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An Economic Analysis of Cumbu Napier Grass Farm Using Treated Wastewater in Karur District of Tamil Nadu

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ABSTRACT

This study attempts to examine the socio economic profile, management index and economics of cumbu napier grass production using treated industrial wastewater in Karur district of Tamil Nadu. A sample of 120 farmers was selected through multistage random sampling technique. The major findings of the analysis revealed that, the share of literate heads of the sample farms using treated wastewater was 85.33 per cent. The mean value of management index an indicator of efficiency was 1.03. The gross income of the respondents of the sample farms using treated wastewater was Rs. 293585.51 derived from cumbu napier grass and fodder cultivation, livestock activities and all other on-farm, off-farm and non-farm activities. The net income realized per hectare of cumbu napier grass farm was Rs. 77943.61.

Key words: *Water reuse, Cumbu napier grass, Management index, Cost, Returns*

INTRODUCTION

At the present time, the world is facing a critical problem of water shortage. The Second World Water Forum in Hague in March 2000 showed very clearly to the world public that water will be one of the central issues of the 21st century of this globe and the life of billions of people will depend on the wise management of this source. Water is an essential and basic human need for urban, industrial and agricultural use and has to be considered as a limited resource or a limiting resource. The amount of water used in irrigation should be reduced and transfer it to the domestic, industrial, and environmental sector[1]. Existing sources of water can be saved with numerous approaches, both modern and traditional, that exist throughout the world for efficiency improvements and augmentation, with options such as; conservation of water, efficient use of water, ground water recharge, reuse of waste water, virtual water requirement, etc. Among such approaches, wastewater reuse has become increasingly important in water resource management for both environmental and economic reasons.

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The foundation of water reuse is built upon three principles; (1) providing reliable treatment of wastewater to meet strict water quality requirements for the intended reuse application, (2) protecting public health, and (3) gaining public acceptance. Water reuse accomplishes two fundamental functions ; (1) the treated effluent is used as a water resource for beneficial purposes, and (2) the effluent is kept out of streams, lakes, and beaches; thus, reducing pollution of surface water and groundwater beside the land[2].Wastewater has high potential for reuse in agriculture; an opportunity for increasing food and environmental security, avoiding direct pollution of rivers, canals, surface water; conserving water and nutrients, thereby reducing the need for chemical fertilizer and disposing of municipal and industrial wastewater in a low-cost, sanitary way. Among different source of wastewater, industrial wastewater reuse is one of the significant components of water reuse in agriculture as the source content are known and treatment is done by the industry. In the present study, the hypothesis is that the treated industrial wastewater usage for irrigation is financially viable. The main objectives of this study include: to discuss the personal profile of farmers in the sample villages, to study the average cost of production, yield and returns, per hectare of cumbu napier grass besides computing the management index of the farmers in the sample of the study area.

MATERIAL AND METHODS

A. Primary data

The data relating to the year 2015-16 were collected for the research during November – December 2016 with multistage random sampling technique. Tamil Nadu News Print Limited (TNPL) located in Karur district of Tamil Nadu state was purposively selected for the present study since it has the largest production capacity at a single location in India and this is the only mill that provides the treated wastewater for irrigation to farms in nearby farming villages in Tamil Nadu. All the five villages using treated wastewater from TNPL for irrigation were considered. The number of farmers to be selected from each village was based on the probability proportion to size. A total of 120 farmers were selected for the present study. Data were collected from the sample farmers using pretested, well-structured schedule through personal interview method. The data collected were based on the memory of the respondents.

