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An Economic Analysis of Paddy Cultivation in the Kole Land of Kerala

Jeena T. Srinivasan*

I

INTRODUCTION

The share of area under rice, the major food crop of Kerala in the total cropped area has declined from 32 per cent in 1961-62 to about 8.77 per cent by 2009-10. The area under paddy which had reached to 8.76 lakh hectares during 1975-76 from 7.53 lakh hectares during 1961-62 had since then recorded a steady decrease. By 2009-10, the area under paddy decreased to 2.34 lakh hectares recording 73.28 per cent decrease in a span of about 34 years. The production of rice which accounts for 99 per cent of the total food grain production in the state was 9.88 lakh tonnes in 1960-61 but declined to about 5.98 lakh tonnes by 2009-10 thus registering a decline of about 47 per cent during this period (Government of Kerala, 2010). The decline in the production of rice has been at 2 per cent per annum in the 1980s and at 2.9 per cent per annum in the 1990s (Jeromi, 2003). It may be noted that Kerala agriculture witnessed yield stagnation since mid-seventies including in paddy mainly due to ill-conceived development of critical factors such as water management and land development. Technological stagnation and farmers resorting to increased mixed cropping to minimise earnings fluctuations has been observed during this period (Kannan and Pushpangadan, 1988; 1990). The emergence of small, unviable and fragmented holdings as a consequence of implementation of land reforms had contributed to the non-agricultural use of land and even to real estate (George, 1986; Balakrishnan, 2008). After a period of growth from mid-1980s Kerala agriculture has been in another phase of stagnation since late 1990s. While Unni (1983) observes an increase in the area under coconut where rice has been losing during 1960-61 to 1978-79, a continuous expansion of area under rubber mostly at the expense of coconut which in turn leads to the spread of area under coconut to areas that were previously under rice is found in later periods (Kannan, 2011). On the whole, among the major reasons for changes in cropping pattern are lower profitability of food

*Associate Professor, Research Unit for Livelihoods and Natural Resources, Centre for Economic and Social Studies, Hyderabad – 500 016 (Andhra Pradesh).

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crops, export prospects of commercial crops, increase in the number of absentee land owners, inter-crop variations in land prices and shortage of agricultural labourers, specifically for field crops like rice (Thomas, 1999). As a result of the changes in the cropping pattern, the state depends on the neighbouring states for almost 80 per cent of its requirements for food.

However, with the changing scenario of increasing food prices and global food crisis there has been an increased awareness of the need to be food secure and food self sufficient. During the 11th Plan period intensive efforts are being made to retain the existing paddy land by arresting further conversion of paddy lands by the enactment of the Kerala Conservation of Paddy Land and Wetland Act, 2008, bringing more fallow land area under cultivation, promoting scientific rice farming through participatory group farming approach, etc. In fact, after a long period of continuous decline, the area under paddy increased from 2.29 lakh ha in 2007-08 to 2.34 lakh ha in 2008-09 (Government of Kerala, 2009). Even then the small and unviable holdings still continues to be an important constraint in promoting paddy cultivation. As almost 95 per cent of the holdings in the state are marginal in nature, it is important to understand the major constraints that the marginal holder cultivators face in cultivating paddy including organisational and institutional issues and how best paddy cultivation can be sustained over time. Against this background, this paper attempts to examine the case of paddy cultivation in the Kole land, a unique wetland which faces pressures from various sources in Thrissur district which is the third major rice producing area in Kerala. More specifically, the objective of the paper is to analyse the state of paddy cultivation in Kole land in terms of input use, yield and profitability with a view to identifying the major constraints and opportunities in carrying out and sustaining paddy cultivation.

