

Factors Affecting the Technology Adoption Level of Sugarcane Cultivation in Rainfed Sector in Sevenagala

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ABSTRACT

Sugarcane (*Saccharum spp*) is an important commercial crop cultivation in Sri Lanka over an area of 18,500 hectares. At present domestic sugar production is 56,000 tones per annum, which was sufficient to meet only 9% of the local requirement. The national average yield is 55 tones per hecter. The potential yield is more than two times of that. Non adoption of the technologies was considered as the major reason for this yield gap. Thus this study was conducted in Sevenagala area to find out the factors which affect the technology adoption level by using a multiple linear regression analysis. Empirical model was developed to see the relationship between the Recommended Technology Adoption Index (RTAI) and ten independent variables namely age, monthly income, education, experience, family labour involvement, farmers visit of extension office, social participation, farmer group meetings, extension officers field visits, information obtained through the leaflets. Technology adoption levels of each farmer were measured by using the developed index (RTAI). The results revealed that the adoption of recommended technologies was significantly influenced by the monthly income, education, social participation and farmers visit of extension office. More over there was a significant positive correlation between yield and RTAI. Average technology adoption and average yield of sugarcane in Sevanagala were .7213 and 71.5 tons per hecter. Increment of access for loans and strengthening the extension service are suggested to enhance the technology adoption level of sugarcane cultivation.

KEYWORDS: Adoption level, Recommended technologies, Sugarcane.

INTRODUCTION

Sugarcane (*Saccharum.spp*) is a one of oldest commercial crop viable in the tropics and sub tropics of the world. Sugarcane was originated from South Asia and Southeast Asia. It is belongs to the family *Gramineae* in common with other perennial grasses. Sugarcane is a ratoon crop which can be raised 5-6 ratoons before next cultivation. Number of ratoons can be vary with different climatic conditions and agronomic practices. 1st harvesting can be done within 12-14 months (Mettananda, 1990). Sugarcane was mainly cultivated for sugar production in world. The world sugar production is 95 million tones 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 known as 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, Moneragala. Total land extend of sugarcane in Sri Lanka is around 18,500 ha. At present domestic sugar production is 56,000 tones per annum which was sufficient to meet only 9% of the local sugar requirement (Anon, 2007). The major byproducts of sugarcane are alcohol, vinegar, fertilizer, animal feed, fiber boards and acid.

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 additions, over 2 billion rupees are spent annually on importation of spirit which can be produce 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 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 and development of rural area and the

standards of living of rural people. But sugarcane farmers are shifting to other cultivations due to the less profitability and productivity. The national average yield is 55 tones per hector. But the potential yield is more than two times of that. Poor adoption of recommended technologies is main reason 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 reveals 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 from April to May in 2009. The farmer survey was conducted with 50 farmers which cover a population of approximately 1000 farmers in 3 divisions as D1, D2, 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 a pretested structured questionnaire. The questionnaire schedule for farmers was prepared using the available literature. It consisted questions with three main areas as general information, extension activities, and adoption of recommended technologies.

Twenty two technologies recommended by 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.

Development of the Recommended Technologies Adoption Level Index (RTAI)

The prepared questionnaire 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 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 request to state their reaction to each statement on the five rating points namely strongly adopt, adopt, poor adopt, very poor adopt, and not

adopt. Strongly adopt was given the numeric value of 5 and not adopt was given the 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.

$$RTAI = \sum \frac{w_i}{100} \times L_{ij}$$

RTAI = Recommended Technology Adoption Index

w_i = Weightage of i^{th} technology

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

N = Number of Recommended technology

i = 1,2,3,...,N

j = 1,2,3,...,50

Calculated index value lies in between 0 to 1. This RTAI value was used to measure the adoption level of each sugarcane growers 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 RTAI of all the respondents in Sevenagala area to identify the relationship between RTAI value and yield.

Finally a model was developed by using four continuous variables and six categorical variables. RTAI was the depend variable in model. Indicator variables were made for categorical variables to conduct the analysis. A multiple linear regression analysis was conducted to find out the factors which associate with RTAI value using a statistical package Minitab (Version 15).

