Socio-Economic Factors Affecting the Technology Adoption Level of Sugarcane in Rainfed Sector in Sevenagala

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ABSTRCT

The objectives of this study are (i) to develop the Recommended Technology Adoption Index (RTAI), and (ii) to determine the relationship between socio-economic characteristics of the farmers which affect the technology adoption level of Sugarcane *(Saccharum officinarum)*. The average technology adoption index of study area was 0.72 with minimum 0.46 and maximum of 0.89 and the correlation between index and yield was 62.26%. Multiple Linear Regression technique was used to determine the relationship between RTAI and socio-economic characteristics. The statistical outcome shows that monthly income, education, being a member of social association and farmers' visit of extension office, have a significant impact on recommended technology adaptation. Increment of access for loans and strengthening the extension service is suggested to enhance the technology adoption level of sugarcane cultivation.

Key words : Adoption level, Recommended technologies, Sugarcane

INTRODUCTION

Sugarcane (Saccharum officinarum) is one of the oldest commercial crops viable in the tropics and sub tropics of the world. It was originated in South Asia and Southeast Asia. It belongs to the family Gramineae in common with other perennial grasses. Sugarcane is a ratoonable crop which can raise 5-6 ratoons before next cultivation. Number of ratoons can vary with different climatic conditions and agronomic practices. Sugarcane is mainly cultivated for sugar production in the world.

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The world sugar production is 95 million tonnes per annum. Brazil, India, China, United States, Thailand and Australia are the major sugar producing countries in the world. The development of sugar as an organized industry in the country was started during the middle of the 19th century. There were four sugar factories in Sri Lanka located in Higurana, Kanthale, Pelwatte and Sevenagala. But Kanthale and Higurana factories were ceased their operations due to the unsuccessful privatization and poor management. But today sugarcane is becoming an important cash crop for farmers because there is a great potential for sugar production and byproducts of sugarcane in domestic market. Sugarcane is cultivated in intermediate zone and dry zone of Sri Lanka. But it is grown more in dry zone especially in the districts of Ampara and Moneragala. Total land extent of sugarcane in Sri Lanka is around 18,500 ha. At present domestic sugar production is 56,000 tonnes per annum which was sufficient to meet only 9% of the local sugar requirement (Anon, 2007).

Sugar is an important sub sector in the economy of Sri Lanka, making a significant contribution to the national balance of the payment. In 2007 expenditure of sugar imports was 25 billion rupees (Anon, 2007). In addition, over 2 billion rupees are spent annually on importation of spirit which can be produced from byproduct of sugar manufacture. At present nearly 20,000 farm families are directly involved with sugarcane production. Further more, sugar production provides indirect employment opportunities in the supply of necessary services for sugarcane farmers and sugar processing (Perera, 2002). Therefore expansion of sugarcane industry in Sri Lanka would greatly benefit the economy

by foreign exchange saving, generation of employment and income, development of rural area and the standards of living of rural people. But sugarcane farmers are shifting to other cultivations due to less profitability and productivity. The national average yield is 55 t/ha. But the potential yield is more than two times of that. Poor adoption of recommended technologies is one of the main reasons for less productivity. The objective of this study is to find out the factors affecting the technologies adoption level in sugarcane cultivation in Sevenagala. Further It would reveal the relationship between technology adoption level and sugarcane production.

METHODOLOGY

Sampling procedure and data collection

This study was conducted in rainfed sector in Sevenagala sugar industry. The farmer survey was conducted with 50 farmers which cover a population of approximately 1000 farmers in 3 divisions as D1, D2 and D3. Names were drawn from the list of registered cane farmers of Sevenagala industry who are presently in 3rd ratoon crop. The sample was selected randomly after stratification on the each division.

Primary data were collected using two types of pretested structured questionnaire. One is for extension officers and the other is for farmers. The questionnaire schedule for farmers was prepared using the available literature. It consisted of questions with three main areas as general information, extension activities, and adoption of recommended technologies.

