

IV. RESULTS AND DISCUSSION

The results obtained from the study are discussed under following heads:

- A. Socio-economic profile of the sample farmers based on
 - a. Age-wise classification
 - b. Educational status
 - c. Classification of farmers by religion
 - d. Classification of farmers by community
 - e. Classification of farmers by family structure
 - f. Size of family
 - g. Occupational status
 - h. Income status
 - i. Expenditure pattern and
 - j. Sources of borrowing

- B. Economic performance of the sample farmers based on
 - a. Classification of farming system
 - b. Classification of farm size
 - c. Land holding
 - d. Cropping pattern and cropping intensity
 - e. Livestock
 - f. Expenditure on livestock
 - g. Years of experience
 - h. Impact of organic farming
 - i. Method of sale
 - j. Sources of information
 - k. Descriptive statistics
 - l. Cost of cultivation
 - m. Returns from the farming system – Gross and Net returns
 - n. Resource use efficiency : Cobb-Douglas production function
 - o. Discriminant function
 - p. Efficiency analysis

- C. Constraints faced by inorganic and organic farmers

- D. Motivational factors determining the decision of farmers in conversion to organic farming

A. Socio-economic profile of the sample farmers

The economic development and prosperity of any region largely depends on the demographic composition and quality of its people. The socio-economic aspects of the farmers were discussed at length by using indicators such as religion, education, age, type of family, size of family, family structure, educational level, occupation other than agriculture, family income and expenditure pattern of the households. Knowledge about sociological aspects was indispensable for providing a true understanding of the working of farming systems as also for the proper appraisal of the effects or any particular measure of governmental policy or legislation on the population.

a. Age wise classification

Age is an important factor for the economic analysis of organic and inorganic farming system. If the respondents are young, sincere, hardworking, ambitious and willing to bear the risk, the region will develop economically. The age-wise classification of the farmers is shown in table - 1.

TABLE - 1
AGE-WISE CLASSIFICATION OF FARMERS

Age group (in years)	Inorganic	Organic	Overall
Below 30	7 (5.0)	26 (9.8)	33 (8.11)
31-40	27 (19.1)	61 (22.9)	88 (21.62)
41-50	37 (26.2)	77 (28.9)	114 (28.01)
51-60	35 (24.8)	64 (24.1)	99 (24.32)
Above 60	35 (24.8)	38 (14.3)	73 (17.94)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field Survey, 2013

Foot note: Figures in the parentheses indicate percentages to column totals

It was observed that, 28.01 per cent of sample farmers at overall level, were at the age group of 41-50 years and only 33 per cent belonged to the age group below 30 years. About 96 per cent of farmers under inorganic farming and 67 per cent of organic farmers were in the productive age group of 41-60 years.

b. Age and sex composition of the sample households

Youth are generally considered more radical and the old are more conservative. The young farmer would be interested in getting ahead while the older operator would naturally be interested in preserving whatever sincerely he has attained.

Table - 2 shows the age-wise and sex-wise classification of the sample population.

TABLE - 2
AGE AND SEX COMPOSITION OF SAMPLE HOUSEHOLDS

Age (in years)	Inorganic		Organic		Overall	
	Male	Female	Male	Female	Male	Female
0-5	26 (8.15)	33 (9.06)	55 (10.18)	52 (11.28)	81 (9.43)	85 (10.30)
6-10	39 (12.22)	29 (7.97)	69 (12.78)	48 (10.41)	108 (12.57)	77 (9.33)
11-20	43 (13.48)	61 (16.76)	51 (9.44)	52 (11.28)	94 (10.94)	113 (13.70)
21-30	51 (15.99)	52 (14.28)	85 (15.74)	84 (18.22)	136 (15.83)	136 (16.48)
31-40	55 (17.24)	56 (15.38)	74 (13.70)	79 (17.14)	129 (15.02)	135 (16.36)
41-50	57 (17.87)	75 (20.60)	95 (17.59)	74 (16.05)	152 (17.69)	149 (18.06)
51 and above	48 (15.05)	58 (15.93)	111 (20.56)	72 (15.62)	159 (18.51)	130 (15.76)
Total	319 (100.00)	364 (100.00)	540 (100.00)	461 (100.00)	859 (100.00)	825 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Population across the area showed that the proportion of male members was more when compared to female members. Among the sample households the age group 41-50 years was most

populous with 18.06 per cent falling in this age group which was followed by 16.48 per cent in the age group of 21-30 years and 16.36 per cent in the age group 31-40 years. Organic farmers accounted for more members in the age group of 51 years (20.56 per cent) which indicated more lifespan because of healthy life. The male population among organic households out-numbered inorganic farmers. Majority (17.87 per cent) of the inorganic farmers belonged to productive age group of 41-50 years. The dependents of the sample households consisted of infants and children below the age group of 10 years. The number of dependents in the sample household was on an average 22 per cent of males and 19.63 per cent of females.

c. Educational status

Literacy is one among several indicators of educational development. It is capable of transforming the existing order of defining the aims and objectives of an authentic human resource development. This aspect of the study takes into account the educational status separately for the farmer and farmer household members. The following table - 3 provides details regarding the educational status of the farmers interviewed.

TABLE – 3
EDUCATIONAL STATUS OF THE FARMERS

Educational level	Inorganic	Organic	Overall
Illiterate	37 (26.2)	103 (38.7)	140 (34.40)
Primary	2 (1.4)	13 (4.9)	15 (3.68)
Secondary	73 (51.8)	119 (44.7)	192 (47.17)
Higher secondary	19 (13.5)	17 (6.4)	36 (8.84)
Graduates	10 (7.1)	14 (5.3)	24 (5.90)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field Survey, 2013

Foot note: Figures in the parentheses indicate percentages to column totals

It was observed that, at overall level 65.6 per cent farmers were literate, out of which 47.17 per cent had completed secondary education while 5.90 per cent farmers were graduates. Majority (44.7 per cent) of organic farmers had education up to secondary level followed by higher education (6.4 per cent), graduation (5.3 per cent) and education up to primary level (4.9 per cent). In case of inorganic farmers about 51.8 per cent had completed secondary level of education followed by 13.5 per cent had higher secondary, 7.1 per cent had graduation and 1.4 per cent had primary level of education. The literacy rate among inorganic farmers was found to be lower (26.2 per cent) as compared to organic farmers (38.7 per cent).

Education is significantly associated with adoption of recommended farm practices. A high level of education found to be an important factor for the acceptance and understanding of procedures for organic and inorganic farming. Illiteracy is one of the major handicaps in the proper operation of agricultural production in India. Educational status of members by sex-wise classification among farmer households is given in table - 4.

TABLE - 4
EDUCATIONAL STATUS OF THE SAMPLE HOUSEHOLDS

Level of education	Inorganic		Organic		Overall	
	Male	Female	Male	Female	Male	Female
Primary	43 (31.39)	73 (34.60)	103 (27.54)	94 (34.56)	146 (28.57)	167 (34.57)
Secondary	51 (37.23)	83 (39.34)	71 (18.98)	123 (45.22)	122 (23.87)	206 (42.65)
Higher secondary	21 (15.33)	31 (14.69)	125 (33.42)	32 (11.76)	146 (28.57)	63 (13.04)
Under graduate	13 (9.49)	17 (8.06)	54 (14.44)	17 (6.25)	67 (13.11)	34 (7.04)
Post graduate	9 (6.57)	7 (3.32)	21 (5.61)	6 (2.20)	30 (5.87)	13 (2.69)
Total	137 (100.00)	211 (100.00)	374 (100.00)	272 (100.00)	511 (100.00)	483 (100.00)
No. of Illiterates	182 (52.30)	153 (44.74)	166 (47.70)	189 (55.26)	348 (100.00)	342 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Among the farmer households, mixed level of education between the members were observed. Among inorganic farmer households up to secondary education the females (73.94 per cent) dominated males (68.62 per cent). But after this level of education, it was reversal. In other words, male population outnumbered the female population in terms of higher secondary, under graduation and post graduation which in turn brought the same trend at the overall farming system households. Among organic farmer households, females outnumbered males in secondary education and illiteracy and drop-outs were found to be more. The number of illiterates was found to be more among the farms varying between 44.74 per cent and 55.26 per cent among inorganic and organic families respectively i.e. they did not possess any formal or informal education and 166 infants (9.86 per cent) were yet to be enrolled in schools.

d. Classification of the farmers by religion

Agricultural sector in Indian villages have been traditionally determined by religion; Member of higher castes generally owned land and controlled the production and distribution of food and allocation of services, while those of lower castes were primarily tenants as agricultural labourers rendering services to the members of higher castes (Klass, 1980). The investigation about the religion of the sample farmers are presented in table - 5.

TABLE - 5
CLASSIFICATION OF FARMERS BY RELIGION

Religion	Inorganic	Organic	Overall
Hindus	118 (83.69)	169 (63.53)	287 (70.51)
Christian	18 (12.76)	93 (34.96)	111 (27.27)
Muslim	5 (3.55)	4 (1.50)	9 (2.21)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Of the total sample farmers, 70.51 per cent belonged to Hindu religion and the remaining 29.48 per cent belonged to other religions. Both organic (63.53 per cent) and inorganic (83.69 per

cent) farm households had majority of Hindu population in the selected sample. Other religions constituted 12.76 per cent of Christians and 3.55 per cent of Muslims among inorganic farmers while that of organic farmers accounted for 34.96 per cent and 1.50 per cent.

e. Classification of the farmers by community

The stratification of society on the basis of community has a pervasive influence on the system of agricultural production in India. The break-up of sample farmers across the community is shown in table - 6.

TABLE - 6
CLASSIFICATION OF FARMERS BY COMMUNITY

Community	Inorganic	organic	Overall
Forward community	5 (3.55)	7 (2.63)	12 (2.95)
Backward community	13 (9.22)	44 (16.54)	57 (14.00)
Most backward community	30 (21.28)	97 (36.47)	127 (31.20)
Scheduled caste	71 (50.35)	62 (23.31)	133 (32.68)
Scheduled Tribe	29 (20.57)	49 (18.42)	78 (19.16)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Out of 407 sampled farmers only 2.95 per cent belonged to forward community. The distribution of sample households showed that 32.68 per cent of them belonged to scheduled caste, followed by the most backward community (31.20 per cent). Both the castes together accounted for 63.88 per cent and the remaining fell under backward and forward communities. In the sampled area, majority (36.47 per cent) of organic farmers belonged to most backward community and most (50.35 per cent) of the inorganic farmers belonged to scheduled caste.

f. Classification of farmers by family structure

Family as a social institution governs the economic activities of its members. In the peasant societies economic activities such as supply of food, shelter, and clothing are primarily connected with family and it ensured these basic necessities to each member. The joint family system and its subsequent disintegration without providing for other economic and social institutions to take up its function have also affected the economic performance of farmers. Details regarding the above aspects are provided in table - 7.

TABLE - 7

FAMILY STRUCTURE OF THE SAMPLE FARMERS

Family system	Inorganic	Organic	Overall
Joint	102 (72.34)	163 (61.28)	265 (65.11)
Nuclear	39 (27.66)	105 (39.47)	144 (35.38)
Total	141 (34.64)	266 (65.36)	407 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

It is evident that joint family system was prevailing in the selected sample households in which 65.11 per cent were favouring it. This strengthens the arguments put forth in the studies where agrarian households strictly favour joint family system. Among the sample households, 61.28 per cent of organic farmers and 72.34 per cent of inorganic farmers belonged to joint family system.

g. Size of family

The economic burden and the standard of living of the farmers are significantly influenced by the family size. It is therefore essential to understand the family size of the farmers. The size of the family of all the sample respondents is discussed through the table - 8.

TABLE - 8
DISTRIBUTION OF RESPONDENTS BY FAMILY SIZE

Family size	Inorganic	Organic	Overall
Up to 4	93 (65.96)	173 (65.04)	266 (65.36)
5-7	45 (31.91)	85 (31.95)	130 (31.94)
8-10	3 (2.13)	8 (3.01)	11 (2.70)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Both organic and inorganic farmer households had 65 per cent of family size up to four members in the sample region which implied that the farmers preferred small family which could improve education and the income status of those families in future. Also, only 2.70 per cent of the total sample farmer households had more than eight members and 31.94 per cent accounted for a medium size family of 5 to 7 members.

h. Occupational status

Apart from agriculture, the farmers and their family members took up additional jobs to supplement their income which is presented in table - 9. Figure - 5 explains the occupational status of the study area.