II

THE STUDY CONTEXT

The Kole land is part of the unique Vembanad-Kole wetland ecosystem in Kerala comprising 151250 ha and is a Ramsar site since 2002.[1] Within this ecosystem, the Kole land cover an area of about 13,632 ha[2] spread over Thrissur and Malappuram districts. They are low lying tracts located 0.5 to 1 m below mean sea level located between $10^{o}20'$ and $10^{o}40'$N latitude and between $75^{0}58'$ to $76^{0}11'$E longitude. A unique feature of the Kole land is that it remains submerged under floodwater for about six months in a year during southwest monsoon when water level rises up to 5.5 meters. A network of main and cross canals provides external drainage and connects the different regions of the Kole to the rivers. This wetland comes under the administration of Mukundapuram, Chavakkad, Thrissur and Thalappilly taluks of Thrissur district and Ponnani taluk of Malappuram district (Johnkutty and Venugopal, 1993). Wetland agriculture, mainly paddy cultivation is the most important activity undertaken on this wetland. The name Kole in the regional language Malayalam

indicates bumper yield or high returns under favourable conditions. The practice of paddy cultivation in the Kole land has been evolved over years in response to a host of climatic, ecological, institutional, socio-economic and technological factors. In earlier times, only a single crop was raised as managing flood water with temporary bunds was a major challenge and very expensive. Later permanent bunds were constructed to facilitate double cropping. However, as most farmers consider that double cropping is not as profitable as single cropping largely due to the high input costs incurred and lower yields their preference is for single cropping. Now in a major portion of the Kole land, a single crop is raised though efforts are made by the District Administration to promote double cropping. Depending on the elevation of the Kole land, paddy is cultivated as *Virippu* (Autumn)*, Mundakan* (Winter) *or Punja* (Summer). The varieties of paddy which can withstand floodwater for few days are usually cultivated here. *Punja* is the crop which is raised over the entire Kole area in December-January. When the flood water in the Kole fields starts subsiding by the end of South west monsoon season, pumping out of water will be carried out in 10 to 15 days by the *Padasekhara Samithi's*[3] for which free electricity is provided by the government. Dewatering is carried out using *petti* and *para*.[4] After this, bunds around the fields or *padavu's* are raised and strengthened by means of locally available materials and laterite soils to a height of 1 to 1.5 m above the field level. Crop is directly sown or transplanted when water is around 10 to 15 cm. Water requirements in the early stages of crop are met from summer flow in the rivers and in the storage canals and in later stages water from Peechi and Chimony dams are used for irrigation. The type of farming practiced in the Kole requires co-operation of the farmers as some of the common activities are carried out by the *Padasekhara Samithi's* while crops are raised by individual farmers. The costs incurred for common works are shared among the farmers of a *padasekharam* according to the size of their individual farms. *Jyothi* a high-yielding variety of paddy is cultivated here for almost past 20 years.

It is observed in the recent years that the farmers are increasingly becoming unwilling to cultivate their lands either leaving them as fallows or converting for other uses. An analysis of land use changes in the Kole land using satellite data from National Remote Sensing Agency for the years 1989, 1997 and 2007 and topo sheet for the year 1981 has been carried out as a part of this study. It is seen that the area under paddy has been 25114 ha in 1981 and recorded a sharp decline to 21484 ha by 1989 and further to 20405 ha and 18597 ha by 1997 and 2007. During this period area under mixed crops increased from 26572 ha in 1981 to 28712 ha in 1989 and then to 29528 ha and 30035 ha respectively by 1997 and 2007. Built up area also showed an increase during this period from just 350 ha to about 2388 ha. Fallow and wastelands are also on the rise. Keeping a wetland fallow for a while as a prelude to diverting it for other uses is a common trend in Kerala and Kole land is no exception to this (Nikhil and Azeez, 2009).

III

DATA AND METHODOLOGY

A stakeholder workshop was conducted initially to identify the key issues concerning the Kole land. This was followed by focus group discussions with farmers during September to November 2009. With the inputs received from the workshop and focus group discussions, a detailed questionnaire covering various aspects of paddy cultivation has been prepared and pre-tested. Household surveys were conducted during December 2009 to April 2010. Details of various inputs including material inputs, their quantities and prices, and managerial inputs apart from paddy output have been collected and valued in monetary terms to examine the net returns and profitability aspects. Information on hired labour and family labour both male and female was collected separately in order to identify the most labour absorbing activities. The value of family labour was imputed at the existing average male and female wage rates respectively. The following Cobb-Douglas production function (log linear) has been fitted to examine the input-output relationship and to estimate returns to scale.

