

**SUGAR INDUSTRY****Technical Knowledge and Adoption of Farming Practices to Farmer Level Extension Communication of Outgrower Farmers of Sri Lankan Sugar Industry****M.S. Perera¹, C. Sivayoganathan² and M. Wijeratne³**¹Economics and Extension Division, Sugarcane Research Institute, Uda Walawe, Sri Lanka²Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka³Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka

Low adoption of recommended farming practices has partly been responsible for low cane and sugar yield obtained by sugarcane farmers. The objective of this study was to investigate the role of extension communication at farmer level in relation to knowledge and adoption of farming practices by the outgrower farmers of Sri Lankan sugar industry. Primary data were collected from a stratified random sample of 60 farmers consisting of equal number of non-contract and contract farmers from Pelwatte Sugar Industry (PSI) area. Contract farmers were solely dependent on their Agricultural Assistants/Field Assistants (AA/FA) for the information and services whereas non-contract farmers used other sources also. More attention had been given to marketing and input coordination activities and less attention to farmer education in the main methods of extension communication practised namely AA/FA's field visits and farmer's office visits. The majority of contract farmers attributed high credibility to the AA/FAs as well as higher rating for AA/FA's role and for input services. The highest proportion of contract farmers had medium technical knowledge and adoption levels. But, knowledge and adoption of the majority of non-contract farmers were low and the median adoption and knowledge level of the non-contract group was also significantly lower than that of the contract group. The extension communication activities were significantly related to farmer's knowledge and adoption. Farmers' technical knowledge and adoption were also interrelated. However, in the non-contract situation where extension service were poor, a dominant role of personal factors in relation to knowledge and adoption was observed.

KEY WORDS : Knowledge, adoption, extension, communication, farmers, sugarcane

One of the main technical and management problems of Sri Lankan sugar industry is low cane and sugar yield obtained at present. These figures are well below their technical potential. The cane yield in Sri Lanka during the last 10 years averaged about 58 t/ha; but the potential of cane yield has been identified as 140 t/ha under irrigated condition and 70 t/ha under rainfed condition (Keerthipala, 1996). The sugar recovery rates in India (over 10 per cent) are much higher than in Sri Lanka (Central Bank, 1999). Low level of adoption of recommended farming practices by farmers has resulted in the above situation (Keerthipala, 1997; Central Bank, 1999). Also, according to CADMAR (Composite Approach for Decision Making in Agricultural Research) (1996), low adoption could be attributed to low level

of farmers' knowledge, inefficiency of input services and lack of coordination between farmers and extension staff. This situation is common for both types of farming situations in the sugar sector : settler farmers who were given lands by the industries along with more organized extension service and outgrower farmers who are cultivating their own lands independently with limited assistance or without any services from the industries. And, worse situation could be observed under different extension services provided for outgrower farmers compared to settler schemes. Under the present extension approach of the sugar industry, there are two types of outgrower farmers also according to the extension services provided to them. They are contract outgrowers and non-contract outgrowers. All services are provided by industry staff for contract outgrower farmers who are bound to sell their harvest to particular industry

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so that the industry could deduct from the same the cost incurred for the services with an interest. Hence, these farmers' decision making on adoption mainly depends on extension service which deals with farmer education, coordination of input services and information dissemination etc. However, non contract farmers were provided limited assistance by extension staff of the industries.

The primary aim of this study was to investigate the role of extension communication at farmer level on farmers' knowledge and adoption of farming practices in the outgrower systems of Sri Lankan sugar industry.

MATERIALS AND METHODS

Sample

This study was conducted in Pelwatte sugar industry areas. A farmer survey was conducted with a sample of 60 farmers from the area, 30 contract and 30 non-contract farmers. The sample was selected from the list of registered cane farmers of each industry randomly after stratification based on the localities/mode of operation.

Farmers included in the survey were mainly placed in two groups according to their mode of operation : contract and non-contract outgrowers in Pelwatte.

Data collection

Both primary and secondary data obtained through sample surveys and office records were used in this study. A structured interview schedule was used to gather of data from farmers. This was pre-tested before use and data were gathered by the researcher alone. The schedule consisted of questions dealing with four main areas : general information, farmers' knowledge, adoption of farming practices, and farmers' perception on extension activities.

Variables and their measurements

Age of a respondent was defined as the period of time from his birth to the time of the interview and was measured in years. Education was measured by the highest year of schooling completed by the male head of the family. Sugarcane farming experience was defined as the period of time from the respondent's first involvement in sugarcane cultivation to the time of his interview and was measured in years.