TABLE - 9
OCCUPATIONAL STATUS

Occupation	Inorganic	Organic	Overall
Agriculture only	76 (53.90)	190 (71.43)	266 (65.36)

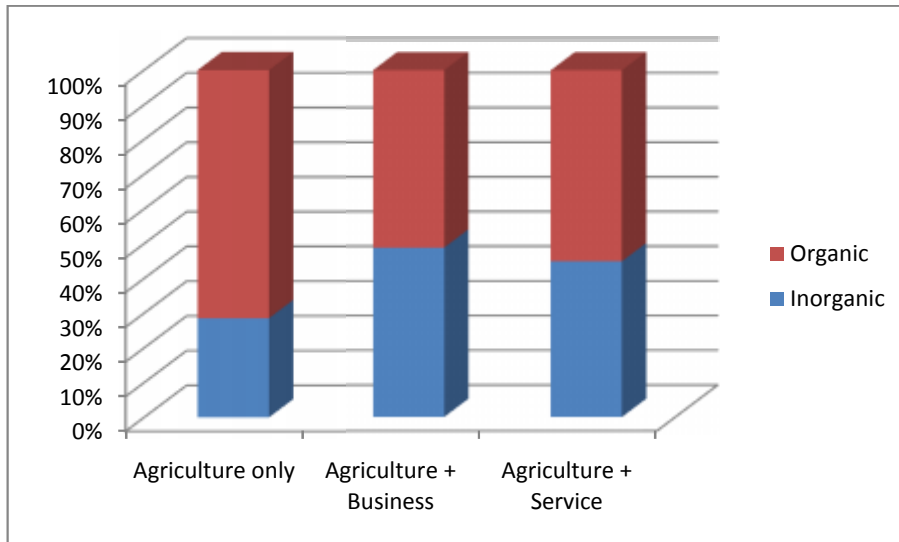
Agriculture + Business	21 (14.89)	22 (8.27)	43 (10.56)
Agriculture + Service	44 (31.20)	54 (20.30)	98 (24.08)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field Survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Figure - 5.

Occupational status



At overall level, majority of the farmers (65.36 per cent) had their main occupation as agriculture, while agriculture + Business were low (10.56 per cent). The organic farmers who had agriculture as their sole occupation accounted for 71.43 per cent and for inorganic farmers it was 53.90 per cent among the regions studied. Agriculture + service was found to be more (31.20 per cent) under inorganic farming which emphasized the urge among the farmers to reset into other types of work, out of economic necessity. It may be noted that diversification in occupation did not mean that they were absentee land owners.

i. Income status

Family income is the most important economic indicator which measures the living standards of the population residing in a particular region or a country to have a standard of living. The total income of the households includes income from agriculture and income from other occupations which are summarised in table - 10.

TABLE - 10
AVERAGE FAMILY INCOME PER MONTH

Income level (in `)	Inorganic	Organic	Overall
Less than 5000	13 (9.22)	72 (27.07)	85 (20.88)
5001-10000	16 (11.35)	16 (6.01)	32 (7.86)
10001-20000	17 (12.06)	23 (8.65)	40 (9.83)
20001-25000	51 (36.17)	72 (27.07)	123 (30.22)
25001 and above	44 (31.20)	83 (31.20)	127 (31.20)

Total	141 (100.00)	266 (100.00)	407 (100.00)
-------	-----------------	-----------------	-----------------

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Details on monthly family income of the sample households showed that it was high for organic farmers (` 25,001 and above). About 20.88 per cent of farmers had a family income of less than ` 5000 in which organic farmers constituted 27.07 per cent of the total 266 organic farmers. The reason was that some farms were in initial stage of conversion. In case of inorganic farming, 36.17 per cent earned an income of ` 20,001- 25,000 followed by an income above ` 25,001(31.20 per cent). Almost 31.20 per cent of total sample farmers earned above ` 25,000.

j. Expenditure pattern

The expenditure pattern of a household depends on their level of income and family size; food, clothing, shelter, education for children, health and for recreation which must be satisfied for bare substance of living. Questions other than farm expenditure were posed to the farmers and their responses are summarised in table - 11.

TABLE - 11
NON-FARM EXPENDITURE

Per capita expenditure per month (in `)	Inorganic	Organic	Overall
Less than 3000	37 (26.24)	54 (20.30)	91 (22.36)
3001 - 5000	19 (13.47)	42 (15.79)	61 (14.99)
5001 – 7000	28 (19.86)	28 (10.53)	56 (13.76)
7001 – 10000	31 (21.98)	44 (16.54)	75 (18.43)
Above 10001	26 (18.44)	98 (36.84)	124 (30.47)
Total	141 (100.00)	266 (100.00)	407 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

It is clear that depending upon the income level, the non-farm expenditure also varied across the sample areas. The per capita expenditure for non-farm activities was found to be high among the organic farmers (36.84 per cent) while 26.24 per cent of inorganic farmers spent less than ` 3,000. This is because of the fact that majority of the organic farmers had a large amount of disposable income on their hands. All the farmers together on an average spent ` 7,001 – ` 10,000 per month as living expenses.

k. Sources of borrowing

Organic farmers need to borrow less money than conventional farmers for two reasons; firstly, organic farmers need to buy fewer inputs such as fertilizer and pesticides; and secondly, cost and income were more evenly distributed throughout the year on diversified organic farms. Sources of borrowing for organic and inorganic farmers are given in table - 12.

TABLE – 12
SOURCES OF BORROWING

Sources	Organic farmers		Inorganic farmers		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Bank	54	38.30	60	49.59	114	43.51
Co-operative	46	32.62	1	0.83	47	17.94
Money lender	41	29.08	57	47.11	98	37.40
Relatives	-	-	3	2.48	3	1.14
Total	141	100.00	121	100.00	262	100.00

Source: Field Survey, 2013

The analysis of farmer's income and expenditure revealed that the farmers were forced to spend more than their earnings. Burdened with large number of dependents on one hand and meagre incomes on the other, it is natural that many of them seeped themselves deep in debts. Out of 266 organic farmers only 141 farmers (53 per cent) were in debt whereas 121 inorganic farmers (85.8 per cent) out of 141 were in debt. The main source of borrowing was bank since it offers loans at low interest rates. About 38.30 per cent of organic farmers borrowed from banks followed by co-operatives (32.62 per cent), money lenders (29.08 per cent). The inorganic farmers depended more on banks (49.59 per cent), followed by money lenders (47.11 per cent) to meet unforeseen changes, relatives (2.48 per cent) and co-operatives (0.83 per cent).

B. Economic performance of the sample farmers based on

In its broadest sense the term farming system is any system that views the farm in a holistic manner and considers interacting factors in the system. A farming system is a complex interrelated matrix of soils, plants, animals, implements, labour, capital and other inputs controlled by farming families and influence to varying degrees by political, economical, institutional and social forces that operate at any levels. Farmer's participation in farming system means that the system itself can be incorporated in the experiment and realistic results can be obtained through farmer managed trials.

a. Classification of farming system

Table - 13 shows the classification of sample farming system according to organic and inorganic farming in the selected districts.

Table – 13

CLASSIFICATION OF FARMING SYSTEM

Farming System	Trichy	Erode	Cuddalore	Vellore	Overall
Organic farming	65 (61.32)	94 (92.16)	70 (75.27)	37 (34.90)	266 (65.36)
Inorganic farming	40 (37.73)	9 (8.82)	23 (24.73)	69 (65.09)	141 (34.64)
Total	106 (100.00)	102 (100.00)	93 (100.00)	106 (100.00)	407 (100.0)

Source: Field Survey, 2013

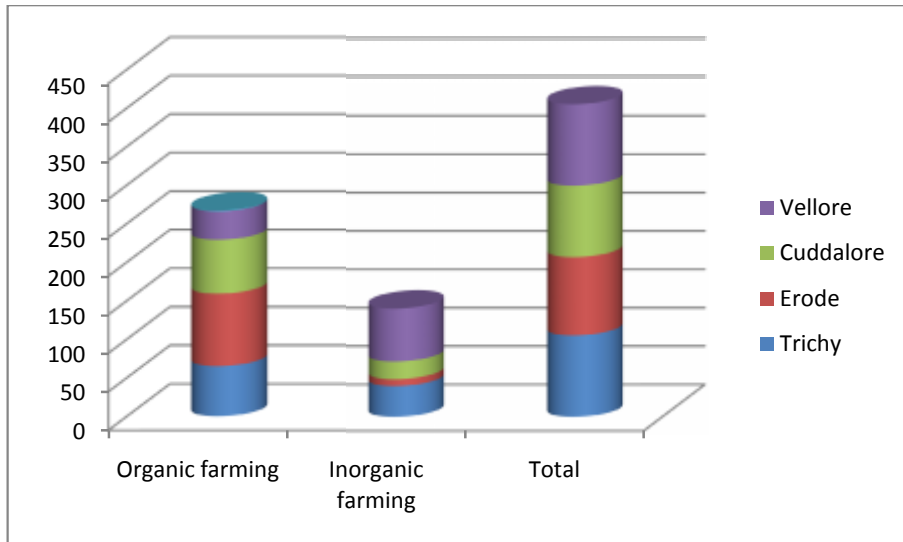
Foot note: Figures in the parentheses indicate percentages to column totals

Out of 266 organic farmers, 92.16 per cent were from Erode district followed by Cuddalore (75.27 per cent), Trichy (61.32 per cent) and Vellore district (34.90 per cent). Out of 141 inorganic

farmers, 65.09 per cent were from Vellore district, followed by Trichy (37.73 per cent), Cuddalore (24.73 per cent) and Erode district (8.82 per cent). Figure - 6 explains the classification of farming system.

Figure – 6

Classification of farming system



b. Farm size

The total land holding of the farmers is one of the important factors to assess its influence in obtaining monetary benefits from organic and inorganic cultivation. The sample farms showed a wide variation in size, with the smallest farm consisting of less than an acre and the largest being 12 acres in size. This shows the predominance of small and marginal farmers in the study area. However, farmers with large size of land holdings were getting more benefits from organic cultivation due to the usage of high input quantities. The small number of farms included in this sample, however, may have a negative influence on the representativeness of the results. Marginal and small farmers could benefit by pooling together their farms to avail great returns.

In Tamil Nadu, the organic farms were 34 per cent smaller than the average inorganic farm (Jaganathan et al, 2012). In rural India land ownership is often an accepted symbol of social status. Land holding is used as one of the universally chosen economic indicators in various studies. Table - 14 shows the sample farm size in acres. Figure - 7 and Figure - 8 explains the farm size of the respondents under organic and inorganic farming system.

TABLE – 14

FARM SIZE OF SELECTED SAMPLE IN ACRES

Farm size (in acres)	Inorganic	Organic	Overall
Marginal (Less than 2.5)	52 (36.88)	95 (35.71)	147 (36.12)
Small (2.5 to 5.0)	56 (39.72)	74 (27.82)	130 (31.94)
Semi-medium (5.0 – 7.5)	30 (21.28)	93 (34.96)	123 (30.22)
Medium (7.5 - 10)	3 (2.13)	4 (1.50)	7 (1.72)
Total	141	266	407

	(100.00)	(100.00)	(100.0)
--	----------	----------	---------

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

It was observed that 36.12 per cent of the study area was of farm size less than 2.5 acres which formed majority of the sample. Classification according to farming system showed that out of 407 farmers, majority (39.72 per cent) of inorganic farmers belonged to small farm size (2.5 to 4

Figure – 7

Farm size of the respondents under organic farming system

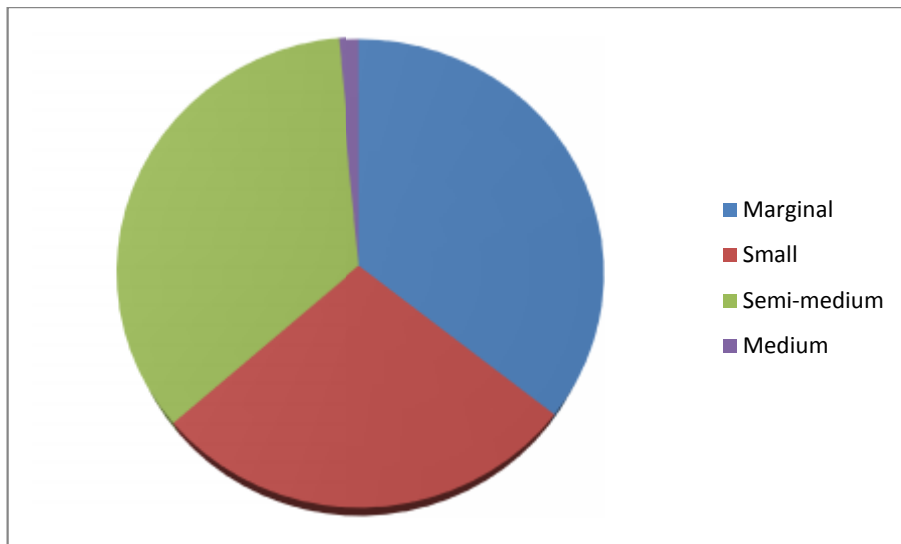
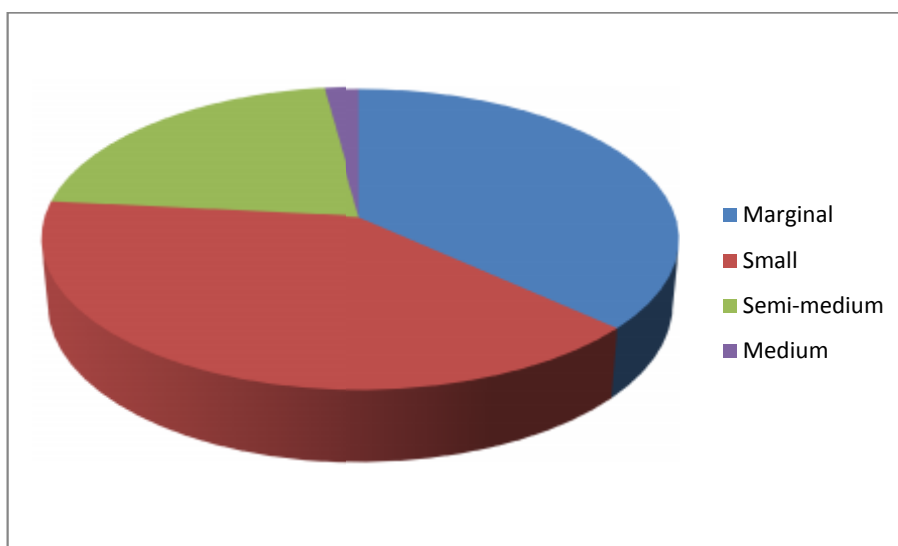


Figure – 8

Farm size of the respondents under inorganic farming system



acres) while majority (35.71 per cent) of organic farmers fell under the category of marginal farmers. Only 1.72 per cent of the total sample comprised medium size farmers. This also explains the fact that farmers holding small farm size were willing to take risk about their yield.

c. i. Land holding

Increasing demand for industrialization, urbanization, housing and infrastructure is forcing conversion of agricultural land to non – agricultural uses; the scope for expansion of the area available for cultivation is limited. In Tamil Nadu, 30 per cent of total cultivable area is covered with irrigation facilities and in the remaining 70 per cent of arable land, which is mainly rain fed, negligible amount of fertilisers is being used. Farm income and productivity varies under different conditions like rainfed and irrigated cultivation. Hence, details regarding the type of operated land holding in the sample area (in acres) are presented in table - 15.