$$LnY_i = \beta_0 + \beta_1 LnX_{1i} + \beta_2 LnX_{2i} + \beta_3 LnX_{3i} + \beta_4 LnX_{4i} + \beta_5 LnX_{5i} + \beta_6 LnX_{6i} + \mu_i$$

Where LnY = log of paddy yield in kilograms per hectare; LnX_{1i} = log of labour used per hectare in labour days; LnX_{2i} = log of quantity of chemical fertilisers used per hectare in kilograms; LnX_{3i} = log of value of pesticides and weedicides applied per hectare in Rupees; LnX_{4i} =log of use of power tillers for land preparation in hours per hectare; LnX_{5i} = log of quantity of seeds used per hectare in kilograms; LnX_{6i} = log of other costs incurred per hectare in Rupees; μ_i = random error term.

In the regression, we have not explicitly included water as an input. Water is assumed to be a non-binding factor because of favourable irrigation conditions reported by the farmers. However, the cost incurred, if any, on irrigation is included in X_6 (other costs). In order to examine the economic viability of Kole farming, net returns have been estimated by taking the difference between gross value of the output and total variable cost of cultivation including the imputed cost of family labour. We also calculated the ratio of gross value of output to total variable costs to see the level of profit margin and to identify the farmers for whom Kole paddy cultivation is viable and not viable.

Sample Selection

In the first stage of sample selection, based on the availability and access to base line information particularly on the number of farmers and their farm size we purposively selected *padasekharams* after arbitrarily classifying them into small, medium and large. Further, farmers in the selected *padasekharams* were stratified

based on their size of landholding and approximately 10 per cent of the farmers from each stratum were selected for an in-depth study adopting probability proportionate sampling method.

TABLE 1. DETAILS OF THE SAMPLE *PADASEKHARAMS* SELECTED FOR THE STUDY

Size class (1)	Name of the Padasekharam (2)	Total No. of farmers (3)	No. of sample farmers (4)
Small	Anayuruli Harijan Kole	47	7
	Nelkathir Kole Karshaka Samithi Kizhakku Mathamathoppu	43	7
	Muriyadu Kayal Maadayikkonam Thekkeppadam Kole Karshaka Samithi	197	23
Medium	Jubilee Thevar Padavu Kole Karshaka Samithi	897	63
Large	Chemmanda Kayal Periyapadam Kadumkrishi Karshaka Sahakarana Sangham	1016	131
All		2200	231

A total of 231 farmers were surveyed of which 49 farmers (21 per cent) reported that they did not cultivate paddy in the reference period,[5] that is, 2008-09 crop season were excluded from detailed analysis. The farmers had cultivated paddy in a single crop season only. Out of the 182 farmers who reported cultivation, nine were small farmers having one to two hectares of land and the rest (95 per cent) marginal farmers with less than one ha of land. This is in line with the trends observed in Kerala.

IV

RESULTS AND DISCUSSION

Yield and Size of Landholding

The average size of individual land holdings across all *padasekharams* in the Kole land is 0.36 ha (Table 2). The marginal farmers have an average area of 0.31 ha whereas that of small farmers is 1.25 ha.

TABLE 2 AVERAGE SIZE OF HOLDING AND YIELD OF PADDY PER HECTARE IN THE KOLE LAND BY SIZE CLASS OF *PADASEKHARAM* AND LANDHOLDING

Size class (1)	Average area (ha) (2)	Average yield per hectare (kg/ha) (3)
Padasekharam		
Small	0.35	4793.45
Medium	0.40	5287.99
Large	0.33	5221.80
Landholding		
Marginal	0.31	5162.05
Small	1.25	5065.36
Total	0.36	5157.27

Source: Primary survey.

