lack of funds, co-ordination, and proper planning. So, there is the need of provision for trainings, workshops, extension programs and financial assistance to the farmers for the better implementation of sustainable agriculture in Odisha as well as in India.

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