A Fruitful Technology for Sustainable Agriculture in Banana Cultivation Growing: Economic Analysis

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ABSTRACT

This paper examine simultaneously, the two aspect continues change and difference in organic and conventional agriculture economic analysis was banana cultivation two districts analysis there are 120 sample collected in organic and conventional farms was collected primary data normal agriculture year (2013-2014). organic farm produces in banana cultivation in Erode district 890 bunches per acre a little more unit 886 bunches per acre produces from conventional was reported, which slightly higher prices than the conventional farmers. The yield and price was not much different under the two methods of cultivation. Banana cultivation in Thanjavur district was 850 bunches for organic and 890 bunches per acre from conventional farms. Organic farmers received ₹ 86 one bunches the low ₹ 84 one bunches. Banana cultivation is common in both the district. However, superior verities like rasthali and green banana are grown largely in Erode. On the other hand, poovan - a common variety is abundantly cultivated in Thanjavur. The National Banana Research Centre, located in Thiruchirapalli is providing all scientific inputs for the development of banana economy. In addition, the organic farming has been found superior in terms of economic well being and livelihood security of the farmers. Include yield reduction in conversion to organic farm, soil fertility enhancement, integrations of livestock, certification constraints, ecology, marketing and policy support. It has been argued that organic farming is productive and sustainable, but there is a need for strong support to it in the form of subsidies, agricultural extension services and research

KEYWORDS: *Biological Power, Cost, Conventional, Sustainability, Soil, Livelihood, Organic.*

Preface

Banana (*Musa sp*.) is a large perennial herb with leaf sheaths that form trunk like pseudo stem. Banana has its origin in tropical region of South East Asia. Banana is a nutritious gold mine. They are high in vitamin B6, which helps fight infection and is essential for the synthesis of home, the iron containing part of haemoglobin. They are also rich in potassium and are a great source of fibre. In recent years, considering the adverse impact of indiscriminate use of chemicals, new trend for organic production of banana is increasing in the country. A new name, i.e. "Green Foods" for this has been coined. This refers to organically grown crops which are not exposed to any chemicals right from source of planting material to the final post harvest handling and processing. It is based on recycling of natural organic matter. In this system nutritional requirement are met through use of enriched composts, cakes, promotion of green manure, inter and cover crops, mulching etc, while pests and diseases are kept below threshold level through integrated crop management.

International scenario:

Bananas are the fifth largest agricultural commodity in world trade after cereals, sugar, coffee and cocoa. India, Ecuador, Brazil and China alone produce half of total bananas of the world. The advantage of this fruit is its availability round the year.

The major banana exporting countries are Ecuador, Colombia, Costa Rica and Philippines and the major importing countries are USA, Belgium, Germany and United Kingdom. According to FAO estimates, India occupies the highest area under banana in the world. It may be noted that 11 percent of the total global area under banana belongs to India. India ranks first in banana production, contributing about 23% in world pool of banana production.

National Scenario:

The major banana producing states of India are Tamilnadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Assam and Madhya Pradesh. The productivity per hectare in India is more than twice that of the world. The state of Maharashtra is the largest producer of banana in the country with 27 per cent of total Indian production and it has the highest productivity, 420 per cent higher than that of the world average and 225 per cent higher than that of the country's average. Even though nearly 23 per cent of total world output is produced in India, the export is negligible when compared to other countries. The exports of Indian Banana are mainly to UAE, Saudi Arabia and other Gulf countries. India has the potential to emerge as a major exporter of organically grown bananas by promotion of Bio fertilizers, bio pesticides and recycling of wastes of eco-friendly inputs and setting up of a national certification scheme and accreditation agency to certify organic products in the country.

Organic Farming

Organic farming is a crop production method respecting the rules of the nature. It maximizes the use of on farm resources and minimizes the use of off-farm resources. It is a farming system that seeks to avoid the use of

chemical fertilizers and pesticides. In organic farming, entire system i.e. plant, animal, soil, water and micro-organisms are to be protected.

Climate

This tropical crop is grown throughout the year under humid weather condition. The optimum temperature suitable for banana ranges between 25-30 ^{0} C. The plant prefers a soil pH of 5.5-7.5.

Soil

Almost all the agricultural soils are suitable, provided they are deep well drained. Black loams and sandy loam soils of uplands are most suited.

Land Preparation

Prior to planting banana, grow the green manuring crop like daincha, cowpea etc. and burry it in the soil. The land can be ploughed 2-4 times and levelled. Use rotovator or harrow to break the clod and bring the soil to a fine tilt. During soil preparation basal dose of FYM is added and thoroughly mixed into the soil.