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

Where,

β_1 to β_{10} = Partial Regression Coefficients

AGR = Age of the Respondent

MOI = Monthly Income

EDL = Education Level

FLI = Family Labour Involvement

FEX = Farmer Experience

FVE = Farmer Visits of Extension Office

FGM = Farmer Group Meetings

SPA = Social Participation

EFV = Extension officers field visits

LLO = Information were obtained through the leaflets

ϵ_i = Error Term

RESULTS AND DISCUSSION

Allocation of Scores for the Selected Technologies

Table 1 presents the scores given by the ten extension officers. The final 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 gapes, 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 specially contributed to increase the yield of sugarcane. Nematode management, usage of sterilizes equipments and off barring were obtained lower scores.

Table 1. Technologies and their scores

| Technology | Scores |
|---|--------|
| 1.1 Planting Recommended Clones (PRC) | 12 |
| 1.2 Use of Healthy Planting Materials (HPM) | 4 |
| 1.3 Fungicide Treatment for Setts (FTS) | 2 |
| 2.1 Land Preparation (LP) | 12 |
| 2.2 Recommended Way of Planting (RWP) | 3 |
| 2.3 Recommended Seed Rate (RSR) | 2 |
| 2.4 Fertilizer Application (FA) | 10 |
| 2.5 Weed Management (WM) | 10 |
| 2.6 Gap Filling (GF) | 7 |
| 2.7 Earthing Up (EU) | 3 |
| 2.8 Mulching (MUL) | 3 |
| 3.1 Pest Management (PM) | 3 |
| 3.2 Disease Management (DM) | 6 |
| 3.3 Nematode Management (NM) | 1 |
| 4.1 Harvesting at Right Time (HR) | 2 |
| 4.2 Harvesting without Fire Setting (HFS) | 3 |
| 4.1 Harvesting stalk at Ground Level (HGL) | 3 |
| 4.4 Usage of Sterilize Equipments (USE) | 1 |
| 4.5 Transport Stalks within 48 hrs (TSF) | 3 |
| 5.1 Trash Aligning (TA) | 6 |
| 5.2 Stubble Shaving (SS) | 4 |
| 5.3 Off Barring (OB) | 1 |

Table 2. Technologies and their adoption percentage

| Technology | Well adopted Percentage |
|---|-------------------------|
| 1.1 Planting recommended clones | 100 |
| 1.2 Usage of healthy planting materials | 32 |
| 1.3 Fungicide treatment for setts | 0 |
| 2.1 Land Preparation | 100 |
| 2.2 Recommended way of planting | 76 |
| 2.3 Recommended seed rate | 12 |
| 2.4 Fertilizer application | 24 |
| 2.5 Weed management | 14 |
| 2.6 Gap filling | 30 |
| 2.7 Earthing up | 4 |
| 2.8 Mulching | 100 |
| 3.1 Pest management | 10 |
| 3.2 Disease management | 30 |
| 3.3 Nematode management | 0 |
| 4.1 Harvesting at right time | 80 |
| 4.2 Harvesting without fire setting | 100 |
| 4.3 Harvesting stalks at ground level | 72 |
| 4.4 Usage of sterilize equipments | 4 |
| 4.5 Transport stalks within 48 hours | 40 |
| 5.1 Trash aligning | 74 |
| 5.2 Stubble shaving | 64 |
| 5.3 Off Barring | 0 |

Table 2 shows percentages of technology adoption by the farmers. Considering the percentages of adoption, planting recommended clones and land preparation were 100% 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 which 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 very 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 increasing cost of production. Sugarcane lands were highly dominated by several types of weeds.