Twenty two technologies recommended by the Sugarcane Research Institute of Sri Lanka were identified (Darmawardene,1999). The selected technologies were grouped under six main components namely, planting materials and treatments, land preparation, planting and aftercare operations, plant protection, harvesting and ratoon management. Recommended technologies were weighted using the scores obtained from 10 Extension officers.

Development of the Recommended Technologies Adoption Level Index (RTAI)

The questionnaire prepared for extension officers was circulated among the ten extension officers and they were requested to indicate scores for each technology to develop the scale. Scores for twenty two technologies were given by extension officers according to the contribution for increment of yield (Chandrashekara and Krishna, 1998). The final roundup scores were obtained for each recommended technologies, after getting the average of 10 values. The five point likert scale was used in this study to measure the level of adoptability. Farmers were requested to state their position to each statement on the five rating points namely *strongly adopt*, *adopt*, *poorly adopt*, *very poorly adopt*, and *not adopt*. *Strongly adopt* was given the scale of 5 and *not adopt* was given 1. Values of likert scale were normalized and values were converted between zero to one. Then RTAI was developed by using allocated scores for respective farmers as follows proposed by Gunawardana et al, 2008.

$$RTAI_i = \sum_{j=1}^{m} \frac{w_j}{100} \times L_{ij} \qquad (1)$$

$RTAI_i$ = Recommended Technology Adoption Index of i^{th} farmer

W_j = Weight given for the j^{th} technology

L_{ij} = Value of j^{th} technology of the likert's scale given by the i^{th} farmer

M = Number of Recommended technology

I = 1,2,…,N; N = Number of sugarcane famers

J = 1,2,…,m

M = Number of recommend technologies

Calculated index value lies in from 0 to 1. This RTAl value was used to measure

the adoption level of each sugarcane grower in Sevenagala area. Average adoption levels of each technology were found through Mean Adopted Scores (MAS).

Method of Analysis and Statistical Model Used

The reliability co-efficient between developed RTAI vs. Yield was tested through the Pearson correlation. Scatter diagram with trend line was created by using the values of RTAl of all the respondents in Sevenagala area to identify the relationship between RTAI value and yield.

Finally a model was developed as follows.

$$RTAI = \beta_0 + \beta_1(AGR) + \beta_2(MOI) + \beta_3(EDL) + \beta_4(FLI) + \beta_5(FEX) + \beta_6(FOV) + \beta_7(FGM) + \beta_8(SPA1) + \beta_9(EFV) + \beta_{10}(LLO) \quad (2)$$

Where,

β_0 to β_{10}	=Partial Regression Coefficients
AGR	=Age of the respondent
MOI	=Monthly Income
EDL	=Education
FLI	=Family Labour Involvement
FEX	=Farmer Experience
FOV	=Farmer Visits to extension office
FGM	=Farmer Group Meetings
SPA	=Social Participation (being a member of social association)
EFV	=Extension officers field visits
LLO1	=Information obtained through the leaflets

RESULTS AND DISCUSSION

Allocation of scores for the selected technologies

Table 1 presents the scores given by the ten extension officers and *Strongly adoption* percentage of each technology by farmers. The final roundup scores were obtained, after getting the average of ten values. Land preparation, Planting recommended clones, Fertilizer application and Weed management were obtained higher scores. These four recommendations play the major role for increasing the yield of sugarcane. Other than that filling of gaps, trash aligning, and disease management also obtained higher scores which is greater than five. These were also important technologies according to the extension officer's knowledge and experience. Therefore out of twenty two technologies, these seven technologies strongly contributed to increase the yield of sugarcane. Nematode management, usage of sterilized equipments and off bearing were obtained lower scores.

Considering the percentages of adoption (Table 1), planting recommended clones and land preparation were 100% correctly adopted by sugarcane farmers. Because those recommended clones were provided by sugar industry in Sevenagala. Co 775, SL 8306, SL 7130, and SL 88-116 were popular clones cultivated in Sevenagala area. Land preparation was also done by the industry using four wheel tractors.