Adoption of practices refers to the utilisation and application of recommended practices during the last cropping year. Extent of adoption refers to the level to which a particular practice was adopted and measured by using the adoption scale. The scale was tested for the reliability using SPSS and Alpha = 0.70.

Farmer's technical knowledge refers to the farmer's knowledge of eight areas of recommended

farming practices and measured by responses to the questions asked in the knowledge test. The scale was tested for the reliability using SPSS and Alpha = 0.81.

Social participation was defined as the degree to which an individual participated voluntarily in different organizations in the community and whether he held executive positions. The extent of participation was measured by summing up involvement in community organizations as an executive member, committee member, ordinary member or none, with a weight of 4, 3, 2, 1 respectively.

The field visits of Agricultural Assistants/Field Assistants (AA/FA) were measured by asking respondents how often during the last cropping year, they had been contacted by AA/FA with respect to their agricultural activities. The frequency of contact was classified as frequently, occasionally, rarely and never. The weighting scores ranged from 4 for frequently to 1 for "never". Measuring the frequency of farmers' office visits also followed the above procedure.

Extension communication was measured by scores obtained by farmers for the use of the main four communication methods : frequency of AA/FA's field visits, frequency of farmer's office visits, number of group discussions attended during the last cropping year and the number of training classes attended during the last 3 years.

Credibility of the AA/FA refers to the farmer's perception of his relationship with FA/AA with respect to extension activities and trustworthiness of FA/AA. Credibility was measured by using Likert type attitude scale, which comprised of ten statements - five positive and five negative. The scale had a reliability value of Alpha = 0.70.

Farmer's perception of the role performed by AA/FA refers to farmers' perception on the usefulness of the role of AA/FA as a catalyst, solution giver, group promoter, and information seeker, educator and resource linker. Role perception was measured separately and altogether using three - point attitude scale. This was done by checking following categories : very useful, useful, and not useful. The weighting scores applied to the categories ranged from 3 to 1, with very useful receiving a score of 3 and not useful receiving a score of 1. The scale was tested for the reliability using SPSS and Alpha = 0.77.

Input services refer to farmers' perception on input services in relation to timely availability, adequacy and quality of each item of the input services separately and altogether, and were measured by using three-point attitude scale. This was done by checking following categories : always, sometimes, never. The weighting scores applied to

Table - 1. Correlation matrix of 12 selected variables (total sample)

Variable	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X11
X1 = Age	X														
X2 = Education	-.354**	X													
X3 = Farming experience	.163	-.074	X												
X4 = Social participation (score)	.038	.218	.109	X											
X5 = Farmers' office visits (frequency)	.109	.341**	.207	.255*	X										
X6 = AA/FA's visits (Frequency)	-.042	-.197	.227	.355**	.462**	X									
X7 = Perception of AA's role (Scores)	-.080	-.190	.373	-.071	.332**	.804**	X								
X8 = Input services (scores)	-.462*	.417*	-.018	.166	.466**	.354*	.447**	X							
X9 = Extension communication (score)	-.027	.325*	.254*	.419**	.663**	.924**	.763**	.544*	X						
X10 = Credibility of AA (scores)	.060	.110	.276*	.251	.312*	.668**	.714**	.406*	.656**	X					
X11 = Cane extent	.004	.128	.290*	-.060	.177	.236	.225	-.136	.241	.109	X				
X12 = Cane yield	-.285	.199	.179	-.029	-.042	.142	.269	-.011	.109	.238	.111	X			
X13 = Knowledge (score)	-.221	.426**	.403**	.352**	.496**	.616**	.668**	.433**	.701**	.611**	.421**	.491**	X		
X14 = Adoption (scores)	-.098	.372*	.373**	.303**	.468**	.596**	.637**	.410**	.656**	.541**	.525**	.460**	.869**	X	.552**

Significant at *p < 0.05 and **p < 0.01

the categories ranged from 3 to 1, with always receiving a score of 3 and never receiving a score of 1. The scale was tested for the reliability using SPSS and Alpha = 0.84.

Training received, referred to the number of training programmes relevant to sugarcane farming, attended by the respondent during the last five years.

Statistical Package for Social Sciences (SPSS) was used to analyze the data gathered by the farmer surveys. Spearman correlation analysis was used to establish the level of relationships between the variables. To identify the most significant independent variable and the degree of association between the dependant variable and the combined effect of all the appropriate independent variables, stepwise multiple regression analysis was employed. The mean differences of selected variables among farmer groups were tested using ANOVA, t-tests and Mann-Whitney test.