The size of individual holdings is lowest at 0.33 ha in the large followed by small *padasekharam* with 0.35 ha. A comparison of per hectare yield of paddy from the Kole land with that of all Kerala and India confirms the widely held view that yield of paddy from Kole land is relatively very high. The average yield of paddy per hectare from Kole farms is found to be 5162 kgs where as it has been 3705 kg/ha in Kerala during 2006-07. The corresponding all India figures has been 2145 kg/ha in 2007-08 which had in fact registered an increase from 2074 kg/ha in 2006-07 (CACP, 2010). Such yield levels have been observed in the Kole farm when paddy cultivation has been more of traditional in nature where no manuring was done due to the high risks involved. One of the earlier studies on the Kole land carried out by the KLDC (1975) has estimated a yield of 2500 kg/ha in *Punja* and 2000 kg/ha in *Mundakan*. The high levels of yield found in Kole land are generally not observed in several places in India. For instance, within India, Punjab leads with a yield level of 4019 kg/ha, followed by Haryana (3361kg/ha), Andhra Pradesh (3344kg/ha) and Tamil Nadu (2817 kg/ha) (CACP, 2010). The yields here are even higher than the world average of 4.1 tonnes per hectare but lower than China's average paddy yield of 6.3 tonnes per hectare (Government of India, 2008). Also, there is no statistically significant difference between the yield levels of marginal and small holdings and also between medium and large *padasekharams*. The lowest yield levels have been observed from small *padasekharams*. However, it is also a widely held view that high levels of yields are maintained with higher input use and therefore at a higher cost of production.

Input Use

As noted earlier, the first step to undertake paddy cultivation is dewatering of the fields. The whole process of dewatering using *petti and para* is energy intensive. However, the cost of energy is not included in the individual farmer's cost benefit calculations as electricity for dewatering is provided free of charge to the *padasekharams* by the government. Labour and other costs incurred for dewatering are shared among the individual farmers' according to the size of their land holdings. After dewatering, tilling of the land mostly using power tillers and construction of bunds are carried out by the farmers independently. Power tillers are used for nearly 15 hours for tilling a hectare of paddy land. At this stage, lime is applied to the soil. As soil in the Kole land is acidic, application of lime based on requirement and letting in water and subsequent drainage is absolutely necessary for correcting acidity and associated toxicities. Almost 90 per cent of the farmers reported lime application on their fields. The average quantity of lime applied per hectare of paddy land was found to be 267 kgs (Table 3). Besides lime, roughly 44 per cent of the farmers reported application of organic manure at the time of land preparation. When compared to 192 kgs per hectare of organic manures applied in Kerala, in Kole paddy land it is 160 kgs and the medium *padasekharams* reported the lowest average of 70

kgs per hectare. Across both size classes of farmers, although marginal farmers were found to apply slightly higher quantity of organic manures the mean difference was not statistically significant. It is estimated that about 150 kgs of seeds are used for per hectare of paddy in the Kole land. High seed rate in the study area have been observed in some of the earlier studies as well (Johnkutty and Venugopal, 1993). The farmers are tempted to use more seeds because of the fear of seed germination problems and survival of plants due to the acidity and other toxicities of the soil. Both broadcasting of seeds and transplanting of saplings after raising them in seed beds are in practice. However, only 10 farmers among those surveyed reported use of any transplanting machines.

TABLE 3. USE OF VARIOUS INPUTS PER HECTARE IN THE KOLE LAND PADDY CULTIVATION

Size class (1)	Tiller (hrs) (2)	Lime (kgs) (3)	Organic manures (kgs) (4)	Seeds (kgs) (5)	Chemical fertilisers (kgs) (6)	Insecticide (Rs.) (7)	Labour (days) (8)
Padasekharam							
Small	13.38	258.58	208.85	154.25	250.78	1727	204.24
Medium	14.25	243.45	69.8	155.76	315.27	2084.12	159.53
Large	15.57	287.72	206.63	141.74	270.86	1665.64	176.54
Landholding							
Marginal	14.91	269.87	163.47	149.77	275.05	1844.62	178.48
Small	10.21	206.2	102.72	135.34	413.78	1360.53	135.88
Total	14.67	266.72	160.47	149.06	281.91	1820.68	176.37

Source: Primary survey.