TABLE – 15

TYPE OF OPERATED LAND HOLDING (IN ACRES)

Type of operated land holding	Inorganic	Organic	Overall
Irrigated	147.93 (50.71)	639.21 (59.30)	787.14 (57.47)
Rainfed	143.8 (49.29)	438.77 (40.70)	582.57 (42.53)

Total	291.73 (100.00)	1077.98 (100.00)	1369.71 (100.00)
-------	--------------------	---------------------	---------------------

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

The total land area operated by sample farmers was 1369.71 acres, out of which the rainfed land formed 42.53 per cent and 57.47 per cent was irrigated. About 50.71 per cent of inorganic sample farmers were farming under irrigated condition while that of organic farmers was 59.30 per cent. Only 40.70 per cent of organic farmers and 49.29 per cent of inorganic farmers were farming under rainfed condition.

ii. Per capita land holding

Per capita land holding across the farming system in sample area were calculated and presented in table - 16.

TABLE - 16

TYPE OF FARMERS BY PERCAPITA LAND HOLDING (IN ACRES)

Type of operated land holding	Inorganic	Organic	Overall
Irrigated	0.3 (14.49)	0.24 (5.97)	0.54 (8.87)
Rainfed	1.77 (85.51)	3.78 (94.03)	5.55 (91.13)
Total	2.07 (100.00)	4.02 (100.00)	6.09 (100.00)

Source: Calculation based on field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

In case of organic farming, per capita land holding across the rainfed and irrigated conditions ranged between 0.24 and 3.78 acres and it ranged between 0.3 and 1.77 acres in case of inorganic farming. When the sample as a whole was taken together, the per capita land holding was 6.09 acres.

d. i. Cropping pattern of farming system

The quality and quantum of gross agricultural production depends upon the type of cropping pattern farmers pursue. Cropping pattern can be considered in a wider perspective as combination of activities leading to diversification or specialization in agriculture. It connotes the crop mix grown in an agricultural year. Cropping pattern determines the output mix in a particular region. It has importance both from the point of view of the individual farm and the nation as a whole. For the individual farm it is a question of combination of crops to be grown on limited land area with given quantities of labour, capital, management and other resources. For the nation it is problem of determining the pattern to be encouraged through national programmes to meet food security. The proportion of the area under various crops at a point of time represented the cropping pattern. Each region was considered as a separate spatial unit and the major cropping systems followed by the farmers in these regions are given in table - 17.

TABLE – 17
CROPPING PATTERN OF SAMPLE FARMS (IN ACRES)

Crop	Inorganic	Organic	Total
Turmeric + Plantain	109.5 (37.53)	152.82 (14.18)	262.32 (19.15)
Maize	13 (4.46)	404.81 (37.55)	417.81 (30.50)
Paddy	80.85 (27.71)	148.35 (13.76)	229.2 (16.73)
Sugarcane	32 (10.97)	141 (13.08)	173 (12.63)
Coconut	14.38 (4.93)	64.5 (5.98)	78.88 (5.76)
Groundnut	42 (14.40)	166.5 (15.44)	208.5 (15.22)
Total	291.73 (100.00)	1077.98 (100.00)	1369.71 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

It is evident from the table that 30.50 per cent of total sample farmers were cropping maize of which organic farmers formed the majority with 37.55 per cent. Among the inorganic farmers, 37.53 per cent were cropping plantain and turmeric followed by paddy (27.71 per cent), groundnut (14.40

per cent), sugarcane (10.97 per cent), coconut (4.93 per cent) and maize (4.46 per cent). Under organic farming, after maize, 15.44 per cent, 14.18 per cent, 13.76 per cent, 13.08 per cent and 5.98 per cent of groundnut, turmeric and plantain, paddy, sugarcane and coconut respectively were cultivated.

ii. Cropping Intensity

Cropping intensities are estimated based on the occupancy of land by crops for organic and inorganic farming system and are presented in Table – 18.

TABLE – 18
CROPPING INTENSITY ON SAMPLE FARMS (in Per cent)

Crop	Inorganic	Organic	Total
Plantain	239.56	171.65	411.21
Maize	3213.92	103.21	3317.13
Paddy	283.49	154.50	437.99
Sugarcane	540.62	122.69	663.31
Coconut	548.54	122.29	670.83
Groundnut	496.43	125.22	621.65
Total	5322.56	799.56	6122.12

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Cropping intensity was high in the cultivation of maize (3317.13 per cent) and it was low for plantain cultivation (411.21 per cent) with coconut, sugarcane, groundnut and paddy recording 670.83 per cent, 663.31 per cent, 621.65 per cent and 437.99 per cent respectively for all the farmers. The cropping intensity recorded under organic farming system was 171.65, 154.50, 125.22, 122.69, 122.29 and 103.21 per cent in the cultivation of plantain, paddy, groundnut, sugarcane, coconut, maize and 3213.92, 548.54, 540.62, 496.43, 283.49 and 239.56 per cent under the inorganic farming respectively for maize, coconut, sugarcane, groundnut, paddy and plantain. Cropping intensity under inorganic farming system was high in the cultivation of maize (3213.92 per cent) and low for plantain

cultivation (239.56 per cent) whereas the cropping intensity recorded under organic farming system was high for plantain (171.65 per cent) and low for maize (103.21 per cent).

e. Livestock

Livestock is an integral part of agriculture and has profound influence on its sustainability. Apart from providing additional income, livestock generates employment in the rural area itself. Livestock contributes directly to agriculture by producing manure and influencing the availability of organic carbon to soil. It contributes indirectly through its influence on income of the households. Integration of livestock and crop production, or mixed farming, allows the use of animal manure to increase soil fertility. Farmers recognize the benefits of using manure, and with the relatively high costs of mineral fertilizers, manuring could play a greater role in maintaining soil fertility. Hence an attempt is made in this regard and the number of livestock in the sampled area is given in table - 19.

TABLE - 19
NUMBER OF LIVESTOCK POSSESSED BY FARMERS

Sl.No.	Livestock (no.)	Inorganic	Organic	Overall
1.	Cow	18 (42.86)	108 (47.16)	126 (46.49)
2.	Bullock	8 (19.05)	88 (38.43)	96 (35.42)
3.	Goat	7 (16.67)	14 (6.11)	21 (7.75)
4.	Poultry	9 (21.43)	19 (8.30)	28 (10.33)
	Total	42 (100.00)	229 (100.00)	271 (100.00)

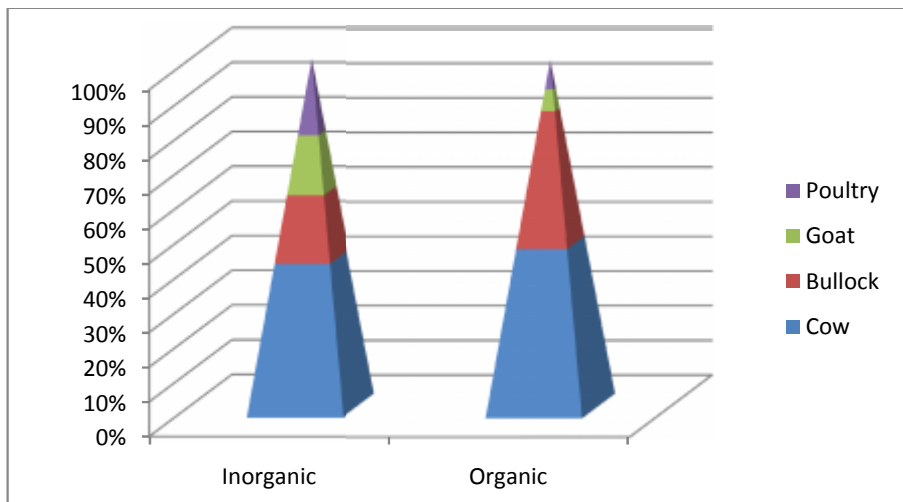
Source: Field Survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Of the total livestock in the sample area, cow was the most dominant (46.49 per cent) and preferred domestic animal. About 84.50 per cent of livestock were possessed by organic farmers since the farmers realised the importance of livestock contribution to agriculture while inorganic farmers possessed only 15.50 per cent. Figure - 9 explains the number of livestock among the farming system of the study area.

Figure - 9

Number of livestock among the farming system



f. Expenditure on livestock

A combination of agriculture with dairy and poultry farming fetches the small farmers more average net income than the other enterprises. Livestock expenditure includes fodder and veterinary expenditures. Table - 20 shows the expenditure spent on livestock by sample farmers.

TABLE - 20
EXPENDITURE ON LIVESTOCK

Expenditure level per month (in `)	Inorganic	Organic	Overall
Less than 500	6 (14.28)	172 (75.11)	178 (65.68)
501-1,000	14 (33.33)	48 (20.96)	62 (22.88)
1,001-3,000	10 (23.81)	7 (3.06)	17 (6.27)
3,001-5,000	9 (21.43)	1 (0.44)	10 (3.69)
Above 5,000	3 (7.14)	1 (0.44)	4 (1.48)
Total	42 (100.00)	229 (100.00)	271 (100.00)

Source: Field Survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Majority (65.68 per cent) of the sample farmers spent less than ` 500 for livestock and only 11.44 per cent of farmers spent more than ` 1000. Majority (75.11 per cent) of the organic farmers spent less than ` 500 since they rely on organic crop by-products like hay, wood, solai in case of sugarcane, tavidu from rice, groundnut kodi as fodder to the livestock which is healthy and nutritious. Around 28 per cent of inorganic farmers spent more than ` 3000 for fodder and veterinary expenses.

g. Years of Experience

As a farmer's experience increases, so do his skills in optimally allocating the resources at his disposal. The more experience a farmer has, the higher his output and higher the technical efficiency. Years of experience among the farmers under both organic and inorganic farming is given in table - 21.

TABLE – 21
YEARS OF EXPERIENCE

Experience (in years)	Organic farmers		Inorganic farmers		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
0-10	133	50.00	57	40.4	190	46.68
11-20	58	21.80	37	26.20	95	23.34
21-30	41	15.40	25	17.70	66	16.22
31-40	17	6.40	11	7.80	28	6.88
Above 40	17	6.40	11	7.80	28	6.88
Total	266	100.00	141	100.00	407	100.00

Source: Field Survey, 2013

It was evident that 50 per cent of organic farmers and 40.4 per cent of inorganic farmers had a minimum of 10 years of experience in the farm. Only 6.40 per cent of organic farmers and 6.88 per cent of inorganic farmers had experience more than 30 years.

h. Impact of organic farming

It is pertinent to examine the impact of organic farming on economy of farmers and ecology of the area. In this section an effort has been made to pinpoint some of such effects based on the survey. The investigation about the impact of organic farming in sampled area is shown in table-22. Figure - 10 explains the impact of organic farming of the study area.

