

An economic appraisal of cultivation of korai grass in Central Tamilnadu

Abstract

Cyperus grass or Korai Grass cultivation is quite popular in the block of Musiri in Central Tamil Nadu as it is heavily demanding among the sleeping mats manufacturing industries in Tamil Nadu. Pathamadai village in Tirunelveli District is capable of producing quality mats for the use in the households both in the rural and urban environments. Though it is a less preferred crop in the delta region, farmers are showing interest in establishing such crop for its economic incentives associated with its cultivation. Economic factors and ratios are in favour in respect of Korai cultivation in the part of Central Tamil Nadu. Output input ratio outlined that this crop could generate more than a rupee of net return for a rupee of investment. This paper is one of its kind in addressing the preference of the farmers, cropping pattern followed by them amidst other crops and the revenue generation through this crop is presented and discussed.

Keywords: cyperus cultivation, korai grass, economic incentives, factors influencing

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An Overview

Korai grass (*Cyperus rotundus*) is found in abundance along the banks of the rivers and in marshy areas in Tamil Nadu. Pattamadai village in Tirunelveli District of Tamil Nadu is famous for its fine quality mats. Sleeping on this natural grass mats helps in cooling the body heat, relieves back pain, eco friendly, long life and provides deepsleep as well. It is suitable for all types of climates by keeping us warm during winter and cool during summer. Natural Korai River Grass mats are 100 per cent Eco-Friendly which is a space saver in households one could say. After the sleep, it can be folded and kept it safely for reuse which is convenient also. In this respect, brief introduction of Cyperus will be helpful.¹

Cyperus rotundus was part of starchy tuberous sedges that may be eaten by Pliocene hominines. Biomarkers and microscopic evidence of *C. Rotundus* are present in human dental calculus found at the Al Khiday archaeological complex in central Sudan dating from before 6700 BC to the Meroitic pre-Islamic kingdom of 300-400 AD.² It is suggested that *C. rotundus* consumption may have contributed to the relatively low frequency of dental caries among the Meroitic population of Al Khiday because of its ability to inhibit *Streptococcus mutans*.

C. rotundus was employed in ancient Egypt, Mycenaean Greece and elsewhere as an aromatic and to purify water. It was used by ancient Greek physicians Theophrastus, Pliny the Elder and Dioscorides as both medicine and perfume. It prefers dry conditions, but will tolerate moist soils and often grows in wastelands and in crop fields.

Cyperus Species

Mat sedge, belonging to the family Cyperaceae, is a glabrous robust plant with culms of 1.5 to 2 m height arising from a creeping woody rhizome. There are several species under the genus *Cyperus* and these are mostly habitants in swampy, marshy land predominant in tropical to subtropical environmental conditions.³ It is important to understand and learn the species of *Cyperus* which are delineated as follows.

1) *Cyperus irria* Linn

In Bangladesh, it is called Bura Chuka and sometimes it is used as 'madur kathi', i.e., mat stick.⁴

2) *Cyperus tegetum* or *C. Tegetiformis* Roxb

It is synonymous with *C. Pangorei* (silk mats of Pathamadai, Tamil Nadu), *C. dehiscentis*, *Papyrus pangorei* and *Papyrus dehiscentis* (Tamil Nadu, Andhra Pradesh, Kolkata of West Bengal, Killimangalam and Palghat of Kerala). It is mainly used as mat-stick and known as 'madurkathi' in West Bengal. *C. tegetum* differs from 'sitalpati' (*Clinogyne dichotoma*), which belongs to the family Marantaceae. Sitalpati plant has 2-2.5 cm cylindrical stem with cut-prominent node except at the terminal end. Sitalpati is very popular in the marshy areas of Cooch Behar district of West Bengal where annual rainfall is about 3000 mm.⁴

3) *Cyperus corymbosus* Rottb.

It is known as fine quality 'madurkathi' in Tinnevely area in Tamil Nadu and expensive with high aesthetic beauty. *Cyperus corymbosus*, locally named as 'korai', is used as mat-stick for mat making in Tamil Nadu.⁵ It differs from *C. tegetum* in having much more distinct glumes, the margins of which in the dried specimen are incurved and not overlapping.⁴

4) *Cyperus articulatus* L.

It is popularly known in Brazil as "Pripricoa" or "Piriprioca", is a tropical and subtropical plant used in popular medical practices to treat many diseases, including cancer.

5) *Cyperus malaccensis* Lam.

It is also called as short leaved Malacca galingale. It is planted in the land between the sea water and fresh water, mainly in Vietnam and processed in Dongguan. It is used in packaging goods in South China. For packaging dry foods, it can provide a cheap, biodegradable and readily available alternative to plastic bags.

In hot humid climate of our country, mats are very comfortable when spread over the hot, cold or damp earthen or cemented floor, or even on cotton beddings, as they are bad conductors of heat. These are also accessible to the common people of our country, because it is comparatively cheaper, can afford even by poor section of the people.⁶ A single mat more or less it lasts about 3-4 years at a stage of use. Now a days, most decorative with colourful mats are available in the market are used in most religious and ritual functions of our

country.⁷ Such wonderful grass mats are widely used in both rural and urban households. But the production of Korai grass and its utilization aspects are not much known to the common public⁸ and hence efforts

have been taken to assess the economic aspects of production and utilization in the mat industry.



Figure 1 Harvesting of Korai Grass.