A pit size of 45cm x 45cm x 45cm is normally required. The pits are to be refilled with topsoil mixed with 10 kg of FYM (well decomposed), 250 gm of Neem cake and 20 gm of conbofuron. Prepared pits are left to solar radiation helps in killing the harmful insects, are effective against soil borne diseases and aids aeration. In saline alkali soil where PH is above 8 Pit mixtures is to be modified to incorporate organic matter. Addition of organic matter helps in reducing salinity while addition of purlite improves porosity and aeration. Alternative to planting in pits is planting in furrows. Depending on soil strata one can choose appropriate method as well as spacing and depth at which plant is required to be planted.

Varieties

In India banana is grown under diverse conditions and production systems. Selection of varieties, therefore is based on a large number of varieties catering to various kinds of needs and Situations. However, around 20 cultivars viz. Dwarf Cavendish, Robusta, Monthan, Poovan, Nendran, Red banana, Nyali, Safed Velchi, Basarai, Ardhapuri, Rasthali, Karpurvalli, Karthali and Grandnaine etc.. Grandnaine is gaining popularity and may soon be the most preferred variety due to its tolerance to biotic stresses and good quality bunches. Bunches have well spaced hands with straight orientation of figures, bigger in size. Fruit develops attractive uniform yellow colour with better self life & quality than other cultivars.

Review of Literature

Howard and Albert (1940) draw attention to the destruction of soil and deals with the consequences of it. It suggests methods to restore and maintain the soil fertility. The study contains a detailed deposition of the famous Indore method of maintaining soil health. The reasons and sources of the erosion of soil fertility and its effect on living things are discussed. The criticism of the agriculture research and examples of how it had to be carried out to protect soil and its productivity are discussed in detail.

Rajendran and Basavaraj (2005) in their study note that in the era of modernization, it is difficult to refuse to adopt different modern farming methods and techniques and at the same time, it is not possible to

completely give up the IKS merely for the reason that they are easily adoptable at local level. In fact the economic, environment and social consequences of modern farming have been widely addressed in the recent past and the literature favouring sustainable agricultural development. As a consequence, low external input sustainable agriculture, ecological farming and organic farming are being advocated across the globe. In this context the Indigenous Knowledge System (IKS) proves to be some solace, but strategy. Not much attention has been given to this important issue.

Rajendran and Tholkappian (2010) in their study on "Is Organic in Farming a Panacea for Food and Nutritional Security in India?" in their article observe that the modern farming system enabled to increase the food grain production substantially. Compounded with this, environmental degradation, loss in biodiversity and so on has been noticed. This has made individual thinkers to find alternative model and organic agriculture is found as sustainable and viable. In India many individuals and NGOs have been actively engaged in this domain. Nevertheless, there are some obstacles especially in marketing the organic products. Marketing for both inputs and output is found as either weak or underdeveloped. Appropriate and timely intervention will help solve the marketing problems. In this connection the filed experiences in Erode, Thanjavur district and elsewhere reveal that though the spread of organic farming is found as slow, it has much advantage like environment sustainability, crop diversity, economic viability and technical feasibility. Though it is an exploratory exercise, the sample farms are highly skewed.

Mendoza (2002) notes that organic farming in general and organic rice farming in particular is more laborious than agrochemical depended modern rice farming in the Philippines. This study explains the amount of labor utilization on the modern rice farming and organic rice farming. As result organic rice farming can be more labor intensive depending on what operations (nutrient management) is involved. As a sown in audit, modern farming is more labor intensive especially after the adjustments on labor cost were made. Though it is a household study, it does not cover other crops including wheat and other major cereals.

Shirsagar (2008) study reveals the impact of organic farming on economics of sugarcane cultivation in Maharashtra. The study was based on primary data collected from two districts covering 142 farmers, 72 growing organic sugarcane and 70 growing conventional sugarcane. The results concluded that cultivation enhances human labor employment by 16.9 per cent and its cost of cultivation is also lower by 14.2 per cent than the conventional crop, it is more than compensated by the price premium received and yield stability observed on organic sugarcane farms. Overall, the organic sugarcane farming gave 15.63 per cent higher profits than conventional sugarcane farms.