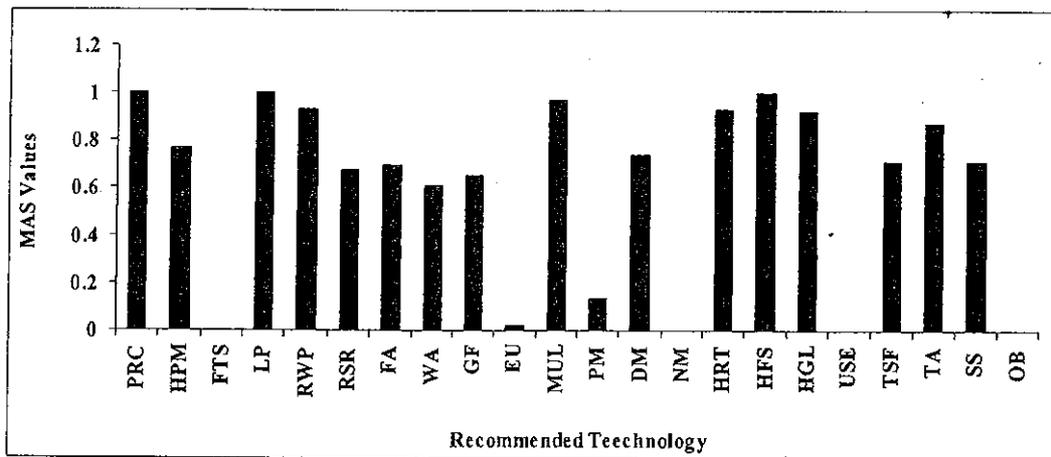


Figure 1. Average Mean Adopted Score and Recommended Technology

They highly compete with sugarcane plants as well as act as a host plant for pest and disease. Gap filling, disease management and trash aligning were also very important practices. Disease management was well adopted by the 30% of farmers. Several diseases were spreaded 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 it to the boundaries. It may cause to 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 baring, nematode management and fungicide treatment for setts 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.

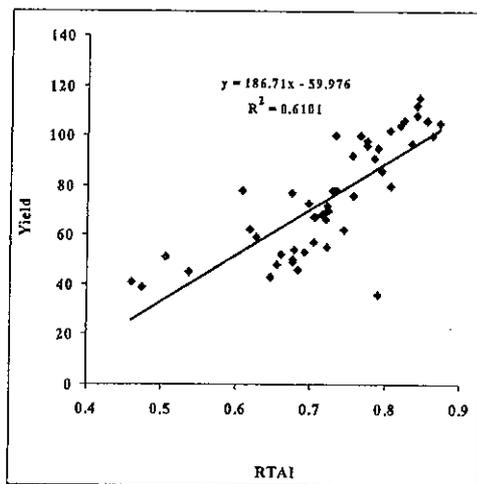


Figure 2. Yield vs. RTAI

Table 3. Results of multiple linear regression

| Predictor | Regression Coefficients | Std. Deviation | Probability value |
|-----------|-------------------------|----------------|-------------------|
| Constant | .48105 | .0619 | .000 |
| AGR | .00084 | .0013 | .543 |
| MOI | .000009 | .00000 | .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% P value = .000

Table 3 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. According to the results, four independent variables significantly affected to the technology adoption namely monthly income, education, farmers visit of extension office, social participation (Table 3.). Coefficient for farmer's monthly income was positive. That means farmers monthly income significantly contributed for increment of technology adoption. If monthly income of farmer is higher, they tend to practice recommended technologies more. It is evident that adoption level can be increased by giving incentives to the farmers. Education was another significant variable. That means, If farmer had a higher education, they tend to improve the productivity of land through the increment of technology adoption.

Social participation also significantly affected to the technology adoption level. That means, If farmer was a member of association which related to the sugarcane cultivation. The value of RTAI was increased than the farmer who was non member of organization. It reveals that social participation helps to increase the technology adoption level of farmers. Farmer visits of extension office also significantly affected to the RTAI value. If farmer visited to the extension office frequently to obtain the extension services, the RTAI value was increased than the farmer who didn't visit to the office frequently. The results revealed that informal education of farmers were improved by extension services like farmer visits of extension office and social participation.

Figure 2 presents the scatter diagram of yield vs. RTAI. There was a positive slope 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 .781 That reveals, there was a strong relationship between yield and RTAI.

CONCLUSIONS

The result of the study reveals that average technology adoption level of farmers in Sevenagala area is .7213. Average technology adoption was relatively higher in Sevenagala area due to the effective extension

services and providing incentives to the farmers by Sevenagala sugar industry. Present average yield of the study area is 71.5 tons per hectore. But farmers can be obtained over hundred metric tones per hectore according to the information gathered from literature survey. But most of farmers were unable to come to the potential yield of sugarcane due to the poor knowledge about technology adoption. Therefore more extension communications were required to improve the knowledge of farmers. Further survey was discovered that serious problem failed by the farmer in cultivation is weed and disease management due to the mal practice of the recommended technology to control the weed and disease. Monthly income, farmers visit to extension office and social participation significantly affected to the technology adoption levels. Therefore increment of access for loans and strengthening the extension services was suggested to enhance the technology adoption level of sugarcane cultivation.

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