Design of the study

The authors of the project were travelling across the villages leading to Musiri town of Tiruchirappalli District on a day trip. In the rice fields of Cauvery delta, few of the farmers were cultivating *Cyperus* sp and enquired specifically for what purpose it was being cultivated in the paddy lands and the farmers were revealed that these are the raw materials for making Korai Mat which is a value added product used by poor and urban households for their auspicious occasions and capable of generating considerable return with less investment. On availing the discussion with the farm households by the researchers, developed an interest to learn the prospects and constraints that are associated with the mat industry and hence the Musiri Taluk of Tiruchirappalli District was selected purposively for the study.

Sampling design

The study is focusing on addressing the problems in connection with production of *Cyperus* culms and marketing of value added products in the study environment. For that purpose, the study area was selected as Musiri Taluk of Tiruchirappalli District as it encompasses large number of farmers whom are interestingly cultivating *Cyperus* culms as part of their main crop and hence it was selected purposively in the first Stage. In the second stage, the list of number of blocks available in Musiri Taluk was enlisted from the records of Department of Agriculture and Farmers' Welfare, Tiruchirappalli.

Data collection

For this study, both primary data and secondary data were used. Primary data was generated through a well structured interview schedule designed for the farm level survey and the same was pretested in the field appropriately and modified accordingly. The method of data collection was done by personal interview. Data on general characteristics of farmers like age, education, farming experience, size of the land holdings, crops grown in the area, awareness and adoption of inputs, knowledge on application of inputs and farmers preferences on raising *Cyperus* culms as their main crop, economics of cultivating the crop and the returns realized from the crop, marketing and value addition practices. Secondary data like area under crops, population in rural and urban areas, literacy level, number of workers etc., were gathered from the records of Department of Agriculture and Farmers' Welfare, Tiruchirappalli and are suitably analyzed using percentage analysis.

Study period

The reference year for the study was the agricultural year 2022 and the collection of data from the sample households were taken up during the months of April to June 2023.

Cost

The cost of cultivation / production was estimated by adopting the cost concepts like Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2 and Cost C3 as defined by the Directorate of Economics and Statistics, Government of India. In respect of *Cyperus*, the cost concepts like Establishment Cost, Maintenance Cost and the Harvesting Cost was categorized and the Benefit Cost Ratio was worked out.

Cost analysis for cyperus: In respect of cost analysis of *Cyperus*, the costs were classified into three different categories viz, Cost A, Cost B and Cost C.

The concept of three costs such as Cost-A, Cost B and Cost-C is followed by the Directorate of Economics and Statistics, Government of India in their cost studios. These cost concepts are generally followed in the studies of cost of production of crops.

The input items included under each category of cost are given below.

Cost-A1: Actual paid-out costs for owner cultivator, inclusive of both cash and kind expenditure which include following cost items,

1. Hired human Labour : a) Male b) Female
2. Total bullock Labour a) Owned b) Hired
3. Seeds
4. Manures
5. Fertilizers
6. Insecticides and pesticides
7. Irrigation charges
8. Land revenue, cusses and other taxes
9. Depreciation or capital assets

10. Harvesting, transport and Marketing

11. Interest on working capital

Cost-A2: Cost A1+Rent paid for leased in land

Cost-B1: Cost A1+ Interest on Fixed Capital

Cost- B2: Cost B1 + Rental Value of owned land + Rent for leased in land

Cost-C1: Cost B1 + Imputed value of Family Labour

Cost C2: Cost B2 + Imputed value of Family Labour

Cost C3: Cost C2 + 10 Per Cent of Cost C2 (as Management Cost)

Results and discussion

Korai grass or Cyperus grass is being cultivated in Musiri Taluk by few farmers whom are thinking in a different direction and they could find that the raw material drawn out of Korai will be a good input to the mat industry whom are operating as a cottage industry in different pockets of Tamil Nadu and they never forgot to tap the resource materials from Musiri Block of Tiruchirappalli District and hence it gains significance on a commercial scale. The data collected from the sample farmers and dealers were subjected to cost percentage analysis and the results are presented and discussed in this chapter in the light of the objectives set forth in the introductory chapter. The results are discussed under the following heads precisely.

- Cropping Pattern in Vogue with the Grass Cultivators
- Factors Influencing the Cultivation of Korai Grass in Paddy Belt
- Costs and Returns in Korai Grass Cultivation

Cropping pattern in vogue with the grass cultivators

As a prelude to the discussion on the cropping pattern, one would be interested in analyzing the area under different crops at district level, block level and then in the sample farm level so as to have a clear understanding and hence these are analyzed and the results are discussed under the following heads.

- Area under Different Crops Cultivated in Tiruchirappalli District
- Area under Commercial Crops Cultivated in Tiruchirappalli District
- Area under Different Crops in Musiri Block of Tiruchirappalli District
- Size of Holding with the Sample Farms and
- Cropping Pattern Prevalent among the Sample Farms

Area under different crops cultivated in Tiruchirappalli district:

Area under different crops cultivated every year gives an ideal decision to the researcher to foresee the nature and kind of crops to be brought under cultivation by the Department of Agriculture and Farmers Welfare. In this respect, the area under different crops cultivated in Tiruchirappalli District is analyzed and the results are presented in Table 1.