TABLE - 22

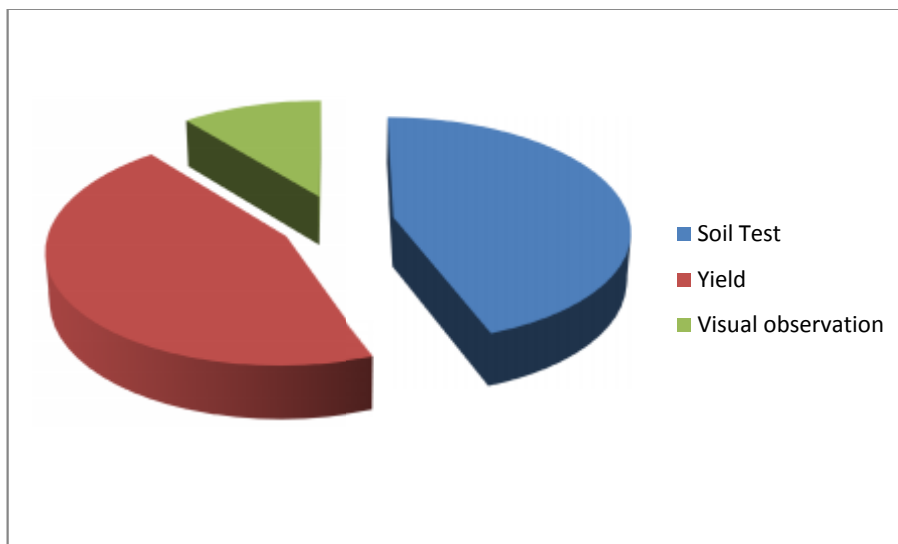
IMPACT OF ORGANIC FARMING

Parameters	Frequency	Percentages
Soil Test	118	44.36
Yield improvement	119	44.74
Visual observation	29	10.90
Total	266	100.00

Source: Field Survey, 2013

Figure - 10

Impact of organic farming



The general observation or perception of the farmers was that initially yield declines significantly but later covers up to some extent. About 44 per cent of organic farmers had opined that their soil health had improved which they had realised by soil testing and higher yield (44.70 per cent). About 10.90 per cent of farmers had opined that they realised through visual observation. Thus organic farming protects environment and promises a sustainable future. About 84 per cent of respondents were of the view that quality of the farm products also had improved apart from better taste. This is based on the perception of farmers and their family members as consumers. However, this needs to be educated to the consumers in general.

i. Method of sale

One challenge faced by the farmers is to get a fair price for their farm yield, and to get it to the market as early as possible. The farmers in the sample area sell their produce through pre-harvest contractors, by direct sale and in local markets. The pre-harvest contractors collect the demand from different traders and accordingly fix a price and collect the product from individual farmers. Sometimes, they process it in their own processing unit and sell it to the consumers. Besides, advertisements in magazines and exhibitions about the farm products can be increased by the farmers to increase sales.

Table - 23 shows the sample farmers method of sale.

**TABLE - 23
METHOD OF SALE**

Methods	Organic farmers		Inorganic farmers		Overall	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Pre-harvest Contractors	98	36.80	3	2.10	101	24.81
Direct sale	84	31.60	28	19.90	112	27.52
Local market	34	12.80	99	70.20	133	32.68

Own use	50	18.80	11	7.80	61	14.99
Total	266	100.00	141	100.00	407	100.00

Source: Field Survey, 2013

It is evident that organic farmers had lot of pre-harvest contractors (36.80 per cent) so that they had a fixed price for their products. About 31.60 per cent of organic farmers and 19.90 per cent of inorganic farmers sell their output directly to the consumers. Among inorganic farmers, majority (70.20 per cent) of them sold their produce in the local markets. About 18.80 per cent of organic farmers and 7.80 per cent of inorganic farmers had self-consumption of their produce. At overall level, 32.68 per cent of farmers sold their products in local market.

j. Sources of information

Considering the fact that the level of their education was low and that they are a caste based society, the response of the farmers on motivational factors responsible for adoption of organic farming were quite varied and numerous. The organic farmers rated their own awareness through media, training, conversations with other organic farmers and agents about organic farming as the most important sources of information about organic farming, and their responses are summarised as under:

TABLE – 24

SOURCES OF INFORMATION FOR ORGANIC FARMERS

Sources	Frequency	Percentage
Agents	47	17.67
Neighbours	86	32.33
Training	74	27.82
Media	62	23.31
Total	266	100.00

Source: Field survey, 2013

There existed a mixed reaction among the organic farmers in conversion, which they feel was influenced by certain major factors. It was gratifying to note that about 32.33 per cent of farmers learnt about the system of organic farming from their neighbours. The second major source pertained to the

training provided (27.82 per cent) and the third factor responsible was media (23.31 per cent). Further the interaction revealed that 17.67 per cent were influenced by agents like NABARD and NGOs.

Information sources which supported this process and helped farmers to gather knowledge about organic farming were mainly their own conversations with other organic farmers, training and media addressing organic farming issues. This complies partly with the findings of Fisher, who found books, seminars and conversations with individuals in the organic movement to be the most useful sources for practicing organic farming. These findings provide evidence of the small national involvement in organic agriculture research and lack of information availability in Tamil Nadu.

k. Descriptive statistics

The descriptive statistics like mean, standard deviation and coefficients of variation for organic, inorganic and for overall farming system of variables used for the estimation are presented in table - 25.

TABLE – 25

DESCRIPTIVE STATISTICS

Variables	Inorganic farming			Organic farming			Overall		
	Mean	Standard deviation	Co-efficient of variation	Mean	Standard deviation	Co-efficient of variation	Mean	Standard deviation	Co-efficient of variation
Gross returns	46985.67	19989.60	42.54	53529.06	23225.57	43.39	51262.19	22351.62	43.60
Expenditure on land	316.92	142.04	44.82	115.36	352.40	305.49	185.19	311.83	168.39
Expenditure on labour	14909.57	14376.62	96.43	13627.35	11259.99	82.63	14071.56	12425.77	88.30
Expenditure on livestock	296.45	735.81	248.20	624.36	1051.23	168.37	510.76	965.61	189.05
Expenditure on machinery	774.68	1224.23	158.03	1053.91	1645.38	156.12	957.17	1517.09	158.50
Expenditure on fertiliser	4369.15	5577.09	127.65	6544.36	7674.08	117.26	5790.79	7087.91	122.40
Expenditure on seed	3013.58	3312.41	109.92	3711.30	4059.29	109.38	3469.58	3827.43	110.31
Expenditure on plant protection	1410.82	1607.99	113.98	2559.66	2953.71	115.39	2161.66	2624.05	121.39
Expenditure on irrigation	4313.65	7314.70	169.57	12160.90	21331.15	175.41	9442.32	18149.97	192.22

Foot note: Calculations are based on field survey, 2013

The deviations from the mean were higher for organic farming than for inorganic farming in case of gross returns. The deviation from the mean expenditure on land and labour was more for inorganic farming and for all other expenditures the mean value appeared to be greater for organic farming. However, the coefficients of variations were higher for gross returns, land, plant protection and irrigation in case of organic farming than inorganic farming. The variability in inorganic farming system that was explained by labour employed usage of livestock and fertiliser was much higher than that of the variability as explained by either organic farming or overall farming system. The percentage of variation due to land was higher in organic farming than inorganic farming and overall farming system. The variability in overall farming system that was explained in farm machinery, seed, plant protection, irrigation and gross returns was much higher than that of the variability explained by either inorganic farming or organic farming system.

I. Cost of cultivation

Generally cost of cultivation varies with crops, region as well as with the nature of operations. A brief note on the cost of cultivation per acre will provide an explanation to the differences in the cost of cultivation of organic and inorganic farming system. Table - 26 shows the field operation wise cost of cultivation (₹ / acre) for both organic and inorganic farmers in the selected area.

TABLE – 26

COST OF CULTIVATION PER ACRE UNDER ORGANIC AND INORGANIC FARMING

Field operation	Inorganic (₹ /acre)	Organic (₹ /acre)	Overall (₹ /acre)
Land preparation	2800 (20.74)	1900 (15.91)	4700 (18.47)
Seed sowing/transplanting	600 (4.44)	540 (4.52)	1140 (4.48)
Manures and Fertilizers	1200 (8.89)	1000 (8.37)	2200 (8.65)
Irrigation	1500 (11.11)	700 (5.45)	2200 (8.65)
Plant Protection	2100 (15.56)	1700 (14.24)	3800 (14.94)
Weeding	1600 (11.85)	2000 (16.75)	3600 (14.15)
Harvesting/ Threshing	1200 (8.89)	1200 (10.05)	2400 (9.43)
Marketing/Transport	2500 (18.52)	2900 (24.29)	5400 (21.23)
Total	13500 (100.00)	11940 (100.00)	25440 (100.00)

Source: Calculations are based on field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

It is observed from the table that out of the total cost 20.74 per cent was spent on land preparation by inorganic farmers while organic farmers spent more (24.29 per cent) on marketing or transporting their produce followed by weeding (16.75 per cent), land preparation (15.91 per cent) and plant protection (14.24 per cent). Apart from land preparation, inorganic farmers also spent mostly on marketing (18.52 per cent) followed by plant protection (12.65 per cent), weeding (11.85 per cent) and irrigation purposes (11.11 per cent). The table also explains the fact that the total cost of cultivation required for organic farming was less than that of inorganic farming by ₹1560. It was 11.56 per cent less over inorganic farming. At overall level, 21.23 per cent of sample farmers spent on marketing followed by land preparation, plant protection, weeding, harvesting or threshing, irrigation, manures and fertilisers and seed sowing or transplanting by 18.47 per cent, 14.94 per cent, 14.15 per cent, 9.43 per cent, 8.65 per cent, 8.65 per cent and 4.48 per cent respectively.

m. a. Returns from organic and inorganic farming system

Conversion from the traditional low-external input system of cultivation rarely results in lower yields. However, when switching from external-input-intensive forms of agriculture, the yields may decline significantly, atleast during the initial years of conversion, until the natural soil tilth and fertility were sufficiently restored. But, after that, they may stabilize at comparably, lower or even higher levels, depending on the efficiency of organic management and the quality of organic fertilizers applied. Table - 27 shows the gross returns from organic and inorganic farming system.

TABLE - 27

GROSS RETURNS FROM ORGANIC AND INORGANIC FARMING PER ACRE

Gross returns (in ` / month)	organic	Inorganic	Overall
Less than 5,000	104 (39.10)	19 (13.47)	123 (30.22)
5,001-10,000	49 (18.42)	49 (34.75)	98 (24.08)
10,001-15,000	28 (10.53)	21 (14.89)	49 (12.04)
15,001-20,000	26 (9.77)	12 (8.51)	38 (9.34)
20,001-25,000	15 (5.64)	11 (7.80)	26 (6.39)
Above 25,000	44 (16.54)	29 (20.57)	73 (17.94)
Total	266 (100.00)	141 (100.00)	407 (100.00)

Source: Calculations are based on field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

About 30.22 per cent of the sample farmers earned below ` 5000 among the total farmers. Also, 39.10 per cent of organic farmers at sample area were earning less than ` 5000 per month because the crop yields were boosted previously by artificial fertilizers and it takes time for the soil fertility to get reboosted. In case of inorganic farming, 20.57 per cent of farmers were able to earn above ` 25,000 while 16.54 per cent of organic farmers earned the same by organic farming. More

number of organic farmers (44) when compared to inorganic farmers earned above ` 25,000 since many of them have not applied chemical inputs to their farm.

In the sampled areas, organic farmers were reducing cost by producing their own inputs in the farm with perishable waste, cow dung, dry leaf, sambal, ragi thattu, jeevamurutham, panchakavya, herbal inputs, composting etc while inorganic farmers buy fertilisers and plant protection chemicals like DAP, Urea etc. at high price. Thus, in the long-run, organic farmers earned more yield and returns and cost-effective than inorganic farming.

b. Net returns from organic and inorganic farming

Details regarding net returns enjoyed by farmers are shown in table - 28.

TABLE – 28
NET RETURNS UNDER ORGANIC AND INORGANIC FARMING (IN `)

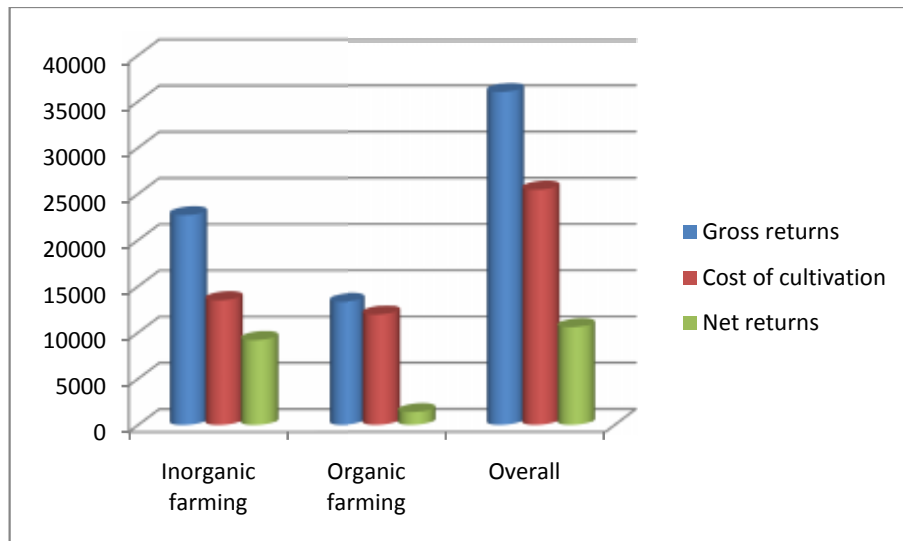
Details	Inorganic farming	Organic farming	Overall
Gross returns	22698.39	13315.69	36014.08
Cost of cultivation	13500.00	11940.00	25440.00
Net returns	9189.39	1375.69	10565.08

Source: Calculations are based on field survey, 2013

The gross returns realized per acre were ` 22,698.39 for inorganic farming and ` 13,315.69 for organic farming respectively. Though the cost of cultivation for inorganic farming was high (` 13,500), net returns was more with ` 9,189.39 in the sample area. This may be because of the fact that usage of high yielding variety seeds and artificial synthetic inputs has boosted the gross returns and the soil is producing more than its original capacity which in turn will result in depletion of available limited resources. Although, the gross and net returns from organic farming were lower than inorganic farming, it can be compensated by the price premium. Figure - 11 explains the Cost and returns of organic and inorganic farming system

Figure – 11

Cost and returns of organic and inorganic farming system



n. Resource use efficiency of organic and inorganic farming system – An application of Cobb-Douglas Production Function

The resource use pattern of any production activity indicates composition of the expenditures incurred on various inputs. It is useful to locate the strength and weakness in the production system so as to increase the efficiency of inputs. Taking gross returns as dependent variable and expenditure on land, labour, livestock, machinery, fertiliser, seed, plant protection and irrigation as independent variables, Cobb-Douglas production function was computed. Table - 29 shows the results of Cobb-Douglas production function for inorganic farmers.