Use of chemical fertilisers per hectare of paddy is two times more than that of Kerala average. While the quantity of chemical fertilisers used is 123 kgs per ha in Kerala (CACP, 2010), it is as high as 282 kgs per ha in the Kole fields. Across different size classes of *padasekharams*, relatively higher amounts of fertiliser use have been observed in the medium size *padasekharams* which incidentally had reported smaller amounts of organic manure application. When compared to marginal size holder cultivators, small holder cultivators use almost one and half times more quantity of chemical fertilisers. A mean difference of 139 kgs in fertiliser use found per hectare of paddy land between small and marginal holders is statistically significant at one per cent level of significance. The use of pesticides and weedicides are also high in Kole land. Various types of weeds such as *Cyperus Rotundus, Cyperus Difformis, Fimbristylis Miliacea, Marsilea Quadrifolia, Oryza Rufipogon, Ischaemum Rugosum, Echinochloa Crusgalli, Monochoria Vaginalis, Cynodon Dactylon, Sacciolepis Interrupta, Marsilea Spp* are found here. Both manual weed removal and use of weedicides are practiced in the Kole land. Similarly, various types of plant diseases at various stages of plant growth are also reported. On an average insecticides worth of Rs 1820 are applied per hectare of land. Here again medium size *padasekharam* has reported higher use.

A look into the labour input shows that it is almost twice the average labour use reported for all Kerala. Almost 176 human days are employed per hectare of Kole land paddy cultivation whereas it is 98 man-days during 2006-07 for all Kerala as per the reports of the CACP (2010). The highest amounts of labour use have been reported from small *padasekharams*. Activity wise labour use shows that almost 32 per cent of the total labour is used for land preparation and construction of bunds followed by 21 per cent for weed control including manual removal and labour used for application of weedicides etc. In the focus group discussions also, farmers pointed out that weed control and management has become a serious problem in the recent years. The next major share of cost on labour is incurred for transplanting of paddy plants (17 per cent) and 15 per cent for harvesting and threshing operations. Here it is to be noted that the use of machines especially transplanting and harvesting machines is dismal due to various reasons which include lack of its availability when it is needed and smaller size of holdings etc. Labour used for disease control also accounts for about 6.50 per cent. On the whole, it is seen that higher yield of paddy per hectare in the Kole land is attained with higher per hectare input use.

The Cobb-Douglas Production Function

The sign and significance of the estimated coefficients of the Cobb-Douglas production function indicates that seed, application of chemical fertilisers and insecticides, human labour, tilling hours influence yield levels to a great extent. The coefficients for seed and chemical fertilisers were of higher magnitude indicating higher marginal efficiency of these two inputs (Table 4). The coefficient of the variable X_6 (other costs) although has a negative sign was however not significant. While a study conducted by Muraleedharan (1987) had reported constant returns to scale (1.10), in the present study returns to scale is only 0.69 indicating that cultivation of paddy in the study area is at a diminishing returns to scale.

TABLE 4. ESTIMATED PRODUCTION FUNCTION OF PADDY

Variables (in Logs) (1)	Coefficient (2)	Std. Error (3)	t value (4)
Labour used per ha in labour days (X_1)	0.108542**	0.052438	2.07
Qty of chemical fertilisers used per ha in kgs (X_2)	0.143275*	0.040992	3.5
Value of pesticides and weedicides applied in Rs per ha (X_3)	0.134541*	0.032686	4.12
Use of power tillers in hrs per ha (X_4)	0.105578**	0.049064	2.15
Qty of seeds per ha in kgs (X_5)	0.22611**	0.097226	2.33
Other costs in Rs per ha (X_6)	-0.02817	0.038963	-0.72
Constant	5.005403*	0.637123	7.86
Number of obs = 182			
F (6, 175) = 11.04; Prob > F = 0.0000			
R-squared = 0.2745; Adj R-squared = 0.2497			

Source: Primary survey.

* and ** respectively at 1 and 5 per cent level of significance.

Economic Viability of Paddy Cultivation

In order to examine the economic sustainability of paddy cultivation in the Kole land it is important to look into the costs and returns to the farmers. The important costs incurred for paddy cultivation are the costs of seeds and other material inputs such as chemical fertilisers including lime used at the time of land preparation, organic manure, pesticides and weedicides, labour, cost of tilling and other machines used etc. Irrespective of the size of the landholding or *padasekharam*, the cost of cultivation per hectare of paddy cultivation is about Rs. 45,588 (Table 5). The analysis of cost of cultivation landholding size wise shows that small holder cultivators incur significantly lesser costs.