Table 1 revealed that Tiruchirappalli District is enriched with Cereals, Pulses, Oil Seeds, Commercial crops, Horticultural crops. Among the cereals, Paddy is the predominant crop being the delta area which is occupied at 73 per cent of the total area under cultivation. Since this project is focusing on studying the commercial crops particularly Korai (Coco Grass) grass cultivation and its marketing which is occupying an area of 7.25 per cent to the total area under cultivation. Though the area is meagre, there exists lives depending on the cultivation of commercial crops which are money spinners.

Table 1 Area under different crops cultivated in tiruchy district (2021-22) (Area in Ha)

Sl. No	Name of the Block	Cereals (Ha)	Pulses (Ha)	Oilseeds (Ha)	Commercial Crops (Ha)	Horticultural Crops (Ha)	Total Area (Ha)
1.	Andhanallur	3797.53(03.79)	02.96	138.54	53.275 (00.59)	1168.61 (09.35)	5160.88
2.	Thiruverumbur	7979.49 (07.96)	80.17	27.28	07.28 (00.08)	152.97 (01.22)	8247.19
3.	Manapparai	4299.17 (04.29)	160.23	210.28	108.34 (01.20)	68.53 (00.55)	4846.55
4.	Manikandam	7505.65 (07.49)	263.39	59.48	42.90 (00.48)	171.65 (01.37)	8043.07
5.	Marungapuri	3474.67 (03.47)	40.85	489.08	280.09 (03.11)	20.80 (00.17)	4305.49
6.	Vaiyampatti	4303.08 (04.29)	459.66	525.54	302.43 (03.36)	222.95 (01.78)	5813.66
7.	Lalgudi	9015.01 (08.91)	2340.50	51.66	592.03 (06.57)	378.81 (03.04)	12378.28
8.	Pullambadi	4620.51 (04.63)	975.65	67.35	457.08 (05.07)	431.25 (03.47)	7151.85
9.	Mannachanallur	7374.72 (07.36)	1376.67	793.04	3350.65 (37.17)	1186.18 (09.49)	14081.26
10.	Musiri	8944.04 (08.92)	706.83	2068.01	1007.68 (11.17)	215.99 (01.73)	12941.75
11.	Thathaiyangarpettai	8171.03 (08.15)	288.29	1920.50	136.93 (01.52)	87.37 (00.69)	10604.12
12.	Thottiyam	7690.42 (07.67)	151.37	1151.73	314.40 (03.49)	2735.17 (21.89)	12043.09
13.	Thuraiyur	9605.45 (09.58)	439.39	1088.77	1534.41 (17.02)	4036.58 (32.31)	16704.60
14.	Uppiliyapuram	13436.60 (13.41)	203.45	299.31	826.36 (09.17)	1617.09 (12.94)	16382.81
Total Area in Hectare		100217.37 (100.00)	7489.41	8890.57	9013.86 (100.00)	12493.95 (100.00)	138105.16

(Source: Office of the Deputy Director of Statistics, Tiruchirappalli District)

(Figures in Parentheses indicate Percentage to Respective Total)

The total area under cereal crops is arrived at 100217 ha in Tiruchirappalli District. Among the total area under cereal crops, Uppiliyapuram is found to dominate in higher area under cereals which is arrived at 13.41 per cent followed by Thuraiyur, Musiri and Lalgudi Blocks had an area under cereals which are respectively arrived at 9.58 per cent, 8.92 per cent and 8.91 per cent indicated

that these blocks are richer in cereal crops. However, the least area under cereal crops are also found out in respect of Andhanallur and Marungapuri which are respectively arrived at 3.79 per cent and 3.47 per cent indicated that the farmers in these areas are concentrating on cultivation of commercial and horticultural crops.

In Andhanallur block, horticultural crops could find a place which is arrived at 9.35 per cent. However, higher area under horticultural crops could also be found out in Thuraiyur, Thottiyam and Uppiliyapuram and their area is respectively arrived at 32.31 per cent, 29.89 per cent and 12.94 per cent to the total area under horticultural crops. Thottiyam block is blessed with Tamil Nadu Banana Producers' Company which is involved very actively in promoting and utilizing all the parts of Banana into a value added product. Around 20 products are being prepared out of Banana and are being exported to the consumers both in India and abroad which could facilitate Banana cultivation in higher area.

In respect of commercial crops, area is predominantly found out in Mannachanallur block which is accounted for 37.17 per cent to the total area under commercial crops of Tiruchirappalli District followed by Musiri block blessed with 11.17 per cent and Lalgudi is enriched with commercial crops to an extent of 6.57 per cent. The least area under commercial crops is found to be at Thiruverumbur

and Manikandam which are respectively arrived at 0.08 per cent and 0.48 per cent to the total area under commercial crops.

Area under commercial crops cultivated in Tiruchirappalli district: The interest of the researcher is identifying how much area is brought under commercial crops especially the Korai Grass which is occupying the interest of human minds in the Musiri block of Tiruchirappalli District. In this respect, these details are assessed, analyzed and the results are presented in Table 2.

Table 2 revealed that the Cotton is occupying the predominant place in this district among the commercial crops which is arrived at around 81 per cent followed by Sugarcane found to occupy an area of 1291 ha which is arrived at 14.33 per cent. Among the 14 blocks, Mannachanallur block is found to cultivate highest area under cotton crop which is arrived at 3151 ha accounting for 43 per cent to the total area under cotton in the district. Andhanallur and Thiruverumbur blocks are not concentrating on cultivation of cotton in their lands. It might be due to the preference of horticultural crops.