TABLE – 29
COBB-DOUGLAS PRODUCTION FUNCTION FOR INORGANIC FARMERS

Independent variables	Parameter (β)	Standard Error	t-value
Constant	3.101***	0.641	4.836
Land	0.921***	0.129	7.150
Labour	0.008	0.113	0.070
Livestock	-0.012	0.031	-0.405
Machinery	0.102	0.072	1.430
Fertilizer	-0.108**	0.046	-2.363
Seed	0.081*	0.043	1.889
Plant protection	-0.088	0.051	-1.731
Irrigation	0.026	0.027	0.966
R ²	0.666		
F-value	7.80***		
Returns to scale	0.93		
Dependent Variable: Gross returns			

Foot note: Calculations are based on field survey, 2013

* Statistically significant at 10 per cent level

** Statistically significant at 5 per cent level

*** Statistically significant at 1 per cent level

Foot Note: Constant Elasticity of substitution (CES) function is assumed

It could be observed that, the coefficient of multiple determination (R^2) was 0.67 indicating the point that 67 per cent of variation in gross returns were jointly explained by independent variables included in the function. The efficiency with the given level of resources and existing technology in sample areas was found to be 3.101 and significant at one percent level. For inorganic farmers, expenditure on labour, livestock, plant protection, irrigation and machinery were insignificant which showed shortage of inputs. Expenditure on fertiliser was negative but significant which could be due to excess usage of the fertilisers than the recommended level. One per cent increase in the expenditure on land, labour, machinery and seed would lead to 0.921, 0.008, 0.102 and 0.081 units increase in the returns respectively from inorganic farming. The function co-efficient 0.93 (sum of co-efficients) showed decreasing returns to scale. This suggested that the inorganic farmers in the area employed more of some of the resources.

Table - 30 showed the results of Cobb-Douglas production function for organic farmers.

TABLE – 30
COBB-DOUGLAS PRODUCTION FUNCTION FOR ORGANIC FARMERS

Independent variables	Parameter (β)	Standard Error	t-value
Constant	1.434**	0.707	2.027
Land	0.199**	0.084	2.359
Labour	0.101***	0.069	-1.463
Livestock	0.179*	0.068	2.631
Machinery	-0.453	0.119	-3.803
Fertilizer	0.051**	0.047	1.084
Seed	0.215	0.068	-3.164
Plant protection	0.506***	0.088	2.763
Irrigation	0.057**	0.024	2.356
R^2	0.551		
F-value	11.13***		
Returns to scale	1.56		
Dependent Variable: Gross returns			

Foot note: Calculations are based on Field survey, 2013

* Statistically significant at 10 per cent level

** Statistically significant at 5 per cent level

*** Statistically significant at 1 per cent level

The coefficient of multiple determination (R^2) was 0.55 indicating the fact that 55 per cent of variation in dependent variable was jointly explained by independent variables included in the function. The efficiency with the given level of resources and existing technology in different areas was found to be 1.434 and significant at five percent level. Value of the coefficients of individual inputs revealed that all the expenditures were not positively related to the returns from organic cultivation. Expenditure on machinery was negatively related to the gross returns of organic farming. Expenditure on machinery and seed alone were insignificant which showed the shortage of organic inputs. Expenditure on land, labour, livestock, fertiliser, irrigation, plant protection and seed was positively related and significant. It is pointed that there is scope for increased usage of these inputs.

Based on the elasticity coefficient of the Cobb-Douglas production function, it could be inferred that one per cent increase in expenditure on land, livestock, fertiliser, seed, irrigation and plant protection would fetch 0.199, 0.179, 0.215, 0.051, 0.057 and 0.506 units increase in the gross returns from organic farming respectively. The value of the function coefficient for organic farming 1.56 (sum of co-efficients) showed increasing returns to scale which showed that the farmers in the area underutilised some of the resources.

The estimated production function enabled to evaluate the efficiency of prevalent factor use in production. The production function analysis is used to determine economic efficiency of resource use, which requires estimation of Marginal Value Products (MVP) of different resources. Given the level of technology and prices of both inputs and outputs, efficiency of resource use could further be ascertained by equating the Marginal Value Product (MVP) to the productive Marginal Factor Cost (MFC) of resources. A resource is said to be optimally allocated if there is no significant difference between the MVP and MFC i.e. if the ratio of MVP to MFC =1. Table - 31 shows the input utilisation of inorganic farming system.

TABLE – 31
ESTIMATES OF UTILISATION OF INPUTS USED FOR INORGANIC FARMING

Inputs used	Mean	MVP	MVP/MFC	Efficiency in utilisation
Land	2.44	2.00	2.00	Under utilised
Labour	4.85	0.41	0.41	Under utilised
Livestock	0.84	0.82	0.82	Under utilized
Machinery	2.61	0.21	0.21	Under utilized
Fertilizer	3.32	-0.18	-0.18	Over utilized
Seed	2.92	0.14	0.14	Under utilized
Plant protection	2.48	0.21	0.21	Under utilized
Irrigation	3.41	-0.04	-0.04	Over utilized

Foot note: Calculations are based on Field survey, 2013

The ratio of MVP to MFC was less than unity for all the inputs except for land. This implied that land was under-utilized, while negative values of the ratio for expenditure on fertiliser and irrigation demonstrated that they were over-utilized. It meant that the returns from inorganic farming were likely to increase if more of inputs such as land, seed and livestock were used.

Table - 32 demonstrates the input utilisation under organic farming system. Figure - 12 explains the resource use efficiency of the farming system.

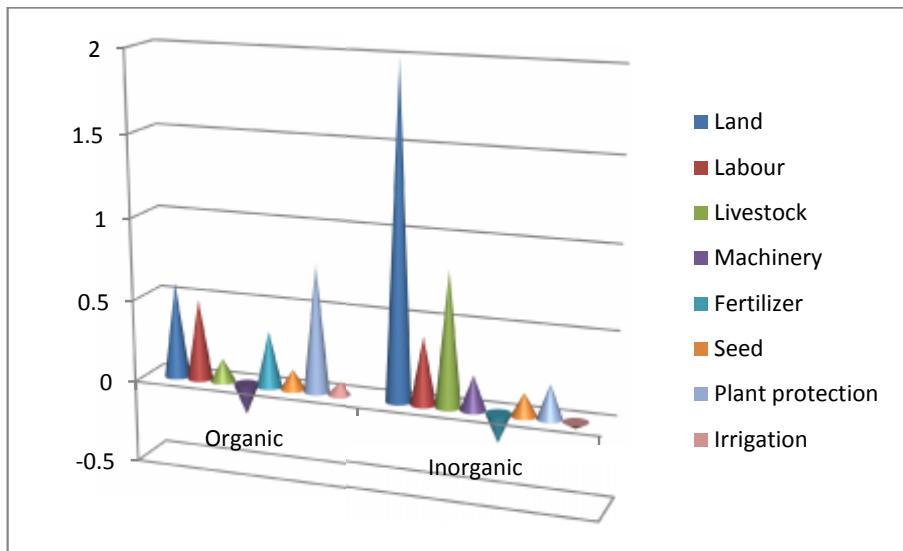
TABLE – 32
ESTIMATES OF UTILISATION OF INPUTS USED FOR ORGANIC FARMING

Inputs used	Mean	MVP	MVP/MFC	Efficiency in utilisation
Land	1.83	0.58	0.58	Under utilized
Labour	4.80	0.49	0.49	Under utilized
Livestock	2.55	0.14	0.14	Under utilized
Machinery	2.76	-0.19	-0.19	Over utilized
Fertilizer	3.46	0.34	0.34	Under utilized
Seed	3.48	0.12	0.12	Under utilized
Plant protection	3.11	0.78	0.78	Under utilized
Irrigation	3.81	0.08	0.08	Under utilized

Foot note: Calculations are based on Field survey, 2013

Figure – 12

Resource use efficiency of the farming system



The ratio of MVP to MFC was less than unity for all the inputs. The inputs like land, labour, fertiliser and irrigation were under-utilized, while negative values of the ratio for expenditure on machinery demonstrated that input (machinery) was over-utilized. It meant that the returns from organic farming would increase if more of inputs such as land, labour, fertiliser, seed, irrigation, plant protection and livestock were used. Using more livestock in such a labour intensive cultivation would enable increased returns from organic farming system.

Conclusion

Under inorganic farming system, expenditure on labour, livestock, plant protection and machinery were insignificant which showed the inadequate inputs. Expenditure on fertiliser was negative but significant which could be due to excess usage of the fertilisers than the recommended level. The estimated function showed decreasing returns to scale which suggested that the inorganic farmers in the area employed more of some of the resources. Similar results have been obtained for the study conducted by Kademani, 1983 and Pan et. al, 2011 on economics and resource-use efficiency of brinjal in Jharkhand in which land influenced significantly. The input expenditure on land was under-utilized, while expenditure on fertiliser and irrigation demonstrated over-utilization. It meant that the returns from inorganic farming were likely to increase if more of inputs such as land, seed and livestock were used.

Value of the coefficients of individual inputs under organic farming system revealed that expenditure on machinery was negatively related to the gross returns of organic farming. Expenditure on machinery and seed alone were insignificant which showed the shortage of organic inputs. Expenditure on land, labour, livestock, fertiliser, irrigation, plant protection and seed was positively related and significant. It is pointed that there is scope for increased usage of these inputs. The value of the function coefficient for organic farming showed increasing returns to scale which showed that the farmers in the area underutilised some of the resources. The inputs like expenditure on land, labour, fertiliser and irrigation were under-utilized, while expenditure on machinery alone demonstrated over-utilization. It meant that the returns from organic farming were likely to increase if more of inputs such as land, labour, fertiliser, seed, irrigation, plant protection and livestock were used. Using more livestock in such a labour intensive cultivation would enable increased returns from organic farming system. Subramanian et.al, 1992 and Koppad, 1993 have shown the same conclusion when they applied resource use efficiency in their analysis.

o. Factors influencing gross returns of farming system – Discriminant function

To identify the factors influencing the gross returns of organic and inorganic farming system, the discriminant analysis was applied by taking gross returns of the farming system as dependent variable and expenditure on land, human labour, livestock (fodder and veterinary charges), machinery (power and fuel) charges, seed, fertiliser, plant protection and irrigation as independent variables.

a. Mean and standard deviation for group 1 and group 2 among the farming systems

Table - 33 provides data relating to the mean and standard deviation of the economic variables between organic and inorganic farming.

TABLE – 33

GROUP STATISTICS

Discriminating variables	Inorganic farming				Organic farming				Overall			
	Group I Mean	Standard deviation	Group II Mean	Standard deviation	Group I Mean	Standard deviation	Group II Mean	Standard deviation	Group I Mean	Standard deviation	Group II Mean	Standard deviation
Land	297.38	148.09	338.51	132.82	98.97	161.21	128.82	453.02	316.92	142.04	115.36	352.40
Labour	12133.45	10557.46	17975.75	17232.55	14423.96	13857.19	12972.60	8553.82	14909.57	14376.62	13627.35	11259.99
Livestock	271.62	405.11	323.88	982.59	731.25	1194.82	536.51	911.48	256.45	735.81	624.36	1051.23
Machinery	858.51	1316.15	682.09	1116.50	1267.5	2164.20	878.36	1017.37	774.68	1224.23	1053.91	1645.38
Fertiliser	5248.65	6667.62	3397.76	3870.463	6024.58	7126.33	6971.57	8095.90	4369.15	5577.09	6544.36	7674.08
Seed	2670.07	3179.32	3392.98	3437.37	3557.04	3488.34	3838.08	4482.429	3013.58	3312.41	3711.30	4059.29
Plant protection	1209.59	1364.50	1633.06	1824.79	2437.75	2974.00	2659.86	2943.37	1410.82	1607.99	2559.66	2953.71
Irrigation	3274.32	6542.23	5461.57	7975.34	9904.17	19643.3	14015.75	22521.87	4313.65	7314.70	12160.90	21331.15

Foot note: Calculations are based on field survey, 2013

The data revealed varied trend in the mean and standard deviation of the variables considered. The farmers falling under organic farming category have a mean less than that of inorganic farming and high standard deviation for expenditure on land. The mean and standard deviation for expenditure on labour of organic farming was low than that of inorganic farming. The mean expenditure incurred on livestock, machinery, fertiliser, seed, plant protection and irrigation for inorganic farming was less than that of organic farming. This was probably due to the high price of organic inputs prevailing in the market. With respect to overall farming system, the result did not reveal much variation in the variable seed. However, there appears more dispersion in land, labour, livestock, machinery, fertiliser, plant protection and irrigation among the farming system.

b. Wilks' Lambda

The next step in the discriminant analysis was the estimation of univariate F-statistic and Wilks lambda. Wilks lambda indicates the mean difference between organic and inorganic farming system and for overall farming system.

