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Interlinkages of Property Rights and Production Management: A Reflection from Commercial Farming

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ABSTRACT

Lease land farming which is legally banned in most of the Indian states, is gaining importance though in a concealed manner. However, the uncertainty over the productivity and sustainability aspects of lease farm cultivation is limiting its expansion. Under the background of conflicting reports, a study was conducted to assess the farm efficiency and management differences between owner operated and leased-in farms, focusing on a commercial fruit crop (pineapple) in a region where ecological awareness is high (Kerala). The study revealed that the lessees used more of chemical inputs like fertilisers, pesticides, weedicides and insecticides intensively keeping a short term profit motive whereas own farm cultivators depended heavily on organic inputs, with a long term sustainability perspective. On employing the discriminant analysis to find out the major factors that discriminate the groups, it was revealed that age, occupation, farming experience, total operational holdings, organic input cost, fertiliser cost and labour cost as the major factors. Despite the threat to sustainable ecosystem health, the yield from leased in farms was found to be almost 20 per cent more than that from their own farms. It was reflected in the returns as well. In this account, it is imperative to promote lease land farming under strict monitoring on the management practices.

Keywords: Property rights, Sustainable ecosystem, Commercial farming

JEL: D23, Q12, Q15.

I

INTRODUCTION

The system of leasing has been banned or prohibited in many parts of the country for the past five to six decades on the grounds of ensuring social equity (Haque, 2012). Even then, in almost all the states where it is not legally permitted, there is an active informal lease land market. The social structure of our country, since Independence, has facilitated the emergence of two categories of people, '*those who own land but are not interested/ unable to cultivate* and *those who have the labour and skills, but do not have enough land'*. This situation has triggered the re-emergence of lease land farming. Thus, the system has re-emerged in Kerala too (Nair and Menon, 2006; Haque, 2012), as in the case of many other states, though in a concealed manner.

The effect of tenancy on productivity is a seriously debated issue. The traditional theoretical notion considers share tenancy as an inefficient form of tenurial arrangement, because the terms of sharecropping provides disincentives to resource

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use (Johnson, 1950; Marshal, 1952). Some others at the theoretical level have argued that resource allocation and productivity appears to be invariant of tenurial arrangement (Cheung, 1969). Some studies found no significant difference in productivity between the owner and tenant farms (Talukdar, 1980) while some researchers are of the opinion that owner operated farms are more productive than the tenant farms (Bhoumick *et al*., 2003).

There are some criticisms on the sustainability aspects of the system. The argument that short term profit motives of the lessee may prompt for unscientific/intensive chemical input use that may challenge the sustainability of the system, is the major one among them. There are conflicting reports on this aspect, from across the world. Bhaumik, 1991 and Leibold, 2013 reported intensive farming techniques under leased in situations which lead to environment damage. On the contrary, Bezbaruah and Roy (2002) reported, based on their study in Barak valley in Assam state, that tenancy was found to be a hindrance to use of high yielding varieties, increasing cropping intensity as well as in applying fertilisers. Chattopadhyay (1979), in West Bengal, reported that intensive cultivation practices as being followed by owner cultivators than tenant cultivators.

Here arises two concerns, one whether tenancy leads to better farm performance and income realisation and two whether there is management differences in these systems that are environmentally sensitive. This paper analyses the management differences in the owner operated farms and leased in farms in one of the major commercial fruit crop of Kerala (pineapple) where lease farming is very common and where there is high level of awareness on ecosystem safety. It may be remembered that Kerala is a state where tenant farming is legally banned and the Land Reforms Act was first implemented.

II

MATERIALS AND METHODS

The study was taken up in pineapple farming as the lease farming is very popular in the crop. Pineapple is cultivated in Kerala in 8002 hectares of which Ernakulam district alone accounts for 62.4 per cent. Among the seven Block Panchayats (BP) where pineapple farming is a commercial activity, Muvattupuzha BP (the study area) alone accounts for 30 per cent (1549 ha). Various geographical and climatic conditions make the region congenial for the production of about 16354 tonnes of pineapple. The Vazhakulam pineapple which is grown in this area has got Geographical Indication (GI) registration.