Table 2 Area under Commercial Crops in Tiruchirappalli District (Area in Ha during 2021-22)

Sl. No	Name of the Block	Commercial Crops			Total Area in Ha
		Cotton	Korai	Sugarcane	
1.	Andhanallur	0.00	0.00	53.28	53.28
2.	Thiruverumbur	0.00	0.00	07.28	07.28
3.	Manapparai	30.29	0.00	78.05	108.34
4.	Manikandam	09.01	0.00	33.89	42.90
5.	Marungapuri	203.25	0.00	76.84	280.09
6.	Vaiyampatti	223.14	0.00	79.29	302.43
7.	Lalgudi	395.50	0.00	196.53	592.03
8.	Pullambadi	287.16	0.00	169.92	457.08
9.	Mannachanallur	3151.09	0.00	199.56	3350.65
10.	Musiri	500.99	429.02	77.66	1007.67
11.	Thathaiyengarpettai	113.16	0.00	23.77	136.93
12.	Thottiyam	141.28	31.30	141.82	314.41
13.	Thuraiyur	1481.73	0.00	52.68	1534.41
14.	Uppiliyapuram	725.44	0.00	100.92	826.36
Total Area in Ha		7262.04 (80.57)	460.32 (05.10)	1291.49 (14.33)	9013.86 (100.00)

(Source: Deputy Director of Statistics, Government of Tamil Nadu 2021-22 and the Figures in Parentheses indicates Percentage to the Total area under Commercial Crops)

Cultivation of Korai in Tiruchirappalli District is arrived at only 5.10 per cent to the total area under cultivation under commercial crops. Though it is meagre, the dependent communities are many and hence the farmers of Musiri are cultivating Korai grass in an area of 429 ha followed by Thottiyam 31 ha. To sum up, the Korai grass are not being a dearer crop to the farmers of Tiruchirappalli District other than the farmers of Musiri and Thottiyam blocks.

Area under different crops in musiri block of Tiruchirappalli district: The farmers of Musiri block are showing their interest in raising Korai grass as their friendly crop. Since Musiri block is capable of cultivating Korai grass in a higher area, their cropping details and its analysis becomes much more important to the researcher and hence these details are analyzed and the results are presented in Table 3.

Table 3 revealed that the total area under different crops is arrived at 12918 ha. Among this, the area under horticultural crops is arrived at only 1.67 per cent to the total area under crops. The area under agricultural crops is found to be predominant which is arrived at

12702 ha accounted for 98.33 per cent to the total area under crops in Musiri Block of Tiruchirappalli District. Predominantly the cereal crops have occupied an area of 69 per cent to the total area under crops. In Musiri Block, the Commercial crops area is arrived at 1667 ha which is accounted for 7.78 per cent to the total area under crops in Musiri Block.

Size of holding with the sample farms: Though the area under cultivation is appreciable, each and every farmer and their size of holding in possession with them are of much more important and hence these details are analyzed and the results are presented in Table 4. The size of holding is classified as Marginal whom are in possession with less than one ha area, Small farms are classified in the range of one to two ha area, Semi Medium category lies in the range of 2 to 4 ha while the medium category is in the range of 4 to 10 ha and the large farms are classified into the category of above 10 ha following the standard norms prevalent with Department of Statistics, Government of Tamil Nadu.

Table 3 Area under Different Crops in Musiri Block of Tiruchirappalli District (2021-22)

Sl. No	Name of the crop		Percentage to total area
	Cereals	Total area in Ha	
1.	Paddy	2838.48	21.94
2.	Maize	251.87	01.95
3.	Sorghum	5828.46	45.05
4.	Pearl Millet	01.25	00.01
	Total Area under Cereals	8920.06	68.95
	Pulses		
5.	Red Gram	574.85	04.46
6.	Black Gram	131.98	01.03
	Total Area under Pulses	706.83	05.49
	Oil Seeds		
7.	Groundnut	2048.95	15.83
8.	Gingelly	03.41	00.03
9.	Sunflower	15.66	00.21
	Total Area under Oil Seeds	2068.02	16.07
	Commercial Crops		
10.	Cotton	500.10	03.86
11.	Korai Grass	429.02	03.32
12.	Sugarcane	77.66	00.60
	Total Area under Commercial Crops	1006.78	07.78
	Horticultural Crops		
13.	Onion	156.10	01.23
14.	Banana	36.98	00.29
15.	Tapioca	22.91	00.19
	Total Area under Horticultural Crops	215.99	01.67
	Total Area under Agricultural Crops	12,701.69	98.33
	Total Area under Horticultural Crops	215.99	01.67
	Total Area under Crops	12,917.68	100.00

Table 4 outlined that the study area is not enriched with the medium and large farm category among the sample farms. However, the marginal category of farms was found to be predominant whom are accounted for 60 per cent to the total followed by small farms accounted for 36.67 per cent to the total. Semi Medium category is occupying only 3 per cent to the total number of sample farms. From that one could infer that the Musiri block is enriched only with Marginal farms followed by Small farms.

Cropping pattern prevalent among the sample farms: Cropping pattern was much influenced by the interest of the farmers, the extension agency contacts and the knowledge on money spinning crops based on their awareness level. In this respect, one would be interested in analyzing the details of cropping pattern prevalent among the sample farms of Marginal and Small farmers and hence these results are analyzed and the results are presented in Table 5.