Tholkappian C and S. Rajendran (2011) notes that organic sugarcane farming is important in achieving the goal of sustainable agriculture. It has been suggested that organic farming should receive prime attention from all the stakeholders to realize its full potential in increasing profitability and providing the much sought after of agriculture

Objectives

- The Socio- Economic background of organic and conventional Banana Cultivation in study area.
- Economic Analysis of organic and conventional Banana Cultivation in the study area.

Data and Methodology (Sample Size)

As per the records of the above sources, there are 60 organic farmers, located in Erode (30) and Thanjavur were selected from the neighbourhood of organic farms in both the districts.

The criteria for selection of these farmers are that they represent the same characters of organic farmers in terms of socio – economic background, geographical location and crops grown. Thus there are 120 farmers in both the sample districts for the study.

Sample Design

This near investigate was conducted in Tamil Nadu and the state has been purposefully selected due to the availability of data base relating to organic farmers. The research NGO - Gandhigram Trust is located in Dindugal and this agency documents the details on organic farms. The New Delhi based, Centre for Science and Environment has also documented the particulars of organic farmers. These two sources were used for elucidating the farmers list. Erode and Thanjavur districts were selected for primary data collection. These districts were purposefully selected because of the high concentration of organic farmers in these districts. In addition to these, extensive discussion was held with various officials in the department of agriculture.

Arithmetical Tool Use (Input Cost)

Study Period

Relevant field data have been collected from organic banana cultivation farm for one crop year. The survey period was reported as normal agriculture year (2012-2013) in state of Tamil Nadu in general and particularly sample in Erode and Thanjvaur districts. (30) districts. The study covered all the 60 farmers practicing organic farming system. In order to make a comparative study a control group of 60 farmers practicing conventional agriculture

Cost A1 Input cost relates to owner farm situation in which the farmers cultivate own land and also contributes other resources. Since all the sample growers are owner cultivators, this cost concept is appropriate to calculate cost of cultivation. It includes the following items of costs.

Value of hired human labour, Value of owned and hired draught animal power, Value of owned and hired machinery charges including rent, Value of fertilizer, Value of manures (owned and purchased), Value of seed (both farm produced and purchased), Value of insecticides and pesticides, Irrigation charges (both owned and purchased), Canal water charges, Land revenue, cusses and other taxes, Miscellaneous expenses (repairs to farm implements and artisans)

Cobb-Douglas production function has been the most widely used model in many empirical studies. Therefore, this functional form is used in the present analysis. The following Stochastic Production Frontier is estimated.

$\ln Y_{it} = \beta_{0t} + \beta_{1t} \ln X_{1it} + \beta_{2t} \ln X_{2it} + \beta_{3t} \ln X_{3it} + \beta_{4t} \ln X_{4it} + V_{it} + U_i$ Where Y_{it} is the total output X_{1it} = Value of farm power in rupees of i^{th} farm in the t^{th} period. X_{2it} = Value of organic

nutrients in rupees of i^{th} farm in the t^{th} period. X_{3it} = Value of seed in rupees of i^{th} farm in the t^{th} period. X_{4it} = Irrigation charges in rupees of ith farm in the t^{th} period $_{it}$ = Random variable and assumed to be independent and identically distributed (iid) as N (0, σ_v 2)and independent of U_i random variables. U_i =is firm-specific technical efficiency related variable and non-negative, Defined by the truncation (at zero of N (0, σ_u^2)

Result and Discussion (Socio Economic)

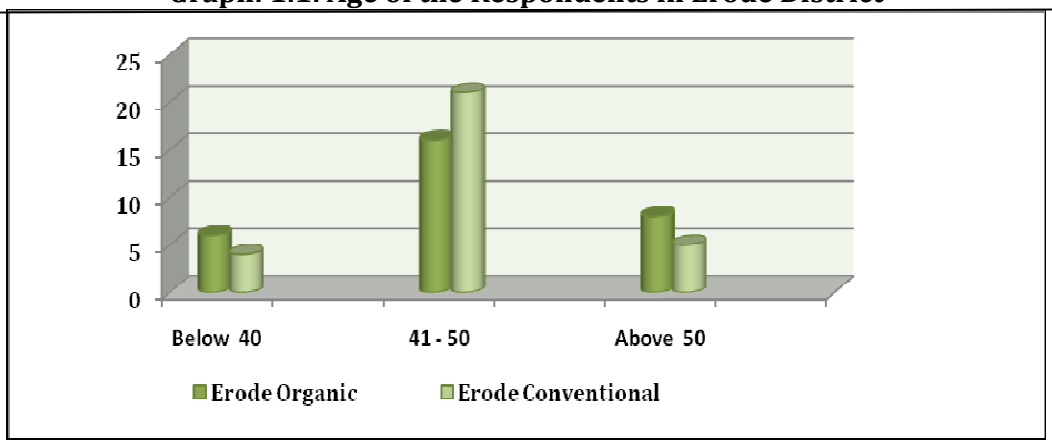
Age of sample farmers is categorized into four group's viz., those below 40 years, between, 41 and 50 years and above 50 years. Distribution of sample farmers according to age group is presented in table 1.1.