The study adopted a multistage random sampling method for sample selection with the Gram Panchayats (GP) (three out of eight) as the first stage and farm households as the second stage. Three specific groups of respondents were pre-determined, viz., own farm cultivators, lessors and lessees. For the preparation of sampling frame, out of the eight Gram Panchayats in Muvattupuzha block Panchayat, three were randomly selected and from the respective Krishi Bhavans, the list of

pineapple farmers were collected. The data maintained at Vazhakulam Pineapple Farmers Association was also collected for the same. A random sample of 40 respondents belonging to each of these groups was then identified. Thus the total sample size for the study was 40*2 = 80.

The study is based on both primary and secondary data. Primary data was collected by personal interview method using pretested structured interview schedule as well as personal observations. The primary data included the details of socio-economic information of the farmers, holding size, lease land characteristics and lease conditions. Based on the area under pineapple cultivation (leased in and owned), the three categories of respondents were post stratified into marginal farmers (MF), small farmers (SF) and large farmers (LF) and the range was fixed based on the sample distribution. A marginal farmer is one who cultivates less than 0.8 hectares of pineapple, small farmer is who cultivate 0.8 -1.6 hectares of pineapple and large farmer is the one who cultivate more than 1.6 hectares. The secondary data sources were government publications, data maintained by various departments and other similar sources. The survey was conducted during the period from December 2014 to March 2015.

The statistical tool used for the analysis of management difference in two farming situations is discriminant analysis. Discriminant analysis is a technique used to investigate differences between groups on the basis of the attributes of the cases, indicating which attributes contribute most to group separation (Gujarati, 2004; Margai, 2001 and Fakayode *et al.*, 2012). Gandhimati and Vanitha (2010), employed discriminant analysis to assess the borrowing behaviour of farmers from commercial and co-operative banks. Chandrakanth *et al*.,(2013), used this approach to differentiate two groups - drip irrigation farmers and conventional irrigation farmers in dry land areas of Karnataka.

The function is expressed as:

$$D = a + v_1 X_1 + v_2 X_2 + v_3 X_3 = a + ViX_i$$

where
D = discriminate function
v_i = the discriminant coefficient or weight for the variable
Xi = respondent's score for the variable
a = a constant
i = the number of predictor variables

The v's are unstandardised discriminant coefficients analogous to the b's in the regression equation. Standardised discriminant coefficients can also be used like beta weight in regression.

In the study, the function is used to assess the management differences between lessees and owner operated farms, by identifying the factors that contribute more to the separation of these groups. The description of the variables selected in the study are given in Appendix 1.

III

RESULTS AND DISCUSSION

Pineapple emerged as a major commercial crop in Kerala, consequent to the functioning of Kerala Horticulture Development Programme during 1990s. The institutional, technological, economic and infrastructural support facilitated the wide adoption of pineapple cultivation in Muvattupuzha area, transforming it as the 'pineapple hub of Kerala'. Initially the cultivation was done as pure crop in reclined paddy fields and garden lands. Presently, it is cultivated as an intercrop in newly planted rubber plantations, mainly due to the scarcity of land. The positive economic signals have attracted many agro business entrepreneurs from across Kerala to this region, which facilitated the emergence of lease farming. Thus, most of the lessees are non-resident agri entrepreneurs/resident marginal farmers or agricultural labourers. The details of lease land structure and dynamics in the area is detailed by Thomas and Devi, 2016. The lease rent fixed in this region is within the range of Rs.37,500 and Rs.1,12,500, depending upon geographical and infrastructural factors and lease conditions.

Two main varieties of the crop which are grown in Kerala are *Kew* and *Mauritius*. Mauritius is the popular variety in the study area, due to its general acceptability and marketability. The average plant population is seen around 20,000 suckers per hectare.

Input Management: Organic Manures

The major production inputs used for pineapple farming are organic manures, chemical fertilisers and plant protection chemicals. Organic manure (cow dung and poultry manure) is generally applied at the time of planting. The Package of Practices of Kerala Agricultural University recommends 25000 kg per hectare of FYM and 10000 kg per hectare of poultry manure, for pure crop pineapple. However, the average application by the respondents was much lower than this. On an average, the organic manure application in owner farms was 7000 kg per hectare of cow dung and 8750 kg per hectare of poultry manure whereas the level of application in leased in farms was about 6000 kg per hectare of cow dung and 7500 kg per hectare of poultry manure. Own farm cultivators apply relatively larger quantity of organic manure than leased in farms (17 per cent) because of their sustainability perspective to conserve the soil structure and fertility (Table 1). The resistance from neighbours (due to the bad odour of these manures), is also a reason for lower level of application by the lessees. The rate of application in owner operated farms was lower than the recommended levels by a margin of 3.5 times in case of cow dung and 1.2 times with respect to poultry manure whereas in leased in farms it was by 4 times and 1.3 times respectively.