It is quite interesting that the study area is almost evacuated the Medium and Large farms from the Musiri Block. It might be due to the fragmentation of holdings among the members of farm households because of the commercialization trend of land and its value being these lands are nearer to the city environment. The mean size of holding is arrived at only 0.33 ha which is utilized for paddy cultivation. Whereas, the mean size of holding per farm is available at 1.23 ha for Korai grass cultivation. The mean size of holding with the

sample farms is arrived at 2.36 ha which is classified under the semi-medium category of farms. With these data, one would be interested in assessing the General characteristics of farm households whom are cultivating different crops. The involvement in Agricultural activity is also influenced by their age, education, expertise and hence these are analyzed and the results are presented under the head General characteristics of farm households.

General characteristics of farm households

Age of the sample farms: Age of the farmer is one of the factors that could influence the decisions on how to practice agriculture that will be a learned process from experience. In support of this one should play a vital role in assessing the age of the sample farmers as to know whether they are young or middle age or at their old age? These details are analyzed and the results are presented in Table 6.

Table 6 outlined that less than 40 years age group of the farmers are found to be in the range of 50 per cent and the remaining 50 per cent of the farmers were in the age group of above 40 years. In that around 17 per cent of the farmers are above 50 years of age. Being the farm owner cum labourers and their sustained efforts in augmenting the land for enhancing the productivity, they toil all along and that could elevate the health status of the farmers and hence they will be young always in farm front.

Educational status of sample farms: The decision making rests with the educational status and the experience gained over a period of time by the farmers. This could influence on what crop to be grown, when it should be grown and how it should be grown and what kind of technologies that are available to the farmer producers to use in the production process etc. and hence the educational status of the head of farm households were analyzed and the results are presented in Table 7.

Table 7 outlined that the farm households are not having much educational back up. Around 32 per cent of the sample households had their educational background to the level of secondary to collegiate education. That is not much impressive to take decisions in agriculture. But by gaining expertise and innovative attitude among the farmers could have motivated them to practice such commercial crops in their holdings.

Occupational status of sample farms: The sample households are earning their bread by generating income through different sources. The details of occupation available to the farm households and their sources of income are analyzed and the results are presented in Table 8.

Table 8 indicated that the main occupation of the farm households are agriculture alone whom are accounted for 67 per cent to the total farm households followed by non-farm activities like conducting petty shops, real estate broking combined with agriculture accounted for 30 per cent to the total farm households. Non-Farm activities alone are the income generation possibilities to only 3 per cent of the farm households. From that one could infer that the farm households are mostly depending on agriculture as their principal occupation.

Annual income and its classification: Occupation held by the sample households explain how much income is able to be generated by the sample farmers. In this respect, the annual income generated by the farm households were recorded and their quotes were arranged in ascending order and the cumulative average for the annual income of the sample farmers and are divided into three different income groups. These details are analyzed and the results are presented in Table 9.

Table 9 revealed that the sample households are stratified into three different income groups and are designated as low, middle and high income category. The low income category of farms could generate an average annual income of Rs. 120000/- whom are accounted for 70 per cent of the total sample farms followed by medium income category whom could generate an annual income of 120001 to 3.50 lakhs accounted for 17 per cent to the total. The higher income category according to the survey is they could generate upto 6 lakhs per annum as their annual income. However, the results are presented according to the income group classified.

Experience gained by the sample farmers: Experience in Agriculture that directs, teaches the farm households to practice agriculture vividly against the vagaries of monsoon. In this respect, the experience gained by the farmers is analyzed and the results are presented in Table 10.

Table 10 outlined that the low income category of farms comprising 13 households who has gained less than 20 years of experience in agriculture. Their share is accounted for 43 per cent to the total followed by middle income category in which 9 farm households are dwelling and their share is accounted to be 30 per cent. They have gained 21 to 40 years range of experience. Higher income group category has gained greater than 40 years of experience in agriculture whom are accounted for 27 per cent to the total.

Under the head of general characteristics of sample farmers, the marginal farm category are higher and their size of holding is also arrived at less than one ha and the mean size of holding is found to be 0.80 ha. Education status and occupational status are not much appreciable in the farm households because majority are primary and illiterate level of education and depend for their livelihood only from agriculture.

Factors influencing the cultivation of korai grass in paddy belt

Paddy is the recommended crop for cultivation in the Cauvery Belt. Since Tiruchirappalli District is coming under Cauvery delta zone, the recommended cereal crop like paddy alone should be practiced. However, the farmers are raising different commercial and horticultural crops to sustain their income for a long to meet the various emerging needs. One of its kinds is Coco grass or Korai grass. In this respect, one would be interested in analyzing the reasons that motivates the farmer to raise Korai grass or Coco grass in their farm holdings amidst all others are raising paddy crop is of much more important and hence these results are analyzed and are presented in Table 11.

Table 11 revealed that cultivation of Korai Grass or Coco grass is found to be remunerative to most of the respondents and hence it has gained the highest Garrett's Score and stood first among the seven reasons followed by Minimal expenditure involved in establishing the crop. Once planted and it lost for few years and generates income without much expenditures which will be reflected in the cost of cultivation section. This factor is ranked as the second one among the seven and the third factor in order is Ready market availability to the output generated from Korai grass. Absence of middlemen to meddle the distribution process is almost absent in this transaction and hence it is placed in the seventh rank with the Garrett score of 756. From that one could infer that the crop is capable of fetching higher income coupled with lower maintenance cost found to be the reason for cultivating this crop.