Fertilizer application and weed management were necessary agronomic practices which highly influence the rapid growth of sugarcane plants. These two practices also 100% adopted by farmers. Time of application, quantity of application and frequency of application were important information which farmers should follow, when they apply fertilizer or weedicide. But fertilizer application was well adopted by only 24% of farmers and weed management was well adopted by 14% of farmers due to the poor knowledge and high cost of fertilizer and weedicides. Sugarcane lands were highly dominated by several types of weeds. Therefore they compete with sugarcane plants as well as act as a host plant for pests and diseases. Gap filling, disease management and trash aligning were also important practices. Disease management was well adopted by 30% of farmers. Several diseases spread in sugarcane lands due to wind, vectors and water logging conditions, namely grassy shoot disease, white leaf disease and black brown disease.

Farmers used to uproot the infected plants and throw them to the boundaries. It may cause spread the disease to other lands.

Trash aligning was well adopted by the 74% of farmers. That is important for sprouting of stubbles. Filling of gaps were adopted by 64% of farmers. That is also important to maintain a homogenous plantation. Off bearing, nematode management and fungicide treatment for sets were not adopted by any farmers in Sevenagala.

Mean adopted scores can be used to assess the adoptability levels of farmers for each technology (Figure 1).

Technologies which obtained mean adopted scores of 0.75 or over 0.75 were highly adopted by farmers namely planting recommended clones, usage of healthy planting materials, land preparation, recommended way of planting, mulching, harvesting at right time, harvesting with out fire setting, harvesting stalks at ground level, trash aligning, and stubble shaving. Other technologies were obtained scores lower than 0.75.

Figure 2 presents the scatter diagram of yield vs. Recommended Technology Adoption Index (RTAI) which was developed by the study using Equation 1. There was a positive correlation between RTAI and yield with R^2 value of 0.6226. According to the trend line fitted to the scatter diagram, 62% of variation of yield was explained by the RTAI. The value of Pearson correlation for the yield and RTAI was 0.781. Further, it reveals that there was a strong linear relationship between yield and RTAI.

Table 2 shows the results of regression model. The adjusted R^2 was 65%, which indicates the 65% of variability of the technology adoption level was explained by the chosen independent variables. That means independent variables have higher explanatory power. Regression coefficient was used to measure the relative contribution of each variable to the technology adoption level.

Table1: Average scores given by the extension officers and *Well adopted* (likert scale point 5) percentage

Technology	Score (out of 100)	Strongly Adopt (%)
1. Planting Recommended Clones (PRC)	12	100
2. Land Preparation (LP)	12	100
3. Fertilizer Application (FA)	10	24
4. Weed Management (WM)	10	14
5. Gap Filling (GF)	7	30
6. Disease Management (DM)	6	30
7. Trash Aligning (TA)	6	74
8. Use of Healthy Planting Materials (HPM)	4	32
9. Stubble Shaving (SS)	4	64
10. Earthing Up (EU)	3	4
11. Mulching (MUL)	3	100
12. Pest Management (PM)	3	10
13. Recommended Way of Planting (RWP)	3	76
14. Harvesting without Fire Setting (HFS)	3	100
15. Harvesting stalk at Ground Level (HGL)	3	72
16. Transport Stalks within 48 hrs (TSF)	3	40
17. Recommended Seed Rate (RSR)	2	12
18. Harvesting at Right Time (HR)	2	80
19. Fungicide Treatment for Setts (FTS)	1	0
20. Nematode Management (NM)	1	0
21. Usage of Sterilize Equipments (USE)	1	4
22. Off Barring (OB)	1	0