TABLE 1. ORGANIC MANURE APPLICATION IN OWNER OPERATED AND LEASED IN FARMS

Organic inputs (1)	Recommended dose (kg/ha) (2)	Owned farms (kg/ha) (3)	Leased in farms (kg/ha) (4)	Per cent difference with owned farms (5)
Cow dung	25000	7500	6000	20
Poultry manure	10000	8750	7500	14.2

Chemical Fertilisers

Chemical fertiliser application is an important management strategy in pineapple farming. Farmers apply chemical fertilisers at different stages of crop growth, as top dressing. Package of practices of KAU prescribes a nutrient supply of 8:4:4 g/plant/year of N:P:K. There was considerable difference between the two groups in this regard. In general, lessees applied more of nutrients than owners. The N application was 20 per cent higher whereas P was 25 per cent and K was 17 per cent higher (Table 2). This situation is similar to that reported by Bhaumik (1991) and Leibold (2013). The lessees in general try to reap maximum short term gains through intensive cultivation practices, to safeguard their investment. The sustainability motive of the owners prompt them to follow practices that reduce long term adverse impact.

TABLE 2. COMPARISON OF PER PLANT APPLICATION OF NUTRIENTS IN OWNER OPERATED FARMS AND LEASED IN FARMS

(*g/plant/year*)

Nutrients (1)	Recommended dose (2)	Owned farms (3)	Leased in farms (4)	Per cent difference (5)
Nitrogen	8	25	30	20
Phosphorous	4	16	20	25
Potassium	8	35	41	17

Plant Protection Chemicals

The common plant protection chemicals used in the pineapple fields are weedicides, insecticides and fungicides.

The usual weeds found in pineapple farms are *Cyanadon dactylon* and *Cyperus rotandus.* Traditionally, manual labour was employed for weeding. However, the supply shortages of labour and the resultant high wages have brought in chemical substitutes. As reported by Devi (2012) the adoption of chemical technology to address the supply constraints in labour market is mainly in weed management. The labour availability for weed control (mainly women labour) is shrinking on account of the scarcity and skill factors. Chemical weed control is, hence, widely adopted on account of the easiness in management. Many a times, the labour substitution with chemicals act against the social objective of ecosystem balance. It was evident from the level of weedicide application followed by both own farm cultivators and lessees in their fields. The lessees apply weedicides more frequently. The average number of

application is three times an year in owned farms as against five times in the leased in farms.

The commonly used weedicides in pineapple fields are Diuron and Paraquat. Though the same chemical formulations are used by both the groups, there is difference in the dosage of use. On an average, Diuron is applied at the rate of 2.5 kg per hectare in leased in farms, which is 32 per cent higher than owned farms. As per Package of Practices, Paraquat, is recommended only in the non-crop situation. However, it is widely used by the farmers. In leased in farms, the rate of application of this chemical is 4.38 litres per hectare which is 17 per cent higher than the rate in owned farms (3.75 l/ha). Both owners and lessees, however, use the chemicals more than the recommended levels (Table 3).

TABLE 3. CHEMICAL PEST MANAGEMENT IN OWNER OPERATED AND LEASED IN FARMS

(*g/kg or ml/l per ha*)

(1)	Chemical (2)	Recommended dosage (per ha) (3)	Owned farms (4)	Leased in farms (5)
Weedicide	Diuron 80 WP (kg/ha)	1.25-2	1.87	2.5
	Paraquat (litre/ha)	Non crop situation	3.75	4.38
Pesticide	Chlorpyriphos 20EC (ml/ha)	500-1500	3750	5000
	Imidacloprid 200 SL (ml/ha)	150	-	250
Insecticide	Mancozeb 75WP (g/ha)	1500-2000	1500	2500
	Carbendazim + Mancozeb	-	-	2.5