Table - 34 shows the estimated F-value and Wilks lambda.

**TABLE – 34
WILKS' LAMBDA AND UNIVARIATE F- STATISTICS**

Discriminating Variables	Inorganic farming system		Organic farming system		Overall farming system	
	Wilks' Lambda	F- stat	Wilks' Lambda	F- stat	Wilks' Lambda	F- stat
Land	0.879*	2.990	0.898**	42.433	0.899	0.422
Labour	0.759***	6.015	0.896	0.981	0.898	0.652
Livestock	0.899	0.176	0.791***	10.886	0.898	0.811
Machinery	0.895	0.729	0.986	3.138	0.880	0.028
Fertiliser	0.772***	3.955	0.796***	8.847	0.891**	3.863
Seed	0.898	1.683	0.892	3.078	0.896	1.595
Plant protection	0.783	2.464	0.799*	18.422	0.995	1.997
Irrigation	0.878**	3.193	0.891*	17.945	0.988**	4.854

Foot note: Calculations are based on Field survey, 2013

* Statistically significant at 10 per cent level

** Statistically significant at 5 per cent level

*** Statistically significant at 1 per cent level

Under inorganic farming category, land, fertiliser and labour was significant at one per cent level. Further, expenditure on irrigation exhibited significant difference five per cent level. Expenditure on livestock and fertiliser under organic farming system were significant at one per cent level. Expenditure on plant protection, land and irrigation were significant at ten and five per cent level respectively. Taking into account the entire farming system, the Wilk's lambda for expenditure on factors such as fertiliser and irrigation for the gross returns of farming system were significant. Hence the above said factors were capable to distinguish between organic and inorganic farming system. There is no significant difference existed between expenditure on land, livestock, plant protection, machinery and seed.

c. Canonical Discriminant co-efficients

To identify the significant factors determining the gross returns of farming system, canonical discriminant co-efficients were calculated. The magnitude of canonical discriminant coefficients indicates the degree of contribution towards the farming system (inorganic, organic and overall) which is presented in table – 35.

TABLE – 35
CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

Discriminating Variables	Inorganic farming system	Organic farming system	Overall farming system
Expenditure on land	0.580	-0.174	-0.704
Expenditure on labour	-0.670	0.148	-0.150
Expenditure on livestock	0.276	0.441	0.305
Expenditure on machinery	-0.568	0.633	0.188
Expenditure on fertiliser	0.463	0.705	0.123
Expenditure on seed	-0.076	-0.059	-0.022
Expenditure on plant protection	0.378	0.336	0.283
Expenditure on irrigation	0.266	-0.573	0.492
Eigen value	0.190	0.047	0.232
Wilk's lambda	0.840	0.855	0.811

Foot note: Calculations are based on Field survey, 2013

Based on the canonical discriminant function which represented a linear composition of the data variability, the group variability for inorganic (Z_1), organic (Z_2) and overall (Z_3) farming system was estimated as follows.

$$Z_1 = 0.580X_1 - 0.670X_2 + 0.276X_3 - 0.568X_4 + 0.463X_5 - 0.076X_6 + 0.378X_7 + 0.266X_8$$

$$Z_2 = -0.174X_1 + 0.148X_2 + 0.441X_3 + 0.633X_4 + 0.705X_5 - 0.059X_6 + 0.336X_7 - 0.573X_8$$

$$Z_3 = -0.704X_1 - 0.150X_2 + 0.305X_3 + 0.188X_4 + 0.123X_5 - 0.022X_6 + 0.283X_7 + 0.492X_8$$

In case of inorganic farming system (Z_1), labour, machinery and seed exhibited negative contribution and in case of organic farming system (Z_2), land, seed and irrigation made negative contribution which implied any increase in expenditure of these inputs would decrease gross returns of the inorganic and organic farming system. In the above function (Z_3) the variables such as expenditure on livestock, machinery, fertiliser, irrigation and plant protection had positive signs implied that these variables had higher discriminating power and suggested increase in gross returns with positive increase in these variables. The other variables such as expenditure on land, labour and seed made negative contribution in discriminating between the gross returns of farming system. The table further displayed eigen values which showed the ratio of the between-groups sum of squares to the within-group sum of squares. The discriminant function exhibited an eigen value of 0.190, 0.047 and 0.232 and Wilk's lambda for the function as 0.840, 0.855 and 0.811 for inorganic farming, organic farming and for overall farming system respectively which is significant at one per cent level.

d. Relative Importance of the discriminating variables

The relative contribution of selected independent variables in determining gross returns of organic and inorganic farming system were calculated and presented in Table - 36.

TABLE - 36**RELATIVE CONTRIBUTION OF VARIABLES (IN PERCENTAGES)**

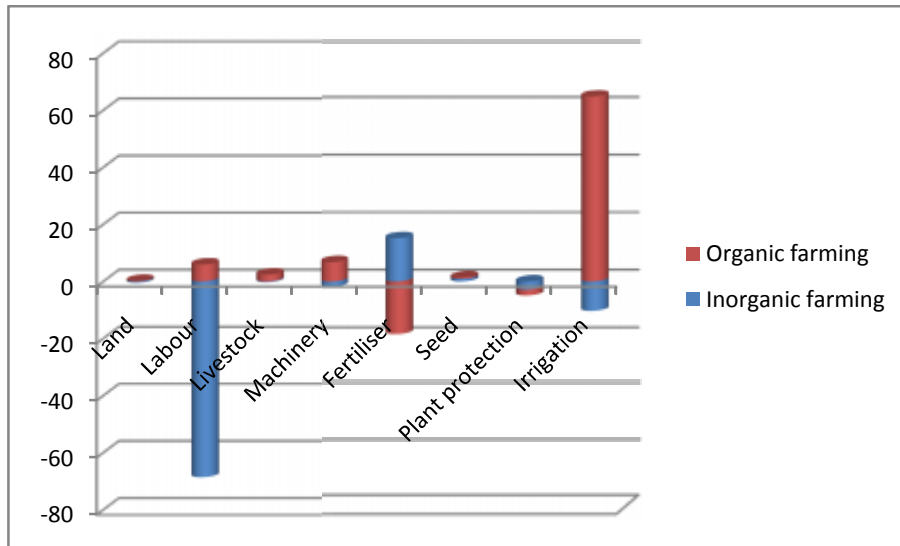
Discriminating variables	Inorganic farming system	Organic farming system	Overall farming system
Land	-0.42	0.14	-2.86
Labour	-68.59	5.86	-3.88
Livestock	-0.25	2.34	-2.02
Machinery	-1.76	6.72	-1.06
Fertiliser	15.02	-18.21	-5.40
Seed	0.96	0.45	0.31
Plant protection	-2.80	-2.04	-6.56
Irrigation	-10.20	64.25	-77.91

Foot note: Calculations are based on field survey, 2013

The criteria for evaluating the relative contribution of each variable as discriminators between the different levels explained that under inorganic farming system, expenditure on labour was the most dominant factor with 68.59 per cent followed by fertiliser, irrigation, plant protection, machinery and seed with 15.02 per cent, 10.20 per cent, 2.80 per cent, 1.76 per cent and 0.96 per cent respectively. In case of organic farming, expenditure on irrigation was the dominant factor with 64.25 per cent followed by fertiliser (18.21 per cent), machinery (6.72 per cent), labour (5.86 per cent), livestock (2.34 per cent) and plant protection (2.04 per cent). Expenditure on irrigation was the first dominant factor to determine the gross returns of overall farming system and it alone contributed 77.91 per cent. Next to Irrigation, expenditure on plant protection contributed 6.56 per cent followed by expenditure on fertiliser (5.40 per cent), labour (3.88 per cent), land (2.86 per cent), livestock (2.02 per cent), machinery (1.06 per cent) and seed (0.31 per cent). Figure - 13 explains the relative contribution of variables among the farming system.

Figure – 13

Relative Contribution of Variables among the farming system



The classification among the two groups for inorganic, organic and overall farming systems are given in the following tables – 37(A), 37(B) and 37(C).

TABLE – 37 (A)
CLASSIFICATION OF INORGANIC FARMING SYSTEM

Farming system		Predicted group membership		Total
		1	2	
Original	1	52	22	74
	2	22	45	67
Percent	1	70.3	29.7	100.00
	2	32.8	67.2	100.00

Foot note: Calculations are based on Field survey, 2013

It was indicative of the fact that among 141 respondents included in group 1, 70.3 per cent were predicted correctly and the remaining was not assigned correctly to the second group. Similarly, in group 2, 67.2 per cent were correctly assigned and remaining was misclassified. The overall percentages of the respondents classified correctly were 68.8 per cent.

TABLE 37 (B)
CLASSIFICATION RESULTS OF ORGANIC FARMING SYSTEM

Farming system		Predicted group membership		Total
		1	2	
Original	1	73	47	120
	2	63	83	146
Percent	1	60.8	39.2	100.00
	2	43.2	56.8	100.00

Foot note: Calculations are based on Field survey, 2013

It was observed that among 266 respondents included in group 1, 60.8 per cent were predicted correctly and the remaining was not assigned correctly to the second group. Similarly, in group 2, 56.8 per cent were correctly assigned and remaining was misclassified. The overall percentages of the respondents classified correctly were 58.6 per cent.

TABLE 37 (C)**CLASSIFICATION RESULTS OF OVERALL FARMING SYSTEM**

Farming system		Predicted group membership		Total
		1	2	
Original	1	118	23	141
	2	52	214	266
Per cent	1	83.7	16.3	100.00
	2	19.5	80.5	100.00

Foot note: Calculations are based on Field survey, 2013

It was revealed that among 407 respondents included in group 1, 83.7 per cent were predicted correctly and the remaining was not assigned correctly to the second group. Similarly, in group 2, 80.5 per cent were correctly assigned and remaining was misclassified. The overall percentages of the respondents classified correctly were 81.6 per cent.

Conclusion

Under inorganic farming category, expenditure on land, labour, fertiliser and irrigation exhibited significant difference. Expenditure on plant protection, land, irrigation, livestock and fertiliser under organic farming system were significant. There was no significant difference existed between expenditure on labour, machinery and seed.

In case of inorganic farming system, labour, machinery and seed exhibited negative contribution and in case of organic farming system, land, seed and irrigation made negative contribution which implied any increase in expenditure of these inputs would decrease gross returns of the inorganic and organic farming system. For overall farming system, the variables such as expenditure on livestock, machinery, fertiliser, irrigation and plant protection had positive signs which implied that these variables had higher discriminating power and suggested increase in gross returns with positive increase in these variables. Under inorganic farming system, expenditure on labour was the most dominant factor whereas in case of organic farming and for overall farming system, expenditure on irrigation was the dominant factor to determine the gross returns. The results were very similar to that of the studies of Huchappalvar (2001) and Karki et. al (2011).

p. Technical, scale, cost and allocative efficiency of organic and inorganic farming system

There are four basic forms of efficiency Viz., technical, scale, cost and allocative efficiencies. Technical efficiency refers to the ability of the farm to maximise output from a given set of inputs (Farrell, 1957). Scale efficiency is the ability of the farm to equate its output obtained at the minimum point of long run average cost curve. In other words, the quantum of input used exactly equals the required input associated with constant returns to scale. The cost inefficiency of a farm arises when actual cost of production exceeds the minimum cost – the amount by which a farm lies between the production frontier and above its cost frontier can be referred to as measure of cost inefficiency. Allocative efficiency refers to the response to the economic signals and choice of optimum input combination, given the relative input prices. These efficiency measures were derived by using Data Envelopment Analysis (DEA). Technical and scale efficiency were investigated taking into account gross returns as dependent variable and inputs like expenditure on land, labour, machinery, fertiliser, plant protection and other expenditures like seed, livestock and irrigation as independent variables. Cost and allocative efficiency were measured taking into account input prices in addition to output and input data. These efficiencies were measured under the assumption of constant returns to scale and variable returns to scale options. A value of unity indicates the farm was on the frontier, while a value of less than unity indicates the presence of inefficiency.

a. Technical Efficiency

The results regarding technical efficiency scores both under constant returns to scale (CCR model) and variable returns to scale (BCC model) options based on the DEA model are presented in table - 38.