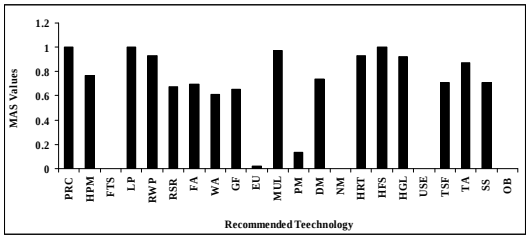

Figure 1: Average mean adopted score and recommended technology

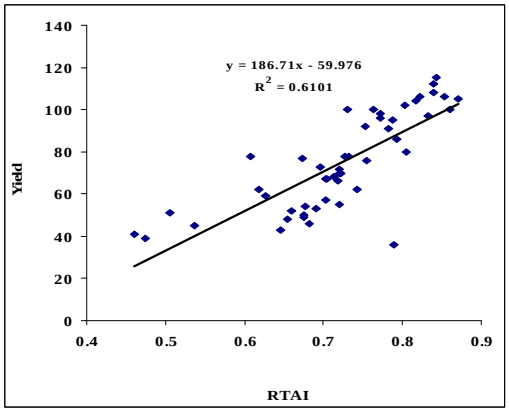

Figure 2: Yield vs. RTAI

According to the results given in the Table 2, four independent variables significantly affected the technology adoption namely monthly income, education, farmer office visits and social participation. Coefficient for farmer's monthly income was positive. It indicated that, farmer's monthly income significantly contributed for increment of technology adoption. If monthly income of farmer is higher, they have positive tend to practice recommended technologies. It is evident that adoption level can be increased by giving incentives to the farmers. Education is another significant variable and It has positive impact on technology adoption.

Table 2: Results of the multiple linear regression

	Coeff.	Std. dev.	Prob.
Constant	.48105	.0619	.000
AGR	.00084	.0013	.543
MOI	.000009	.000002	.001**
FEX	-.002	.0022	.372
FLI	.0088	.009	.334
EDU1	.094	.0308	.004**
EDU2	.064	.0311	.046**
FOV1	.0638	.0185	.001**
FGM1	.0157	.02193	.476
SPA1	.0347	.0188	.073*
EFV1	.0166	.02	.412
NLO1	.028	.0187	.139

**Significance at 5% *Significance at 10%
R^2 (adj) = 65.8%

Social participation also positively affected the technology adoption level. It reveals that, the farmers being a member of an association helps to increase the technology adoption level through sharing knowledge and information. Visits of farmers to the extension office also significantly affected the adoption level of recommended technology. The results revealed that informal education of farmers were improved by extension services like farmer field visits and social participation.

CONCLUSIONS

The results of the study revealed that average technology adoption level of farmers in Sevenagala area is 0.72. Average technology adoption was relatively higher in Sevenagala area due to effective extension services and providing incentives to the farmers by Sevenagala sugar industry. Present average yield of the study area is 71.5 t/ha. But potential yield of the area is over 100 t/ha according to the information gathered from literature survey. But most farmers were unable to obtain the potential yield of sugarcane due to the poor knowledge about technology adoption. Therefore more extension communications are required to improve the knowledge of farmers. Further, survey discovered that serious problems faced by the farmers are weeds and diseases management due to the malpractice of the recommended technology of controlling the weeds and diseases. Monthly income, farmers' visits to extension office and social participation significantly affected the technology adoption levels. Therefore increment of access for loans to obtain input and strengthening the extension services is suggested to enhance the technology adoption level of sugarcane cultivation.

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REFERENCES

Anon, (2007). Annual report of central bank, Colombo.

Chandrashekara, P., and Krishna, K.S., (1998) A Scale to Measure the Adoption Level of Recommended Scientific Practices by coffee growers in India. *Tropical Agricultural Research* (10), 157-168.

Darmawardene, N., (1999). Ratoons Management in Sugarcane. *Sugarcane Research Institute*. Uda Walawe, Sri Lanka.

Gunawardana, G.C.B.,Karunaratne, S.B., Gajanayake, K.C.M.C.P.B., and Gunathilaka R.P.D. (2008). Assessing the Adotation Level of Recommended Technologies by Cashew Growers in Puttalum District in Sri Lanka. Proceeding of Agriculture Research Symposium, Wayamba University of Sri Lanka. 334-338.

Mettananda, C., (1990). Sugarcane growing in Sri Lanka. *Sugarcane Research Institute*. Uda Walawe. Sri Lanka.

Perera, M.S., (2002). Farmer Knowledge and Adoption of sugarcane Farming Practices in relation to Farmer Level – Extension, Communication, in Sri Lanka. M.Phil thesis, University of Peradeniya, Sri Lanka.