The most common pest of pineapple in the study area is mealy bugs. Farmers adopt prophylactic application and the application level is higher than the recommended level of the chemical by 0-550 per cent. At the same time, the water used for diluting the chemical to the desired concentration level is often less than the recommended level. This is also reported by Devi, 2007, while studying the pesticide use practices in major crops of Kerala. Chemical insecticides like chlorpyriphos and imidacloprid are applied at the heart of the sucker. In case of chlorpyriphos, both own farm cultivators and lessees apply more than the recommended level of 50-1500 ml per hectare. The concentration of the spray fluid was more in the case of lessees (5000 ml/ha), which is almost 1.3 times more than that of the owners (3750 ml/ha) (Table 3). Imidacloprid is commonly seen to be used by the owners, where the rate of application is 250 ml/ha against the recommended dosage of 150 ml/ha.

The most widely seen disease in pineapple is heart rot disease caused by *Phytophthara parasitica*. Mancozeb and a combination of Carbendazim + Mancozeb are sprayed by the own farm cultivators as per the KAU recommendation. However, lessees were applying 1.6 times that of the owners (Table 3), which reflects the prophylactic usage of plant protection chemicals for a short-term benefit. It clearly indicates that there is remarkable difference in the use of chemicals between the owner operated and leased in farms.

The debate on the indiscriminate use of chemical pesticides in agriculture in Kerala has been triggered by the Endosulphan spray controversy in Kasaragod district and the suspected health damages on account of that. Simultaneously there have been lot of reports on the high levels of pesticide use, residue in fruits and vegetables and water. Most of the mass media reports linked it to serious health damages including cancer, renal failure and the like. This has created a social behaviour in terms of quality environment. Consequently, there are instances where pesticide sprays are objected by the local public and the sales of chemical sprayed products face a slash. In this background, the respondents do not often reveal the level of pesticide use and the researcher is forced to accept their statements. However informal enquiries around the farm and among the officers and local retail sale, points out possible higher levels of use.

Cost of Cultivation

The differences in management practices are reflected in the economics of the crop and hence an attempt was made to assess the cost of cultivation. Table 4 details the cost associated with the use of inputs. To assess whether there is statistically significant levels of cost difference in these two situations, t-test was conducted. The results show significant difference in input cost (except pesticides), and that of labour. On an average the cost of these inputs were 3 per cent higher for lessees (Rs.466294) than the own farm cultivators (Rs.454732). So, the cost of cultivation (Cost C) was found to be more in leased farms than the owner operated farms. This is mainly due to the higher cost incurred on high amount of fertiliser and labour.

Cost A_1 for owner operated farms is Rs.628051 while for leased in farms it is nine per cent higher (Rs.681601). Cost A_2 (Cost A_1 + rent), shows marked difference, which is due to the actual rent payment by the lessees. The difference is to the tune of 33 per cent. The total cost of cultivation (Cost C_2) of leased in farms were higher by 6 per cent (Rs.855113/ha), compared to the owned farms (Rs.803770/ha).

TABLE 4. INPUT COST INCURRED IN OWNER OPERATED AND LEASED - IN FARMS

	Year 1			Year 2			Year 3		
Input cost	Owner operated farms (Rs./ha)	Leased in farms (Rs./ha)	t-value	Owner operated farms (Rs./ha)	Leased in farms (Rs./ha)	t-value	Owner operated farms (Rs./ha)	Leased in farms (Rs/ha)	t-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Organic inputs	15325	15311	0.000**	-	-	-	-	-	-
Fertiliser	56224	73906	0.000**	50956	58608	0.000**	29694	33474	0.000**
Weedicide	5990	6570	0.010**	2913	3502	0.000**	2037	2441	0.000**
Pesticide	5747	6688	0.104	5747	6688	0.104	5747	6688	0.104
Labour	119523	111797	0.001**	108553	98800	0.001**	52576	41821	0.001**
Total	202809	214272	0.000**	161869	167598	0.000**	90054	84424	0.000**

**denotes significance at 1 per cent level.

Yield and Returns

Mauritius variety is ready to harvest, by 11 months after planting. The yield is higher in the first year and subsequently it decreases. On an average, the yield obtained from owner operated farms in the first year is 28.75 t/ha, and from leased in farms it is around 33 t/ha. The total yield from owned farms is nearly 68.75 t/ha, while the leased in farms could make a 20 per cent higher yield (Table 5).The average price realised being the same, the lessees are earning more from the pineapple cultivation than the own farm cultivators. In the initial year the return is Rs.6,61,250 for the owners whereas it was Rs.7,47,500 for the lessees. The total returns were estimated to be Rs.15,64,250 for the owners while the lessees were found to reap a higher return by 20 per cent (Rs.18,75,000).