Costs and returns in korai grass cultivation

The Costs incurred and the returns realized per ha in respect of Korai grass cultivation is furnished for different income group category to highlight the cost involvement if any across the income groups.

Costs and returns of korai grass cultivation under group I income category: Table 11 outlined that the cultivation of Korai grass could generate higher returns per unit area. To justify the same, the costs incurred over a period of several months and the returns realized are analyzed in respect of different income groups from the period of establishment to harvesting. The costs concepts used for the appraisal are the recommended structure given by Commission on Agricultural Costs and Prices, Government of India. They are Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2 and Cost C3. These details are analyzed and the results are presented in Table 12.

Table 12 outlined the details of cost of Coco grass cultivation under low income category. The total cost of cultivation (Cost C3) is arrived at Rs. 1.23 lakhs during the year of establishment and the same is found to be reduced during the consecutive years which is arrived at Rs 92224/- Among the total costs, the Cost A1 is arrived at Rs. 76395/ during the year of establishment which is accounted for 62 per cent to the total cost. The Cost A1 is found to be reduced during the second and third years. It is mainly due to the absence of cost involvement during the establishment period.

Table 4 Size of holding available with the korai grass cultivating farms in musiri block

Sl. No	Size of farm	Number of farms	Average size of holding in Ha	Percentage to total
01	Marginal (<1 ha)	18	00.80	60.00
02	Small (1 to 2 ha)	11	01.70	36.67
03	Semi-Medium (2 to 4 Ha)	01	03.00	03.33
04	Medium (4-10 ha)	00	00.00	00.00
05	Large (> 10 ha)	00	00.00	00.00
Total		30	01.83	100.00

Table 5 Details of Cropping Pattern Prevalent among the Sample Farms

Sl. No	Size of farm	Cropping pattern (Ha)					Total area in Ha
		Paddy	Korai	Groundnut	Brinjal	Coconut	
01	Marginal	00.30 (37.50)	00.50 (62.50)	00	00	00	00.80 (100.00)
02	Small	00.20 (11.76)	01.20 (70.58)	00.20 (11.77)	00.10 (5.89)	00	01.70 (100.00)
03	Semi-Medium	00.50 (16.67)	02.00 (66.66)	00	00	0.50 (16.67)	03.00 (100.00)
Mean Size of Holding		00.33	01.23	00.20	00.10	00.50	02.36

Table 6 Age of sample farmers

Sl. No	Age (in Years)	Number of farmers	Percentage to total
01	<30	06	20.00
02	31-40	09	30.00
03	41-50	10	33.33
04	>50	05	16.67
Total		30	100.00

Table 7 Educational status of sample farmers

Sl.No	Educational level	Number of farmers	Percentage to total
01	Illiterate	17	56.67
02	Primary	03	10.00
03	Secondary	05	16.67
04	Higher Secondary	02	06.66
05	Graduate	03	10.00
Total		30	100.00

Table 8 Occupational status of sample farmers

Sl. No	Occupational status	Number of farmers	Percentage to total
01	Agriculture only	20	66.67
02	Agriculture and Non-farm	09	30.00
03	Non - Farm	01	03.33
Total		30	100

Table 9 Annual income of Sample Farmers

Sl. No	Group	Annual income	Number of farmers	Percentage to total
01	I	<1,20,000	21	70.00
02	II	1,20,001-3,50,000	05	16.67
03	III	3,50,001-6,00,000	04	13.33
Total			30	100

Table 10 Experience of the sample farmers

Sl. No	Group	Experience (in years)	Number of farmers	Percentage to total
01	I	<20	13	43.33
02	II	21-40	09	30.00
03	III	>40	08	26.67
Total			30	100

Table 11 factors influencing cultivation of korai grass in paddy belt

Sl. No	Factors	Percentile position	Garrett's score	Rank
1	Quite Remunerative	19.09	2126	I
2	Minimal Expense	20.37	1993	II
3	Ready Market	15.58	1635	III
4	No problem regarding pest infestation	15.67	1627	IV
5	No problem during storage	11.24	1171	V
6	No need of regular maintenance	10.85	1132	VI
7	Absence of Middlemen	7.24	756	VII

Table 12 cost and returns of korai grass cultivation under group I income category

Cost	Expenditure (in Rs.)		
	Year I	Year II	Year III
Cost A1			
Establishment Cost			
Value of Human Labour	800	1600	1600
Value of Machine Labour	17500	-	-
Planting Material Cost	23900	-	-
Maintenance Cost			
Cost of Irrigation	5600	6500	6500
Fertilizer	3750	7500	7500
Pesticide	0	0	0
Weeding	8400	10300	10300
Harvesting Cost			
Harvest and Transport	9500	18500	18500
Interest on Working capital	6945	4440	4440
Cost A1	76395 (62.06)	48840 (52.95)	48840 (52.95)
Rent paid for any leased in land (10%)	00	00	00
Cost A2	76395 (62.06)	48840 (52.95)	48840 (52.95)
Cost B			
Imputed rental value of owned land	30000	30000	30000
Interest on owned fixed capital (10%)	3000	3000	3000
Cost B1 (Cost A1 + Interest on Fixed Capital)	79395 (64.50)	51840 (56.29)	51840 (56.29)
Cost B2 (Cost B1 + Rental Value of owned land + Rent for leased in land)	109395	81840	81840
Imputed value of Family Labour	2500	2000	2000
Cost C1 (Cost B1 + Imputed value of Family Labour)	81895	53840	53840
Cost C2 (Cost B2 + Imputed value of Family Labour)	111895	83840	83840
Cost C3 (Cost C2 + 10% of Cost C2 as Management Cost)	123084	92224	92224
Total Cost of Cultivation	123084	92224	92224
Yield in Bundles	120	240	240
Price/Bundle	1200	1200	1100
Total Income	144000	288000	264000