TABLE - 38

TECHNICAL EFFICIENCY SCORES UNDER CRS AND VRS PRODUCTION TECHNOLOGY

Efficiency categories	Inorganic farming system				Organic farming system			
	CRS	Percentage of number of farms	VRS	Percentage of number of farms	CRS	Percentage of number of farms	VRS	Percentage of number of farms
E ≤ 0.1	9	6.43	5	3.54	38	14.28	32	12.03
0.1 < E ≤ 0.2	20	14.28	19	13.47	70	26.31	46	17.29
0.2 < E ≤ 0.3	22	15.71	19	13.47	39	14.66	38	14.28
0.3 < E ≤ 0.4	18	12.86	16	11.34	23	8.64	20	7.52
0.4 < E ≤ 0.5	14	10.00	19	13.47	22	8.27	11	4.13
0.5 < E ≤ 0.6	9	6.43	7	4.96	15	5.64	18	6.77
0.6 < E ≤ 0.7	9	6.43	3	2.13	9	3.38	12	4.51
0.7 < E ≤ 0.8	8	5.71	7	4.96	12	4.51	13	4.89
0.8 < E ≤ 0.9	7	5.00	5	3.55	11	4.13	10	3.76
0.9 < E ≤ 1.0	24	17.14	41	29.08	27	10.15	66	24.81
Average Efficiency	0.440		0.752		0.367		0.785	
Average Inefficiency	1.27		0.330		1.725		0.274	
No.of efficient DMUs (farms)	21		39		18		53	

Foot note: Calculations are based on field survey, 2013

Average technical inefficiency score = $1 - \bar{X} / \bar{X}$ (\bar{X} = Average technical efficiency)

RTS - Returns to Scale; VRS – Variable Returns to Scale; CRS – Constant Returns to Scale.

Under Constant Returns to Scale (CRS) production technology, average technical efficiency scores for organic and inorganic farming system were 0.440 and 0.367 respectively and under Variable Returns to Scale (VRS) production technology, technical efficiency scores recorded were 0.752 and 0.785 respectively for all the inputs namely land, labour, machinery, fertiliser, plant protection and other inputs like seed, livestock, irrigation. This implied that the farm producing output on the efficiency frontier would have needed only 75.2 per cent and 44 per cent for inorganic farms and 78.5 per cent and 36.7 per cent of the inputs for organic farms currently being used. It also indicated that if the average farms were to operate at optimal scale, the inorganic farming system

need to improve the efficiency by 24.8 per cent and 56 per cent under VRS and CRS production technology whereas organic farming system requires 21.5 per cent and 63.3 per cent respectively under CRS and VRS production technology. In terms of average inefficiency, they would have needed 21.5 per cent and 63.3 per cent of more inputs for organic farms and 24.8 per cent and 56 per cent of inputs for inorganic farms to produce the same output, which meant wastage of resources to the extent mentioned above. Details regarding the percentage of number of farmers falling under each technology were calculated. It showed that under CRS production technology the maximum number of farms (17.14 per cent) under inorganic farming fell under the efficiency category of $0.9 < E \leq 1.0$ and maximum number of farms (26.31 per cent) under organic farming fell under the efficiency category of $0.1 < E \leq 0.2$ which implied the technical efficiency. Under VRS production technology as expected the percentage of farms fell under the efficiency category of $0.9 < E \leq 1.0$ was (29.08 per cent and 24.81 per cent). In case of organic farming majority of farms are technically efficient only under VRS production technology.

Under VRS production technology, the number of efficient DMUs (farms) exceeded the number of DMUs (farms) under CRS production technology. Always under VRS production technology, higher average efficiency was recorded. It may be due to the reason that DMUs (farms) that were efficient under constant returns to scale (CRS) were accompanied by new efficient DMUs (farms) that might operate under increasing or decreasing returns to scale. High degree of average technical inefficiency particularly under Constant Returns to Scale (CRS) production technology could be attributable to the fact that the farm may not be using the most efficient technology available to transform the inputs into outputs; due to differences in products produced, the farms were likely to have different best practice frontiers; due to relatively small regional spheres of operation of the farm might have resulted in inefficiencies; and due to structural problems regarding labour efficiency and operating efficiency may have prevented the farm from improving its efficiency level.

Hence, it could be concluded that though the efficiency of the farms varied considerably on account of the various reasons mentioned, all the farms were estimated to be on the frontier at least once. In other words, both under CRS and VRS production technology, the number of inefficiency scores or levels during the entire period, was indicative of the fact that the efficiency of farms were not strongly influenced by the size of production. This indicated that there was substantial scope to reduce production costs and hence obtain output gain through improved efficiency.

b. Scale Efficiency

Table - 39 presents details regarding the scale efficiency scores of farms under study along with average efficiency score and average inefficiency score.

TABLE - 39

SCALE EFFICIENCY (SE) SCORES

Efficiency categories	Inorganic farmingsystem		Organic farming system	
	Number	Percentage of number of farms	Number	Percentage of number of farms
$E \leq 0.1$	-	-	8	3.01
$0.1 < E \leq 0.2$	-	-	7	2.63
$0.2 < E \leq 0.3$	6	4.25	7	2.63
$0.3 < E \leq 0.4$	3	2.13	7	2.63
$0.4 < E \leq 0.5$	5	3.55	11	4.13
$0.5 < E \leq 0.6$	14	9.93	10	3.76
$0.6 < E \leq 0.7$	10	7.09	23	8.65
$0.7 < E \leq 0.8$	16	11.34	33	12.41
$0.8 < E \leq 0.9$	35	24.82	47	17.67
$0.9 < E \leq 1.0$	52	36.88	113	42.48
Average efficiency	0.798		0.781	
Average inefficiency	0.253		0.280	
No.of efficient DMUs (farms)	32		40	

Foot note: Calculations are based on Field survey, 2013

$$\text{Average inefficiency score} = 1 - \bar{X} / \bar{X} \quad (\bar{X} = \text{Average efficiency})$$

Results revealed that in both the groups the mean Scale Efficiency (SE) scores were 0.781 and 0.798 respectively and thereby suggesting that SE for majority of the farms was not close to unity. These results implied that scale inefficiency was not present among these farms and since the farms were very small, scale economies may only be realized by larger farms. This finding confirmed to the results of previous study (Coelli et al., 2002). It also indicated that if the average farms were operating at optimal scale, they could improve the efficiency by 22 per cent and 20.2 per cent

respectively. Majority of inorganic farms (42.48 per cent) and majority of organic farms (36.88 per cent) belonged to the efficiency category of $0.9 < E \leq 1.0$ which implied the presence of scale efficiency in both the farming system. Finally, to substantiate the nature of scale inefficiencies, the analysis further disaggregated into those farms that exhibited Increasing Returns to Scale (IRS) and Decreasing Returns to Scale (DRS) in both the groups. Information as to whether farms were operating at IRS or DRS can provide useful information indicating the potential redistribution of farm resources to maximize productivity.

Table - 40 presents returns to scale which forms the basis to understand the scale efficiency of the farms. Figure - 14 explains the returns to scale of the farming system.

TABLE - 40

RETURNS TO SCALE UNDER ORGANIC AND INORGANIC FARMING SYSTEM

Farming system	IRS	CRS	DRS
Organic farming	92 (62.16)	51 (61.44)	123 (69.89)
Inorganic farming	56 (37.84)	32 (38.55)	53 (30.11)
Total	148 (100.00)	83 (100.00)	176 (100.00)

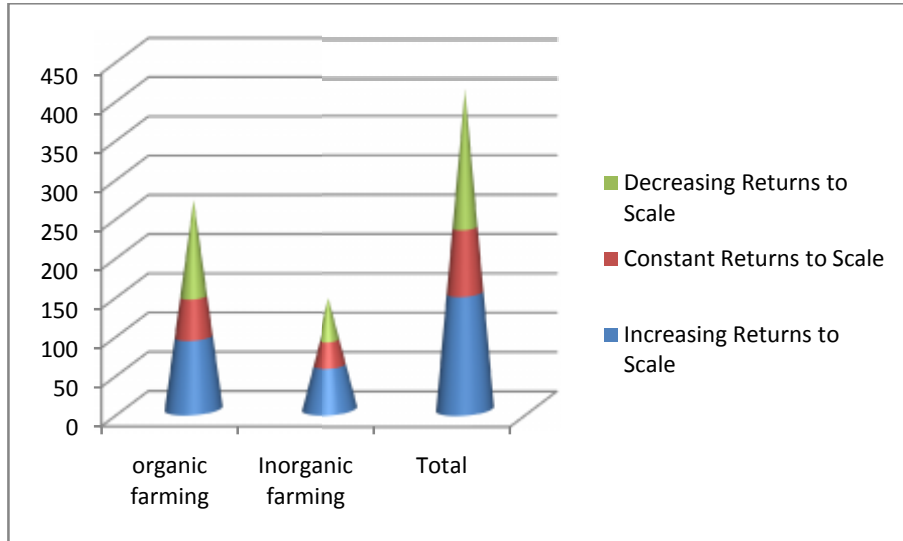
Foot note: Calculations are based on Field survey, 2013

RTS - Returns to Scale; IRS - Increasing Returns to Scale; DRS – Decreasing Returns to Scale; CRS – Constant Returns to Scale.

Additionally, DEA allows in assessing whether a farm lies in the range of increasing, constant and decreasing returns to scale. In other words, it revealed the scale characteristics of DMUs (farms). If market contains farms scale, market efficiency can be increased; more DMUs (farms) attain constant returns to scale, because fewer resources are wasted. The measurement of economies of scale, therefore, helps assess at the same time whether higher market concentration should be encouraged to improve efficiency. A DMU (farm) may be scale inefficient, if it experiences decreasing returns to scale or if it has not taken full advantages of increasing returns to scale. Only 61.44 per cent of organic farmers and 38.55 per cent of inorganic farmers were operating under CRS production

Figure – 14

Returns to scale of the farming system



technology which also indicated the efficiency of organic farming system over inorganic farming system. This phenomenon might be partially due to the fact that the markets of this particular farm might not have taken advantage of the available cost savings due to the absence of price transparency which in turn have allowed the scale inefficient farms to survive. In general, it was very clear that inefficiency can be due to the existence of either increasing or decreasing returns to scale.

c. COST EFFICIENCY

Cost efficiency scores for organic and inorganic farming system taking into account input prices in addition to output and input data for various farms under Constant Returns to Scale (CRS) production technology and Variable Returns to Scale (VRS) production technology is presented in table - 41.

TABLE - 41
COST EFFICIENCY (CE) ESTIMATES UNDER CRS AND VRS

Efficiency categories	Inorganic farming system				Organic farming system			
	CRS	Percentage of number of farms	VRS	Percentage of number of farms	CRS	Percentage of number of farms	VRS	Percentage of number of farms
E ≤ 0.1	49	6.39	1	0.70	112	40.14	17	6.39
0.1 < E ≤ 0.2	45	18.80	23	16.20	70	25.09	50	18.80
0.2 < E ≤ 0.3	15	17.29	40	28.17	36	12.90	46	17.29
0.3 < E ≤ 0.4	6	17.67	17	11.97	26	9.32	47	17.67
0.4 < E ≤ 0.5	6	12.03	21	14.79	16	5.73	32	12.03
0.5 < E ≤ 0.6	2	5.26	9	6.34	6	2.15	14	5.26
0.6 < E ≤ 0.7	1	6.01	4	2.82	7	2.51	16	6.01
0.7 < E ≤ 0.8	3	6.77	4	2.82	3	1.07	18	6.77
0.8 < E ≤ 0.9	9	3.38	5	3.52	2	0.72	9	3.38
0.9 < E ≤ 1.0	5	6.39	18	12.68	1	0.36	17	6.39
Average Efficiency	0.243		0.433		0.189		0.484	
Average Inefficiency	3.115		1.309		4.291		1.066	
No. of efficient DMUs(farms)	3		13		1		6	

Foot note: Calculations are based on Field survey, 2013

Average inefficiency score = $1 - \bar{X} / \bar{X}$ (\bar{X} = Average efficiency)

CRS - Cost Returns to Scale; VRS - Variables Returns to Scale

The cost efficiency of farms revealed that under Constant Returns to Scale (CRS) production technology, organic and inorganic farms were efficient to the extent of 19 per cent and 48 per cent. Under Variable Returns to Scale (VRS) production technology the farm was more efficient to the extent of 24.3 per cent and 43.3 per cent respectively. To operate at optimal scale, the farms could improve the efficiency by 75.7 per cent and 56.7 per cent respectively. This showed that there was a significant margin of increase in gross returns and reduction in cost of production. Majority of farms (18.80 per cent) fell under the efficiency category of $0.1 < E \leq 0.2$ in case of inorganic farming system and 40.14 per cent under organic farming $E \leq 0.1$ under CRS production technology. Under VRS production technology, 28.17 per cent in case of inorganic farming system were in efficiency category of $0.2 < E \leq 0.3$ and 18.80 per cent under organic farming were in efficiency category of $0.1 < E \leq 0.2$ which implied the cost inefficiency among the farms. The average cost inefficiency was more under CRS production technology (4.291 and 3.115 units) than under VRS production technology (1.066 and 1.309 units). This may be due to the inefficiency of the farms in the selection of cost minimising input quantities.

d. Allocative Efficiency

Allocative efficiency estimates taking into account input prices in addition to output and input data for various farms under Constant Returns to Scale (CRS) production technology and Variable Returns to Scale (VRS) production technology for organic farming system is presented in table - 42.