Table – 1.1: Age wise Distribution of the Respondents in the Study Districts

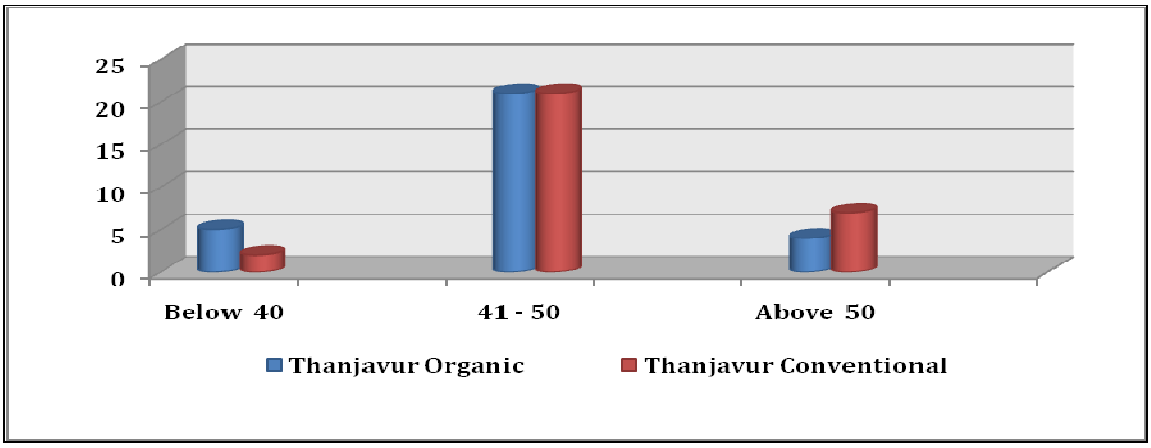
Age Group in years	Erode		Thanjavur		Total
	Organic	Conventional	Organic	Conventional	
Below 40	6 (20)	4 (10)	5 (17)	2 (17)	**17 (14)**
41 - 50	16 (53)	21 (70)	21 (70)	21 (70)	**79 (66)**
Above 50	8 (27)	5 (20)	4 (13)	7 (13)	**24 (20)**
Total	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**	**120 (100)**

Note: Figures in parentheses are percentages, Source: *Survey Data*

Graph: 1.1: Age of the Respondents in Erode District



Graph: 1.2: Age of the Respondents in Thanjavur District



The data indicates that in the case of Thanjavur district, 7 farmers are below 0 years of age. In both farming systems, more farmers belong to the age group of above 40 years. These refute the arguments that younger generations are adopting organic agriculture. Concentration of age group in both farming systems shows that farming is practiced mainly by the older group and younger generation is not practicing agriculture. Influences the production of agriculture. Because increase educational level will improve the farmer's ability to use modern techniques and technology Education background of the farmer is one of the important variables which influence the awareness levels. Data on education background of the sample farmers is presented in table 1.2. It is true that the level of education

Table – 1.2: Education Status of Sample Farmers

Education Status	Erode		Thanjavur		Total
	Organic	Conventional	Organic	Conventional	
Primary	6 (20)	8 (27)	10 (33)	8 (27)	**32 (27)**
Secondary	8 (27)	8 (27)	11 (37)	8 (27)	**35 (29)**
Graduation	12 (40)	13 (43)	8 (27)	13 (43)	**46 (38)**
Professional Degree	4 (13)	1 (3)	1 (3)	1 (3)	**7 (6)**
Total	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**	**120 (100)**

Note: Values within brackets represent percentages, **Source:** *Survey Data*

Data shows that 27 per cent of the farmers are primary and they are concentrated in Thanjavur district. Out of the total 32 primary farmers, 18 farmers are from Thanjavur and 14 farmers are from Erode. District wise observation indicates that in the case of Erode, 13 per cent of the organic farmers are professional and 12 per cent are graduates and 8 percent

completed secondary. The result clearly shows the relationship between the education background and farming system. It is hoped that as the level of education increases, the performance of agriculture in terms of production is better.