(Figures in Parentheses indicate Percentage to Respective Total)

The Harvested part of Korai sticks are normally bundled in the bank of the field and it weighs to 30 kgs. The yield of Korai sticks per ha is arrived at 120 bundles during the year of establishment. But the yield during the consecutive years becomes doubled and the same is arrived at 240 bundles. On an average, each bundle is priced at Rs. 1200 and hence the farm of low income category could generate a gross income of Rs. 1.44 lakhs and the same was arrived at Rs. 2.88 during the second and third years of establishment. Because of the cost involvement during the establishment period, the net income found to be minimum and a farmer could generate only Rs. 21000/. Whereas, during the second year, the farmer could generate an average net income of Rs. 196000/. Because of this economic incentives associated with found to be the reason as stated in Table 11. Hence, the practice of cultivating Korai grass is popularized in Musiri Taluk.

Costs and returns of korai grass cultivation under group II income category: The costs involved and returns realized among the group II income category is analyzed and the results are presented in Table 13.

Table 13 revealed the details of costs and returns for middle income category of sample farms. During the year of establishment, the Cost C3 is found to be 1.29 lakhs which is marginally higher. The difference in cost of cultivation is only a marginal increase. The increase is accounted to be only Rs. 6000/. But the gross income is found to be Rs. 1.56 lakhs during the year of establishment and it has been arrived at Rs. 2.88 lakhs and 2.64 lakhs during the second and third year of establishment. The Cost A1 in middle income category is arrived at Rs. 80000/ which is around 4000 less in respect of low income category outlined that there is no much difference in the cost of cultivation across income group.

Costs and returns of korai grass cultivation under group III income category

Income group III is designated as higher income category whose income ranges between Rs 4 to 6 lakhs. Their cost structure is classified, analyzed and the results are presented in Table 14.

Table 14 outlined that the total cost of cultivation in respect of higher income category is arrived at Rs. 1.39 lakhs and the same was reduced during the second year. When comparing the same in respect of low and middle income category, the absolute difference is mere few thousands and hence there is no much cost difference in respect of farmers of various income categories. The investment outlines that the farmers are always making a defined investment in the production process by avoiding un wanted expenses.

The yield of Korai bundles is also not much appreciable increase across the income group categories. It ranges between 120 bundles to 130 bundles during the year of establishment and the second and third harvest also faced similar yield which is in the range of 240 to 250 bundles. The price per unit is also almost similar which is prevailing in the range of Rs 1200 to Rs. 1300 per bundle. From this one could

infer that the establishment period consumes little higher cost and the same was found to be less because of absence of establishment. But they do maintenance cost on the higher side in respect of higher income category to get higher yield. But the same practice is not in the case of low and middle income category. Their expenditure pattern under the maintenance cost is almost on par.

Economic appraisal of korai grass cultivation

Under the head economic appraisal, only the output-input ration was taken into account to identify the return one could generate out of one rupee investment in the production process. Besides, the concept of net income generation is also analyzed and the results are delineated in Table 15.

Table 15 revealed the details of Gross income generated by the farm households of various income group, the net income able to generate and the output- input ratio for different income class. The low income group is able to generate a net income of Rs. 1.29 lakhs and the same is marginally reduced in middle income group and the same was found to be reduced to around Rs. 17000/ in respect of high income category because of involvement of higher maintenance cost.

Table 13 Cost and returns of korai grass under group II income category

Cost	Expenditure (in Rs.)		
	Year I	Year II	Year III
Cost A			
Establishment Cost			
Value of Human Labour	800	1600	1600
Value of Machine Labour	17500	-	-
Planting Material Cost	23900	-	-
Maintenance Cost			
Cost of Irrigation	5600	8500	8500
Fertilizer	4000	7500	7500
Pesticide	120	0	0
Weeding	10800	13400	13400
Harvesting Cost			
Harvest and Transport	9500	18500	18500
Interest on Working capital	7222	4950	4950
Cost A1	79442 (61.62)	54450 (54.88)	54450 (54.88)
Rent paid for any leased in land (10%)	1750	1750	1750
Cost A2	1750 (01.36)	1750 (01.76)	1750 (01.76)
Cost B			
Imputed rental value of owned land	30000	30000	30000
Interest on owned fixed capital (10%)	3000	3000	3000
Cost B1 (Cost A1 + Interest on Fixed Capital)	82442	57450	57450
Cost B2 (Cost B1 + Rental Value of owned land + Rent for leased in land)	114192	89200	89200
Cost C			
Imputed value of Family Labour	3000	1000	1000
Cost C1 (Cost B1 + Imputed value of Family Labour)	85442	58450	58450
Cost C2 (Cost B2 + Imputed value of Family Labour)	117192	90200	90200
Cost C3 (Cost C2 + 10% of Cost C2 as management cost)	128911	99220	99220
Total Cost of Cultivation	128911	99220	99220
Yield in Bundles	120	240	240
Price/Bundle	1300	1200	1100
Total Income	156000	288000	264000