TABLE 5. PER HECTARE COST OF CULTIVATION OF PADDY IN THE KOLE LAND AND KERALA

(Rs./ha)

Size class (1)	Labour (2)	Tilling (3)	Seed (4)	Organic manure (5)	Lime (6)	Fertiliser (7)	Insecticides (8)	Other cost (Rs.) (9)	Total input cost (10)
Padasekharam									
Small	34252.72	2716.82	2048.04	2274.98	1422.19	1630.09	1727.07	4321.06	50392.97
Medium	26709.16	3127.86	2315.23	670.70	1338.98	2049.28	2084.12	3590.01	41885.35
Large	29593.51	3578.33	2107.87	2651.79	1582.47	1760.56	1665.64	3270.76	46210.92
Landholding									
Marginal	30285.37	3297.33	2188.19	1971.60	1484.26	1787.80	1844.62	3644.26	46503.42
Small	15579.10	2334.85	1746.44	529.91	1134.09	2689.57	1360.53	2608.41	27982.89
Total	29558.13	3249.73	2166.34	1900.31	1466.94	1832.39	1820.69	3593.04	45587.57

Source: Primary survey.

While the cost incurred by marginal farmers is Rs. 46503 per hectare, it is only Rs. 27983 for small holder cultivators. The mean difference of Rs. 18520 between small and marginal farmers is statistically significant at 5 per cent level of significance. On the other hand, small *padasekharams* are found to incur higher cost of cultivation which is also statistically significant. This could be because small *padasekharams* and marginal holder cultivators are not in a position to take advantage of any economies of scale. Among the components of costs considered here, labour costs formed the single largest item and accounted for 65 per cent. The costs incurred on other inputs varied between 3 to 8 per cent of the total cost. It is seen that small farmers are incurring approximately 10 per cent lower cost on labour and comparatively higher cost on fertiliser when compared to marginal farmers. In order to see the economic viability of Kole paddy cultivation one has to look into the profitability aspects. The farmers growing paddy in the Kole land realised a gross return of Rs. 56730 per hectare (Table 6).

TABLE 6. COMPARISON OF COST AND RETURNS FROM PADDY CULTIVATION IN THE KOLE LAND

(*Rs./ha*)

Size class (1)	Gross value of output (2)	Cost of production (3)	Net returns (4)	Ratio of gross value of output to cost (5)
Padasekharam				
Small	52728.00	50392.97	2335.02	1.30
Medium	58167.94	41885.35	16282.60	1.70
Large	57439.78	46210.92	11228.86	1.53
Landholding				
Marginal	56782.54	46503.42	10279.12	1.49
Small	55718.95	27982.89	27736.06	2.58
Total	56729.95	45587.57	11142.38	1.54

Source: Primary survey.

Output has been valued at the procurement price of Rs. 11 per kg. The average net benefit from paddy cultivation is found to be Rs. 11142 per hectare. This is as low as Rs. 2335 for small *padasekharams*. While small holder cultivators have a net return of Rs. 27736 per hectare, it was as low as Rs. 10279 for marginal holders. In order to see the level of margins, we also worked out the ratio of gross value of output and the costs. The ratio shows that the gross value of output have been more than the costs across different size classes of padasekharams, as well as landholding class. The ratio was found to be 1.54 for all categories of farmers and ranged from 1.30 for small *padasekharams* to 2.58 for small holder cultivators (Table 7). It is however significant to point out that for almost 32 per cent of the sample farmers; the ratio of gross value of output per hectare has been less than the cost incurred. The average ratio was found to be 0.74 for them. For another 43 per cent of the farmers the ratio of gross value of output to cost has been between one and two with an average of 1.42. For these farmers even a slight increase in the cost of production or a decrease in the gross value of output or both would make paddy cultivation economically non-viable and are likely to exit from paddy cultivation. These two categories together comprise almost 75 per cent of the total farmers in the Kole land.