TABLE 5. YIELD AND RETURNS FROM OWNED AND LEASED IN FARMS

	Yield (t/ha)		Average annual price (Rs,/kg)	Returns (Rs,/ha)	
	Owner	Lessee		Owner	Lessee
(1)	(2)	(3)	(4)	(5)	(6)
Year I	28.75	32.5	23	6,61,250	7,47,500
Year II	22.5	27.5	23	5,17,500	6,32,500
Year III	17.5	22.5	22	3,85,500	4,95,000
Total	68.75	82.5	-	15,64,250	18,75,000

The higher profit through higher investment and chemical input use may lead to expansion of the cultivation, in the years to come. At the same time the long term ecosystem damages due to higher chemical use may limit the profits as well as social welfare. The private and public health cost investments and private investments on soil health management are the two major areas that may demand higher investments in future. In this background we try to analyse the data to examine whether the management factors discriminate the owner operated farms and leased in farms, and if so which are the major contributing factors.

The discriminant function was fitted with two farming situations (owned farms and leased in farms) as the dependent variable, and age, education, occupation, total household income, farming experience, total operational holdings, organic input cost, weedicide cost, pesticide cost, fertiliser cost and labour cost as the independent variables (Appendix 1). The predictive accuracy of the model for the sample was 87.5 per cent and 80 per cent for cross-validated groups. Hence, the model has good predictive power (Table 6).

TABLE 6. HIT RATIO FOR CROSS VALIDATION (LEAVE ONE OUT CLASSIFICATION)

		Predicted group membership	
Group	No of cases	Owner operated	Lessee
(1)	(2)	(3)	(4)
Owner operated	40	36 (90)	4 (10)
Lessee	40	12 (30)	28 (70)
	80 per cent of grouped cases correctly classified		

Figures in parentheses indicate row percentages.

The descriptive statistics of the variables selected for the analysis is given in Table 7. The data indicates considerable difference in the level of operational holding size, organic input cost and fertiliser cost, weedicide cost and labour cost between the two management situations. The mean values indicate the own land cultivators as possessing higher level of education, better occupation, more years of farming experience, higher organic input and labour cost. Meanwhile, the lessees enjoyed better household income, higher operational holdings and increased levels of pesticide and fertiliser cost.

TABLE 7. DESCRIPTIVE STATISTICS OF SELECTED VARIABLES FOR DISCRIMINANT ANALYSIS

		Owned farms		Leased in farms	
Sl No.	Factors	Mean	Std. deviation	Mean	Std. deviation
(1)	(2)	(3)	(4)	(5)	(6)
1	Age	50.58	7.38	47.93	5.48
2	Education	2.30	.97	2.20	0.79
3	Occupation	3.03	1.27	2.08	1.46
4	Total household income	2.55	0.68	2.78	0.73
5	Farming experience	1.80	0.69	1.43	0.64
6	Total operational holding	0.71	0.36	1.86	0.88
7	Organic input cost	15325	4933	6890	7830
8	Weedicide cost	12513	1959	12513	1504
9	Pesticide cost	5747	2542	6688	2569
10	Fertiliser cost	136874	19102	165987	20049
11	Labour cost	280653	20045	269861	24092

In order to statistically test the mean differences between the selected groups, Wilk's lambda (U- statistics) was carried out. The results and F- ratios are presented in Table 8.