Demographic Features

The family respondents of the farmers influences the family operation as the number of hands available for work and the sharing of workload are vital. Table 5.3 gives the details of family members of the farmers in the study area.

Table - 1.3 Distributions of Family Members

Particulars	Erode		Thanjavur		Total
	Organic	Conventional	Organic	Conventional	
Male	52 (40)	58 (54)	46 (47)	43 (51)	**198 (47)**
Female	49 (38)	27 (25)	34 (35)	30 (35)	**140 (33)**
Children	28 (22)	22 (21)	18 (18)	12 (14)	**80 (20)**
Total	**129 (100)**	**107 (100)**	**98 (100)**	**85 (100)**	**419 (100)**
Per household family members	**4.3**	**3.5**	**3.2**	**2.8**	**3**

Note: Figures in parentheses are percentages, **Source:** *Survey Data*

In this table elaborately mention the distribution of family member of the respondents. In Erode male organic farmers are 40 per cent, females are 38 per cent and children are 22 per cent. In conventional 54 per cent are male, 22 per cent are female and only 21 per cent are children. In Thanjavur 47 per cent male below to organic agriculture, 35 per cent are female and only 14 per cent are children.

Income Status

Income is an important determinant factor in the life of the people. An income farmer is categorized into four group's viz., those below ₹ 25000 between ₹ 25001 to 50000 years, ₹ 50001 to 75000 years and above ₹ 75001 and above. Distribution of sample farmers according to income group is presented in table 1.4.

Table – 1.4 Distributions of Respondents by Income Groups

Annual Income In (₹)	Erode		Thanjavur	
	Organic	Conventional	Organic	Conventional
Below 25000	3 (10)	7 (23)	4 (13)	**8 (27)**
25001 – 50000	12 (40)	11 (37)	16 (53)	**10 (33)**
50001 – 75000	6 (20)	4 (13)	5 (17)	**6 (20)**
75001 and Above	9 (30)	8 (27)	5 (17)	**6 (20)**
Total	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**

Note: Values within brackets represent percentages, **Source:** *Survey Data*

The present table explores 53 per cent of respondents come under the income groups of below ₹ 25000 in Thanjavur organic farmers. The second highest 40 percent of the respondents under the income groups of ₹ 25001-50000 in Erode organic farmers respectively and 37 percent of respondents in conventional farmers. Similarly 23 percent of respondents come under the income group below ₹ 25000 in Erode conventional farmers and 40 percent of the respondents under the income groups of ₹ 25001 – 50000 in Erode organic farmers respectively. Only a medium number of the farmers come under the income category of ₹ 50001 – 75001 and below 25000 in the both districts. The next table shows the own livestock status of the respondents in the study districts.

Land Particulars

Land holding size is categorized into three group's viz., less 5 acre between 5.1 to 10 acre and above 10 acres. Land particulars of sample growers in Erode and Thanjavur districts are given below in table 1.5 Despite the Indian rural economy is under serious transformation, people teed to hold some parcels of agriculture land. This table shows some farm households own more land as compared to others.

Table – 1.5 Numbers of Farmers and Size Class

Categories	Erode		Thanjavur		Total
	Organic	Conventional	Organic	Conventional	
> 5 (Small)	7 (23)	12 (40)	14 (47)	10 (33)	**43 (36)**
5 – 10 (Medium)	18 (60)	10 (33)	12 (40)	15 (50)	**55 (46)**
< 10 (Large)	5 (17)	8 (27)	4 (13)	5 (17)	**22 (18)**
Total	**30 (100)**	**30 (100)**	**30 (100)**	**30 (100)**	**120 (100)**
Banana	**44**	**26**	**11**	**9**	**90**

Note: Values within brackets represent percentages, **Source:** *Survey Data*

The data shows that majority of the sample growers owning land between 5 and 10 acres both in Erode and Thanjavur districts. In Erode district 60 per cent of the organic farmers fall in the mediums size category. Among conventional, 40 per cent farmer represents small farmer's category. Similarly 47 per cent small farmers in Thanjavur district, 40 per cent medium farmers and 13 per cent of large farmers accounting for organic category.

Cost of Returns in Banana Cultivation Erode and Thanjavur

Banana is an annual crop grown mainly in Erode and Thanjavur districts. Average cost and return costs in the production of banana is presented in table 5.15. Some farmers especially in Thanjavur district exclusively cultivate banana for left purpose.