B. Management Index

The following linear type specification[3], to derive the management index (MI) for this study has been used. The functional form employed in this study happens to be;

$$Y = b_0 + b_1 EXP + b_2 EDU + b_3 OCC + b_4 LH \quad (1)$$

where, Y = yield per hectare; EXP = farming experience in years; EDU = education dummy (=1, if secondary school and above; '0' otherwise); OCC = occupation dummy (=1, if agriculture as the primary occupation and '0' otherwise) and LH = land holding in hectare. Using the estimated significant coefficients of the function, and the respective mean value of EXP, EDU and OCC, the management index was worked out for all respondents, using the following equation.

$$MI = (b_1EXP+b_2EDU+b_3OCC+b_4LH)/(b_1EXP+b_2EDU+b_3\overline{OCC}+b_4\overline{LH}) \quad (2)$$

Where, $\overline{EXP}$, $\overline{EDU}$, $\overline{OCC}$ and $\overline{LH}$ happen to be mean values.

C. Cost and Returns

Cumbu napier grass being a perennial crop, the cost of cultivation is to include; variable and fixed costs. The variable cost included the cost of; planting material, manure, fertilizers, plant protection chemicals, human labour, machine power hired, the family labour used evaluated at wages for hired labour, land revenue paid and the interest in working capital during the study year. The fixed cost included; the amortised establishment cost, interest on fixed capital and rental value of land. The total value of produce (seed and by-product) for both main and byproduct together was taken as the gross return. Return obtained by subtracting the total cost from gross return formed the net return. The amortised establishment cost has been arrived using the following formula[4]: Amortised establishment cost = TEC $\{(1+i)^t \times i/((1+i)^t-1)\}$. Where, TEC = total establishment cost; i = interest rate of six per

cent is taken; t = life span of cumbu napier grass which is taken to be 20 years.

RESULTS AND DISCUSSION

The results obtained from the current study are presented below:

D. Socio-Economic Status of Sample Farmers Using Treated Wastewater

The socio economic characteristics of the sample farmers with respect to age, educational status, family size, farm size and source of income are presented in Table 1. The results revealed that the average age of sample farmers was 57.49 years. The share of literate heads of the sample farms using treated wastewater was 85.33 per cent. This indicated that the farmers in the area are largely educated. The average farming experience of the respondents of the sample farms using treated wastewater was 41.49 years. Family size was 3.88 with 1.56 adult male, 1.28 adult female and 1.04 children. The average size of land holding of sample farms using treated wastewater was 1.84 ha. In sample farms using treated wastewater income from crop was Rs.2,11,363 (71.99 per cent) followed by livestock income at Rs.55,302 (18.84 per cent). The non – farm income was Rs.16,000 (5.45 per cent) and income from off – farm activities was Rs.10,920 (3.72 per cent). Thus, the on-farm activities accounted for the major share (90.83 per cent) of all sources of income.

Table 1: Socio–Economic Status of Sample Farmers Using Treated Wastewater

S. No	Particulars	N = 120	Percentage
1	Age in years	57.49	
2	Education		
i.	Illiterate	17	14.17
ii.	Literate	103	85.33
3	Farming experience in years	41.49	
4	Family size in numbers	3.88	
i.	Males	1.56	
ii.	Females	1.28	
iii.	Children	1.04	
5	Farm size in ha	1.84	
6	Source of income in rupees		
i.	Crop income	211363.00	71.99
ii.	Livestock income	55302.51	18.84
iii.	Off-farm income	10920.00	3.72
iv.	Non-farm income	16000.00	5.45
v	Gross income	293585.51	100.00

E. Management Index

The management index used in the present investigation was derived by regressing crop yield in nuts (Y) on; years of experience (EXP), educational level (EDU), occupational status (OCC) and land holding in hectare (LH). Linear, quadratic, and log-linear functions were tested, and, in all regions the linear model provided the best fit. The estimated coefficients for the index of management are given in Table 2.The result of analysis showed that the regression coefficients of all the independent variables happened to be highly significant at one per cent level with the exception of land area which was significant at 10 per cent level. The coefficient of multiple determination was 0.47, indicating 47 per cent variation in the yield of cumbu napier grass was explained by the factors included in the model. The mean value of management index reflecting efficiency was computed to be 1.03.