TABLE 7. DISTRIBUTION OF FARMERS ACCORDING TO THE RATIO OF GROSS VALUE OF OUTPUT TO COSTS

Size class (1)	<1 (2)	Between 1 and 2 (3)	Between 2 and 3 (4)	Between 3 and above (5)	Total (6)
Padasekharam					
Small	19 (51.35)	12 (32.43)	3 (8.11)	3 (8.11)	37 (100)
Medium	13.00 (20.97)	31.00 (50.00)	13.00 (20.97)	5.00 (8.06)	62.00 (100)
Large	27.00 (32.53)	35.00 (42.17)	15.00 (18.07)	6.00 (7.23)	83.00 (100)
Land holding					
Marginal	57.00 (32.95)	77.00 (44.51)	28.00 (16.18)	11.00 (6.36)	173.00 (100)
Small	2.00 (22.22)	1.00 (11.11)	3.00 (33.33)	3.00 (33.33)	9.00 (100)
Total	59.00 (32.42)	78.00 (42.86)	31.00 (17.03)	14.00 (7.69)	182.00 (100)
Avg. ratio	0.74	1.42	2.39	3.72	1.54
Avg. area (in ha)	0.30	0.30	0.46	0.68	0.36

Source: Primary survey.

Figures in parentheses indicate percentages.

It is seen that the levels of margin or profitability improved with the size of holding. The correlation coefficient between size of the land holdings and level of margin has been found to be 0.34 and is statistically significant. For more than 50 per cent of the farmers in small *padasekharam*, the ratio is less than one indicating that paddy cultivation is not economically viable for them. Thirty three per cent of marginal holder cultivators also reported a ratio of less than one.

V

CONCLUSION AND POLICY IMPLICATIONS

This paper examined the yield, input use, and net returns from paddy cultivation in the Kole land, against the backdrop of the attempts from the Government of Kerala to increase paddy production in the state. It is seen that the yield per hectare of paddy is very high from the Kole land. However, this is attained with higher input use raising serious concerns on both ecological and economic sustainability. The returns to scale indicate that Kole is operating under diminishing returns to scale. Labour cost constitutes over 65 per cent of the total cost of cultivation. Higher inputs of labour are used for certain activities like land preparation, weed removal, transplanting and harvesting. The increasing trend in the use of weedicides raises serious concerns on soil health and ecological sustainability. For a large number of farmers' cultivation of paddy as a single crop itself is not economically viable and may prefer to exit from cultivation. In such a situation, measures to improve the economic viability of paddy first as a single crop are important instead of recommending double cropping. Better measures for weed control and management would significantly reduce labour cost. Availability and use of machines for transplanting and harvesting is to be improved and promoted. It is seen that medium size padasekharams are more economically viable than the other two categories. Given the average size of individual land holdings in the Kole land, efforts need to be taken to encourage farmers within a *padasekharams* to carry out cultivation collectively so as to reap some economies of scale and make paddy cultivation economically more remunerative. Similarly, further sub-division and fragmentation of holdings needs to be controlled and the Paddy Land Conservation Act has to be implemented strictly. The study finds greater role for *padasekharams* and *padasekhara samithis* as institutions to overcome the constraints imposed by the small size of holdings. This together with a more judicious use of chemical inputs would make Kole land paddy cultivation economically more viable and contribute significantly to the overall goal of enhanced paddy production in the state.

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NOTES

1. Wetlands included in the list acquire a new status at the national level and are recognized by the international community as being of significant value not only for the country, or the countries, in which they are located, but for humanity as a whole.

2. Analysis of land use data using satellite imageries from National Remote Sensing Agency, Hyderabad discussed later shows a much larger area under Kole wetlands.

3. *Padasekharams* are a collection of contiguous rice fields wherein the land owners form themselves into groups to form a *Padasekharam samithi* in a democratic way under Section 7A of the Kerala Land Development Act, 1964 and registered under Societies Act. The size of individual holding in each Padasekharam ranges from 0.081 ha to 2.02 ha.

4. *Petti* and *Para* an indigenous pumping device developed for dewatering the Kole fields consists of a vertical cylinder (*para)* in which works an impeller on electricity. The impeller pushes the water into the wide wooden box (*petti)* placed horizontally at the top of the cylinder. The outer end of the box is connected to the Kole canal.

5. The important reasons reported for not cultivating paddy included labour problems and lack of profitability.

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