TABLE 8.WILK'S LAMBDA (U- STATISTICS) AND F-RATIO OF SELECTED VARIABLES

Sl No.	Factors	Wilk's lambda	F-ratio
(1)	(2)	(3)	(4)
1.	Age	0.959	3.323*
2.	Education	0.997	0.257
3.	Occupation	0.890	9.660***
4.	Total household income	0.975	2.032
5.	Farming experience	0.924	6.419**
6.	Total operational holding	0.571	58.537***
7.	Organic input cost	0.701	33.232***
8.	Weedicide cost	1.000	0.000
9.	Pesticide cost	0.966	2.713
10.	Fertiliser cost	0.638	44.208***
11.	Labour cost	0.943	4.743**

***,** and * significance at 1, 5 and 10 per cent level respectively

The results identified age, occupation, farming experience, total operational holdings, organic input cost, fertiliser cost and labour cost are significant factors in discriminating the two groups. This is in agreement with earlier studies on this aspect (Bhaumick, 1991; Leibold, 2013). However, the value of Wilk's lambda indicates that

occupation, total operational holdings, fertiliser cost and organic input cost as the most significant factors of discrimination.

In case of data on pesticides, the reliability and completeness is largely apprehensive since the response from the farmers were vague. So our results show no significant difference with respect to pesticide usage.

It is important to understand the relative importance of these factors in discriminating between the two groups. For this the pooled within group correlation between the discriminating variable and canonical discriminant function was estimated as shown in the Table 9.

TABLE 9. CORRELATION BETWEEN DISCRIMINATING VARIABLES AND CANONICAL DISCRIMINANT FUNCTION

Sl No.	Factors	Correlation coefficients	Canonical discriminant coefficients
(1)	(2)	(3)	(4)
1.	Total operational holding	- 0.476	0.710
2.	Fertiliser cost	- 0.463	0.000009
3.	Organic input cost	0.381	0.000008
4.	Weedicide cost	0.367	0.000001
5.	Occupation	0.343	0.251
6.	Labour cost	0.278	0.000005
7.	Age	0.180	0.028
8.	Education	0.124	0.140
9.	Pesticide cost	0.100	0.000007
10.	Total household income	- 0.0953	- 0.135
11.	Farming experience	0.0712	0.108

Standardised beta coefficients are given for each variable in each discriminant (canonical) function and larger the standardised coefficients, the greater is the contribution of respective variable to the discrimination between the groups. Total operational holdings had the highest contribution (0.476) towards the function, followed by fertiliser cost (0.463) and organic input cost (0.381). On the other hand, farming experience had the lowest contribution (0.071). The operational holding size of lessees are found to be double that of owned farms. As such the lessees take up the cultivation in agribusiness perspective and go for higher operational farm size, to ensure economies of scale. Due to higher level of investment, the lessees tend to be more risk resistant and in an attempt to ensure higher returns the application of chemical fertilisers are more among lessees. The organic inputs the third major discriminating factor, is applied at a higher level by the owned farmers owing to the sustainability objectives. Thus the analysis confirms the hypotheses of management difference between the two situations and highlights the intensive farming techniques followed by the lessees. The results however, support the importance of lease farming as an agribusiness that promote food security and rural development. At the same time the sustainability of the returns are questioned as the management practices are geared aiming at short term economic gains. The lease farming institutions are to be promoted with legal backing that ensure monitoring of management practices to

ensure sustainability, which can lead to a win-win situation of private gains and social welfare.

IV

CONCLUSION

There is significant increase in the productivity of pineapple farming under tenant cultivation system. At the same time, the input use reflect indiscriminate practice that may damage the ecosystem and pose threat to sustainability of production. On account of the high investment demands for correction of these externalities, the socio-economic gains from pineapple farming may be challenged in future. Hence, the study supports the promotion of lease land farming with an efficient monitoring system to ensure ecologically sound management practices.

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APPENDIX 1

Sl No. (1)	Particulars (2)	Unit (3)
1.	Age (X_1)	Number of years
2.	Education (X_2)	1- Primary 2-SSLC 3- Higher secondary 4- Degree
3.	Occupation (X_3)	1- Agriculture 2- Government service 3-Private service 4- Self employment 5- Agricultural labours 6- Non- agricultural labours
4.	Total household income (X_4)	Income per annum (Rs.)
5.	Farming experience (X_5)	Number of years
6.	Total operational holding (X_6)	Area in hectare
7.	Organic inputs cost (X_7)	Rs./ ha
8.	Weedicide cost (X_8)	Rs./ ha
9.	Pesticide cost (X_9)	Rs./ ha
10.	Fertiliser cost (X_{10})	Rs./ ha
11.	Labour cost (X_{11})	Rs./ ha