(Figures in Parentheses indicate Percentage to Respective Total)

Table 14 Cost and returns of korai grass under group III income category

Cost	Expenditure (in Rs.)		
	Year I	Year II	Year III
Cost A			
Establishment Cost			
Value of Human Labour	2800	5600	5600
Value of Machine Labour	17500	-	-
Planting Material Cost	23900	-	-
Maintenance Cost			
Cost of Irrigation	6400	9600	9600
Fertilizer	5000	11500	11500
Pesticide	0	120	0
Weeding	10800	15400	15400
Harvesting Cost			
Harvest and Transport	15500	31500	31500
Interest on Working capital	8190	7372	7372
Cost A1	90090 (64.57)	81092 (63.20)	81092 (63.20)
Rent paid for any leased in land (10%)	1750	1750	1750
Cost A2	1750 (01.25)	1750 (01.36)	1750 (01.36)
Cost B			
Imputed rental value of owned land	30000	30000	30000
Interest on owned fixed capital (10%)	3000	3000	3000
Cost B1 (Cost A1 + Interest on Fixed Capital)	93090	84092	84092
Cost B2 (Cost B1 + Rental Value of owned land + Rent for leased in land)	124840	115842	115842
Cost C			
Imputed value of Family Labour	2000	800	800
Cost C1 (Cost B1 + Imputed value of Family Labour)	95090	84892	84892
Cost C2 (Cost B2 + Imputed value of Family Labour)	126840	116642	116642
Cost C3 (Cost C2 + 10% of Cost C2 as management cost)	139524	128306	128306
Total Cost of Cultivation	139524	128306	128306
Yield in Bundles	130	250	240
Price/Bundle	1300	1200	1100
Total income	169000	300000	264000

(Figures in Parentheses indicate Percentage to Respective Total)

Table 15 Economic appraisal of korai grass cultivation

S. No	Particulars	Amount		
		Group I	Group II	Group III
1	Gross income	232000	236000	244333
2	Net income	129490	126883	112288
4	Output-Input ratio	2.30	2.20	1.90

The output- input ratio is found to be in favour with low income category and the same little less in the case of middle and higher income category. Though the investment is financially a viable one, the involvement of costs can be reduced further by prioritizing and analyzing the needs of investment. On investing one rupee in this production process could generate a net return of Rs. 1.30, 1.20 and 0.90 in respect of low, middle and higher income category. However, the farmers should seek the higher price for their produce by analyzing the demanding mat industry and negotiating with them. Few of the producers are also doing little value addition by trimming and pruning the bundles to highlight the uniform sticks of good quality which will generate higher price per unit of the produce.

Conclusions and policy implications

Korai Mats are widely used in rural, semi urban and urban environments for its use in the recreation, reception, ceremonial and

sleep related events as it is good for the human health and hence its cultivation is predominant in the study environment. The yield of Korai sticks per ha is arrived at 120 bundles during the year of establishment. But the yield during the consecutive years becomes doubled and the same is arrived at 240 bundles. On an average, each bundle is priced at Rs. 1200 and hence the farm of low income category could generate a gross income of Rs. 1.44 lakhs and the same was arrived at Rs. 2.88 during the second and third years of establishment. Because of the cost involvement during the establishment period, the net income found to be minimum and a farmer could generate only Rs. 21000/-. Whereas, during the second year, the farmer could generate an average net income of Rs. 196000/-. Because of this economic incentives associated with found to be the reason for resorting to the practice of cultivating Korai grass. The output input ratio outlined that for a rupee of investment in this crop cultivation, it could generate more than one rupee as its net return with less risk of depleting due

to marshy and swampy environments. On establishment of a farmer producer company for this mat production and manufacturing and distribution related events will definitely bring higher revenue to the farmers with collective bargaining support.

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None.

Conflicts of interest

All authors declare that there is no conflicts of interest.

References

1. Ganthi AS, Yogaraj M, Subramanian M. Indigenous knowledge on natural dyeing of korai grass mat in pattamadai, tirunelveli district, Tamil Nadu. 2009.
2. Shi Y, Mei X, Li Y, et al. Study on the quality difference of *Cyperus rotundus* before and after vinegar processing based on ultra-high performance liquid chromatography-quadrupole-time of flight-mass spectrometry and molecular network combined with color parameters. *J Sep Sci.* 2023;46(8):2200990.
3. Taheri Y, Herrera-Bravo J, Huala L, et al. *Cyperus* spp.: a review on phytochemical composition, biological activity, and health-promoting effects. *Oxid Med Cell Longev.* 2021;2021:4014867.
4. Jana K, Das SK, Puste AM. Production economics of mat-sedges (*Cyperus tegetum* Roxb.) cultivation as influenced by water management practices for economic stability of resource-poor rural people of west bengal, India. *International Journal of Environmental & Agriculture Research.* 1(2).
5. Amalraj VA, Ramakrishna GVS, Shankarnarayan KA. Foliage biomass-stem diameter relationship in balanities roxburghii PI. *Annals of Arid Zone.* 1985;24(4):361-364.
6. Jana K, Puste AM. Madur kathi- an important economic non – food crop of west bengal. *Asian agri-history.* 2014;18(2):145-151.
7. Puste AM. Aquatic non – food commercial crops, agronomic management of wet land crops, Kalyani Publishers, India. 2004;198-206
8. Poomari S. A study on problems of mat weavers in pattamadai. *JETIR,* 2018;5(9).