TABLE - 42

ALLOCATIVE EFFICIENCY (AE) ESTIMATES UNDER CRS AND VRS

Efficiency categories	Inorganic farming system				Organic farming system			
	CRS	Percentage of number of farms	VRS	Percentage of number of farms	CRS	Percentage of number of farms	VRS	Percentage of number of farms
$E \leq 0.1$	-	-	1	0.64	-	-	-	-
$0.1 < E \leq 0.2$	1	0.71	2	1.29	-	-	3	1.13
$0.2 < E \leq 0.3$	7	4.96	29	18.71	3	10.53	7	2.64
$0.3 < E \leq 0.4$	44	31.20	52	33.55	28	39.85	39	14.72
$0.4 < E \leq 0.5$	57	40.42	25	16.13	106	37.22	87	32.83
$0.5 < E \leq 0.6$	10	7.09	5	3.22	99	8.65	65	24.53
$0.6 < E \leq 0.7$	4	2.84	3	1.93	23	1.50	40	15.09
$0.7 < E \leq 0.8$	2	1.42	6	3.87	4	1.50	10	3.77
$0.8 < E \leq 0.9$	9	6.38	18	11.61	2	0.75	6	2.26
$0.9 < E \leq 1.0$	7	4.96	14	9.03	1	0.37	8	3.02
Average Efficiency	0.476		0.544		0.497		0.608	
Average Inefficiency	1.101		0.838		1.012		0.645	
No. of efficient DMUs (farms)	3		13		1		7	

Foot note: Calculations are based on Field survey, 2013

Average inefficiency score = $1 - \bar{X} / \bar{X}$ (\bar{X} = Average efficiency)

CRS - Cost Returns to Scale; VRS - Variables Returns to Scale

The allocative efficiency estimates indicated that the farms under CRS production technology had on an average allocative efficiency level of 0.497 and 0.476 in the selected inputs respectively implying that the farms were 1.012 and 1.101 units inefficient. In the case of VRS production technology, an average allocative efficiency of 0.608 and 0.544 units could be observed in inputs respectively implying that the farms were on an average 64.5 and 83.8 per cent inefficient respectively. Majority of farms (40.42 per cent) belonged to the efficiency category of $0.4 < E \leq 0.5$ under inorganic farming and it was 39.85 per cent under organic farming with efficiency category of $0.3 < E \leq 0.4$ under CRS production technology. Under VRS production technology, 33.55 per cent under inorganic farming fell under the efficiency category of $0.3 < E \leq 0.4$ and 32.83 per cent under

Figure - 15 and Figure -16 explains the technical, cost and allocative efficiency under VRS and CRS

Figure – 15

Technical, Cost and Allocative efficiency under VRS

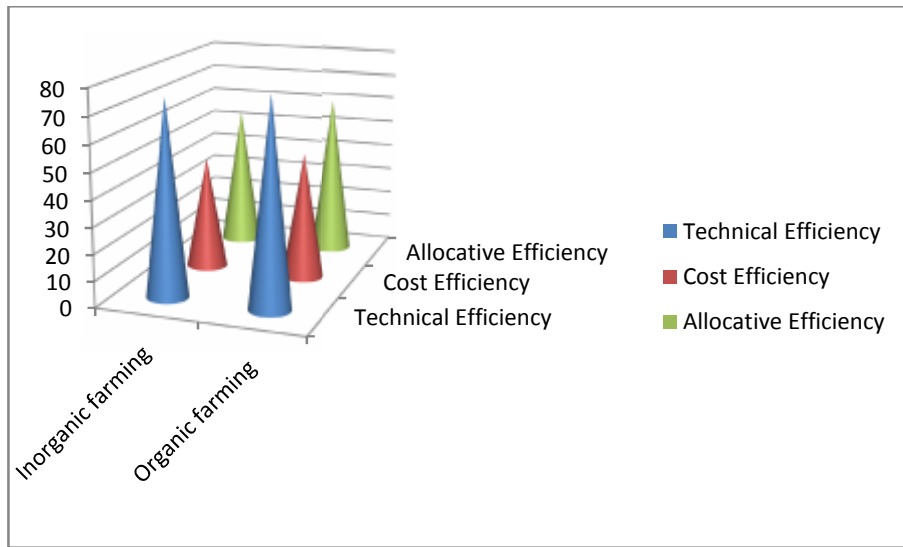
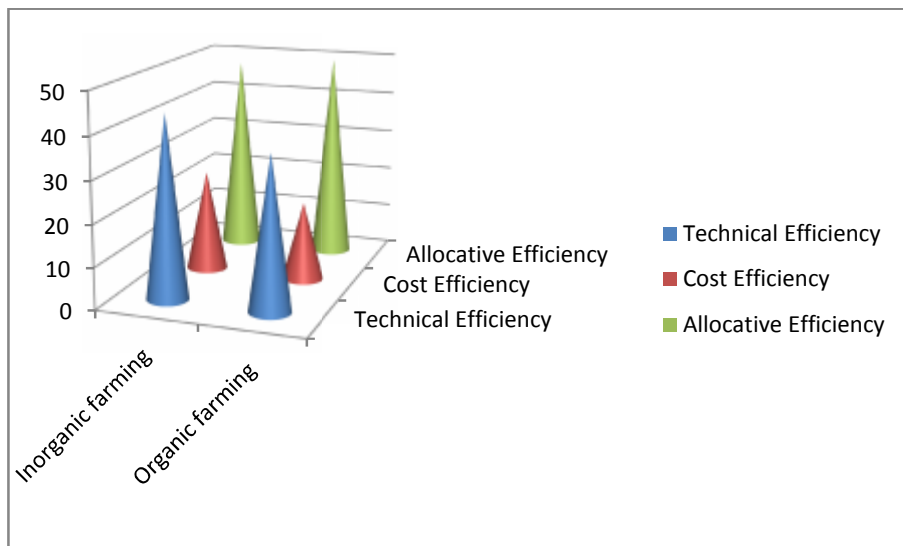


Figure – 16

Technical, Cost and Allocative efficiency under CRS



organic farming fell under the efficiency category of $0.4 < E \leq 0.5$. More efficient DMUs (farms) were observed in VRS production technology compared to CRS production technology. The average inefficiency figures showed that inefficiency was maximum under CRS and VRS production technology for inorganic farms. The low allocative efficiency scores in certain cases might be due to the inability of farms to adjust to new environment or high non-recurring costs. The combined effect of TE and AE were reflected through CE and showed that, both groups can reduce the costs to improve efficiency.

Conclusion

From the above analysis, it could be concluded that the number of technical, scale, cost and allocative efficient DMUs (farms) were more under Variable Returns to Scale (VRS) production technology than under Constant Returns to Scale (CRS) production technology. Also it was very clear that inefficiency could be due to the existence of either increasing or decreasing returns to scale. Farm-wise efficiency score also brought out the fact that the technical efficiency was larger for organic farming system under VRS production technology. Technical efficiency was larger for the inorganic farming system under CRS production technology. With regard to scale efficiency measure, it was found to be larger for inorganic farming system. Cost efficiency under VRS production technology was larger for both organic and inorganic farming system, while cost inefficiency was larger for organic farming under CRS production technology. Allocative efficiency under VRS and CRS production technology was observed larger for organic farms. On the contrary, high allocative inefficiency was observed for inorganic farms both under CRS and VRS production technology. This finding also showed that the main problem of both the groups of farmers were not able to allocate inputs in the most cost minimizing way rather than using the inputs in a technically efficient way. Biswas, 2010, Rahman, 2012 and Elhendy, 2013 were some economists who got similar results for application of DEA in farming system.

C. Constraints faced by inorganic and organic farmers

Various constraints faced by farmers following different farming systems in the selected area are presented in table - 43 and table - 44. Obsolete methods of production, poor irrigation, labour problem, non-availability or high cost input, no proper technical assistance and inadequate financial assistance were some of the reasons expressed by the sample farmers for low yield of farm output. These constraints were expressed as percentages of opinion to the total number of respondents.

TABLE – 43

CONSTRAINTS FACED BY INORGANIC FARMERS IN STUDY AREA (N = 141)

Constraints	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Yield risk	26 (7.39)	22 (6.41)	43 (11.38)	28 (13.66)	22 (16.67)
Market risk	34 (9.66)	15 (4.37)	48 (12.70)	12 (5.85)	32 (24.24)
Non-availability/ costly inputs	37 (10.51)	33 (9.62)	39 (10.32)	20 (9.76)	12 (9.09)
Labour problem	27 (7.67)	34 (9.91)	46 (12.17)	26 (12.68)	8 (6.06)
Credit risk	42 (11.93)	47 (13.70)	38 (10.05)	12 (5.85)	2 (1.52)
Lack of technical assistance	31 (8.81)	56 (16.33)	41 (10.85)	6 (2.93)	7 (5.30)
Spoilage during storage	13 (3.69)	41 (11.95)	36 (9.52)	19 (9.27)	32 (24.24)
Irregular subsidy	78 (22.16)	48 (13.99)	3 (0.79)	7 (3.41)	5 (3.79)
Water pollution	5 (1.42)	19 (5.54)	52 (13.76)	63 (30.73)	2 (1.52)
Electricity failure	59 (16.76)	28 (8.16)	32 (8.47)	12 (5.85)	10 (7.58)
Total	352 (100.00)	343 (100.00)	378 (100.00)	205 (100.00)	132 (100.00)

Source: Field Survey, 2013;

Foot note: Figures in parentheses indicate percentages to column totals

In the course of investigation, about 22.16 per cent of inorganic farmers were very serious about the drawbacks of approaching government for subsidies. The other major constraints faced by the inorganic farmers were power failure (16.76 per cent), credit risk (11.93 per cent) and non-availability or costly inputs (10.51 per cent). The constraints like water pollution and labour problems were tolerable. They also opined that they do not fear much about the yield since they use high yielding variety seeds. About 24.24 percent of inorganic farmers had opined that they do not have market risk and less spoilage during storage.

TABLE - 44
CONSTRAINTS FACED BY ORGANIC FARMERS IN STUDY AREA (N = 266)

Constraints	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Yield risk	37 (7.30)	28 (4.71)	81 (14.41)	54 (10.82)	66 (13.17)
Market risk	53 (10.45)	57 (9.58)	75 (13.35)	38 (7.62)	43 (8.58)
Non-availability/ costly inputs	51 (10.06)	62 (10.42)	47 (8.36)	63 (12.63)	43 (8.58)
Labour problem	26 (5.13)	39 (6.55)	43 (7.65)	76 (15.23)	82 (16.37)
Credit risk	32 (6.31)	39 (6.55)	23 (4.09)	75 (15.03)	97 (19.36)
Lack of technical assistance	74 (14.60)	81 (13.61)	52 (9.25)	34 (6.81)	25 (4.99)
Spoilage during storage	68 (13.41)	83 (13.95)	32 (5.69)	47 (9.42)	36 (7.19)
Irregular subsidy	72 (14.20)	84 (14.12)	46 (8.19)	31 (6.21)	33 (6.59)
Water pollution	45 (8.88)	46 (7.73)	94 (16.73)	39 (7.82)	42 (8.38)
Electricity failure	49 (9.66)	75 (12.61)	69 (12.28)	42 (8.42)	34 (6.79)
Total	507 (100.00)	594 (100.00)	562 (100.00)	499 (100.00)	501 (100.00)

Source: Field Survey, 2013;

Foot note: Figures in parentheses indicate percentages to column totals

About 14.60 per cent of organic farmers were very serious about lack of knowledge about new techniques of farming and they did not have government subsidies. About 13.41 per cent of organic farmers have reported spoilage during storage since they do not have proper warehouse and refrigeration facilities. About 19.36 per cent of organic farmers opined that they do not have credit risk. Taking into account the whole sample farmers, the important constraints faced by both the organic and inorganic farmers in production front were irregular subsidy and they sought for government intervention.

D. Motivational factors determining the decision of farmers in conversion to organic farming

Different motivations were responsible for the decision of the organic farmers to convert from inorganic to organic farming. Financial reasons such as higher prices or the reduction of input costs played a minor to average role in this decision. Most organic farming practitioners have reported that it was not the premium price of the organic produce but the reduced expenditure on inputs and similar yields to their neighbouring conventional farmers that motivated them towards organic farming. Table - 45 shows the determinants of farmers in conversion to organic farming.

TABLE - 45

MOTIVATIONAL FACTORS DETERMINING CONVERSION TO ORGANIC FARMING SYSTEM

Motivational factors	Inorganic	Organic	Overall
Technical guidance	91 (25.07)	125 (30.05)	216 (27.73)
Simple procedure for certification	82 (22.59)	106 (25.48)	188 (24.13)
Input availability on time	61 (16.80)	76 (18.27)	137 (17.59)
Adequate credit at low interest	76 (20.94)	37 (8.89)	113 (14.50)
Relaxation in price	53 (14.60)	72 (17.31)	125 (16.05)
Total	363 (100.00)	416 (100.00)	779 (100.00)

Source: Field survey, 2013

Foot note: Figures in parentheses indicate percentages to column totals

Based on various factors determining the farmer's conversion to organic farming, 27.73 per cent of farmers requested for training and demonstration. About 24.13 per cent of farmers expressed their unhappiness on the lengthy procedure and formalities in certification and demanded simple procedures in order to save their productive time. Under organic farming, the farmers (17.31 per cent) demanded relaxation in price. Regarding credit facilities, 20.94 per cent of inorganic farmers requested for reduction in the prevailing differential interest rate to encourage more farmers to avail credit facilities. About 16.80 per cent of the inorganic farmers demanded availability of inputs on time to convert themselves to organic farming. Most of the farmers gave no suggestion and they expressed their inability as most of them were illiterates. Therefore, they could not give any suggestion either in favour of or against organic farming.