Table -1.6 Cost and Return in Banana cultivation (in ₹ per acre)

SI. No	Particulars	Erode		Thanjavur	
		Organic	Conventional	Organic	Conventional
1	Biological Power	32249	31560	31249	**31749**
2	Organic Manures	4578	1582	4578	**2450**
3	Chemical Fertilizer	-	4120	-	**4530**
4	Seed	5700	5800	5600	**5700**
5	Irrigation	650	540	650	**540**
6	Land Tax	60	55	60	**55**
7	Charges for Implements and Machineries	4150	4250	4850	**4250**
8	Repair of Machineries	800	1257	800	**1257**
9	Total Cost of cultivation (1+2+3+4+5+6+7+8)	48187	49164	47787	**50531**
10	Yield (Bunch / Per acre)	890	886	850	**890**
11	Value (₹ / Per bunch)	90	92	86	**84**
12	Gross Returns (₹) (10×11)	80100	81512	73100	**74760**
	Net Returns (₹) (12-9)	**31913**	**32348**	**25313**	**24229**

Source: Survey Data

It is observed from Table 5.15 that the Banana cultivation in Erode district under organic agriculture found to be marginally higher compared to the banana produced under conventional system. While gross returns from organic agriculture were 80100 per acre, the same from conventional agriculture was 81512 per acre, a difference of 60 per acre. But net return was relatively high from organic agriculture 31913 per acre compared to conventional agriculture 32348 per acre. Because cost of cultivation was lower for organic farms 48187 per acre compared to conventional farms 49164 per acre. Banana cultivation in Thanjavur district shows that gross returns from organic agriculture were 73100 per acre. The same from conventional agriculture 74760 per acre, a difference of 3366 per acre. Similarly net return was relatively low from organic agriculture 25313 per acre compared to conventional agriculture 24299. The cost of organic nutrients, biological power, charges for implements and machineries are higher in organic agriculture. Marginal difference could be seen in other costs. While organic nutrients were expensive, the transportation of FYM its administration, transplantations and weeding require more labor.

This is reflected in the biological power charges, implements and machineries a charge is higher in organic agriculture due to more use of farm equipments. The yield from organic agriculture was not found to be much higher. While organic farm produces in banana cultivation in Erode district 890 bunches per acre a little more unit 886 bunches per acre produces from conventional was reported, which slightly higher prices than the conventional farmers. The yield and price was not much different under the two methods of cultivation. Banana cultivation in Thanjavur district was 850 bunches for organic and 890 bunches per acre from conventional farms. Organic farmers received ₹ 86 one bunches the low ₹ 84 one bunches. Banana cultivation is common in both the district. However, superior verities like rasthali and green banana are grown largely in Erode. On the other hand, poovan - a common variety is abundantly cultivated in Thanjavur. The National Banana Research Centre, located in Thiruchirapalli is providing all scientific inputs for the development of banana economy. Now of late, many farmers show interleaf to take up banana cultivation under organic method.

Conclusion

The research mainly focused on economic analysis of organic and conventional banana cultivation two district analyses there are 120 sample collected in organic and conventional farms was collected primary data normal agriculture year (2013-2014). organic farm produces in banana cultivation in Erode district 890 bunches per acre a little more unit 886 bunches per acre produces from conventional was reported, which slightly higher prices than the conventional farmers. The yield and price was not much different under the two methods of cultivation. Banana cultivation in Thanjavur district was 850 bunches for organic and 890 bunches per acre from conventional farms. Organic farmers received ₹ 86 one bunches the low ₹ 84 one bunches. Banana cultivation is common in both the district. However, superior verities like rasthali and green banana are grown largely in Erode. On the other hand, poovan - a common variety is abundantly cultivated in Thanjavur. The National Banana Research Centre, located in Thiruchirapalli is providing all scientific inputs for the development of banana economy. Now of late, many farmers show interleaf to take up banana cultivation under organic method. The yield on organic farmer has been reported lower but it is more than compensated by the price premium recived and yield and profit stability observed on the organic In addiction, the organic farming has been found superior in terms of economic well being and livelihood security of the farmers. Include yield reduction in conversion to organic farm, soil fertility enhancement, integrations of livestock, certification constraints, ecology, marketing and policy support. The potential for organic farming, especially in the dry land regions has been discussed. It has been argued that organic farming is productive and sustainable, but there is a need for strong support to it in the form of subsidies, agricultural extension services and research

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