Table 2: Estimates of the Linear Production Function in Index of Management of Cumbu Napier Grass Farm

S. No	Particulars	Coefficient	t test
1	Intercept	11781.15***	17.14
2	Farming experience in years	81.90***	5.50
3	Education dummy	1040.60***	3.04
4	occupation dummy	2452.04***	4.04
5	Land holding per hectare	-113.95*	-1.73
6	R^2	0.47	
7	Management index	1.03	

F. Cost and Returns

Cost of Establishment of Cumbu Napier Grass Orchard]

The pre-bearing costs incurred in the establishment of Cumbu Napier Grass crop up to bearing stage (1 year) formed the establishment cost. The establishment cost included that of use at initial establishment years of; planting material, human labour and machine power. The costs of establishment of Cumbu Napier grass worked out are presented in Table 3.

Table 3: Cost of Establishment of Cumbu Napier Grass Farm per ha

S. No	Particulars	Value (Rs./Ha.)	Percentage
1	Planting material	9375.00	57.96
2	Human labour	2800.00	17.31
3	Machine power	4000.00	24.73
	Total Establishment Cost	**16175.00**	**100.00**
	Amortization Cost	**1438.96**	

The results revealed that per hectare cost of establishing Cumbu Napier grass worked out to Rs. 16175.00. Out of this investment, maximum cost incurred was on planting material at 57.96 per cent (Rs.9375) followed by human labour (24.73 per cent) and machine power (17.31 per cent).

Operation and Maintenance Cost of Cumbu Napier Grass

The operation and maintenance costs were worked out and the results presented in Table 4.

Table 4: Operation and Maintenance Cost per ha of Cumbu Napier Grass during 2015 - 2016

S. No	Particulars	Value (Rs./Ha.)	Percentage
1	Human labour	15050.00	67.93
2	Manure	5910.00	26.68
3	Fertilizer	994.17	4.49
4	Miscellaneous charges	200.00	0.90
	Total Operational Cost	22154.17	100.00

The results revealed that the per hectare total cost of operation and maintenance of cumbu napier grass during 2015-2016 worked out to Rs. 22154.17. Out of this total cost, maximum cost was incurred on labour 67.93 per cent (Rs. 15050.00) followed by manure (26.68 per cent), fertilizer (4.49 per cent) and miscellaneous charges (0.90 per cent).

Cost of Production of Cumbu Napier Grass

The total cost of production of cumbu napier grass was worked out and results presented in Table 5. The results also revealed that the total cost of cultivation per hectare worked out to Rs.40856.39 from cumbu napier grass farm. The gross return per hectare realized was Rs.118800 from cumbu napier grass farm. The net return per hectare of cumbu napier grass was Rs.77943.61.

Table 5: Cost of production of Cumbu Napier Grass during 2015-2016

S. No	Particulars	Value (Rs./Ha.)	Percentage
I	**Fixed cost**		
1	Amortised establishment cost	1438.96	
2	Interest on fixed capital	738.28	
3	Rental value of land	14820.00	
	Total fixed cost	16997.24	
II	**Variable cost**		
1	Operation and maintenance cost	22154.17	
2	Interest on working capital	1606.18	
	Land revenue	98.80	
	Total variable cost	23859.15	
III	**Total cost of cultivation**	**40856.39**	
	Yield (tonne.)	237.60	
	Price per unit (Rs.)	500.00	
IV	**Gross income**	**118800.00**	
V	**Net income (IV-III)**	**77943.61**	

CONCLUSION

The major finding of economic analysis revealed the higher share of literate heads of the sample farms using treated wastewater at 85.33 per cent. The mean value of management index of efficiency was 1.03. The gross income of the respondents of the sample farms using treated wastewater was higher at Rs. 118800 as a result of better yield (237.60 tonne). The net income per hectare of cumbu napier grass was and Rs. 77943.61. The study, therefore could establish that using industrial waste water for irrigation will be advantageous in terms of net returns and to an extent substitute use of fresh water for irrigation, besides helping to save on use of and expenditure on fertilizers. The study, thus, proved the hypothesis that the use of treated industrial wastewater for irrigation is financially viable.

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