RESULTS AND DISCUSSION

Information dissemination to farmers

Contract outgrowers were solely dependent on their AA/FA for the information and services. The other information sources such as mass communication, other farmers etc. were negligible. The AA/FA's farm or home visits and the farmer's office visits were the main methods of information dissemination. Training programmes were not generally used to improve farmer knowledge.

But, non-contract farmers are slightly different to contract group regarding the sources of information; 40% of the non-contract farmers identified other farmers also as an information source instead of FA. Contract outgrowers (PSI) are more attached to the industries hence they are bound to follow certain procedures for maintaining their fields and to contribute to industry goals indirectly. As a result these farmers treat field assistant as the main source of information and the link between them and industry was like that of the commodity development and production approach. But, non-contract farmers used field assistant mainly for selling their cane to the industry. So, they deviated from the commodity development approach and hence they sought information from other sources as well.

Frequency and pattern of AA/FAs' field visits as well as farmers' office visits were different between the farmer groups and between the four quarters of a cropping season. The highest frequency of AA/FA's field visits and farmer's office visits was reported in the fourth quarter in both groups and was related to harvesting and marketing aspects. In the contract group both types of visits in the list quarter related to land preparation, planting, fertilizer application and weed management area were reported in lesser frequency compared to the fourth quarter. Visits during the other two quarters were negligible. However, the majority of non-contract outgrowers were not visited during 1st, 2nd and 3rd quarters.

Farmers' perception of extension communication

In the contract group, majority of farmers (more than 80%) perceived that AA/FA was very useful as a catalyst and resource linker while more than 70% perceived the role of AA/FA as a solution giver, educator and an information seeker useful. However, the majority (more than 70%) perceived that AA/FA was not useful as a group promoter. They also attributed high credibility to the AA/FAs as well as higher ratings for input service.

But non-contract farmers did not perceive the role of FA as useful.

Knowledge of farming practices

Mean knowledge scores of the farmer groups were less than 50% of the maximum obtainable scores and median knowledge was significantly higher in the contract group compared to non-contract group (Mann-Whitney test, $z = -4.976$, $p < .001$). The highest proportion of all the farmers had medium knowledge level in the contract group. Total knowledge of more than 80% of non-contract farmers was low.

Adoption of farming practices

For about 50% of contract farmers, the overall adoption level was medium while more than 70% of non-contract farmers were low in the overall adoption. The median adoption level of the non-contract farmers was also significantly lower than the contract farmers (Mann Whitney u test; $z = -4.676$, $p < .001$).

Table - 2 : Stepwise multiple regression: Sugarcane farming knowledge by selected independent variables (total sample)

Step	Variable entered	Multiple R	Coefficient of determination R ²	Per cent of variation
1	Farmer's perception of the FA's role	0.662	0.438	43.8
2	Cane extent	0.736	0.542	54.2
3	Formal education	0.773	0.597	59.7
4	Farming experience	0.804	0.647	64.7
5	Frequency of farmers' office visits	0.820	0.672	67.2

Table - 3 : Correlation Matrix of 13 selected variables (The contract outgrowers)

Variable	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1 = Age	X													
X2 = Education	-.457**	X												
X3 = Farming experience	.265	-.461**	X											
X4 = Cane extent	-.062	-.035	-.028	X										
X5 = Social participation (score)	-.104	.170	-.083	-.165	X									
X6 = Farmer's office visits (frequency)	-.241	.485**	-.093	-.090	.201	X								
X7 = AA/FA's visits (Frequency)	-.261	.227	-.030	.101	.318	.190	X							
X8 = Perception of AA's role (Scores)	-.330	.155	.049	-.008	.285	.062	.585**	X						
X9 = Input services (scores)	-.462*	.417*	-.018	-.136	.166	.466**	.354	.447*	X					
X10 = Extension communication (score)	-.434*	.414*	-.084	.040	.336	.548**	.830**	.525**	.544**	X				
X11 = Credibility of AA (scores)	-.222	-.013	.278	.088	.255	.053	.532**	.0486**	.406*	.502**	X			
X12 = Yield	-.238	-.144	.228	-.187	-.228	-.155	.161	.041	-.011	-.059	.200	X		
X13 = Knowledge (score)	-.483**	.268	.272	.273	-.059	.461*	.407*	.416*	.433*	.539**	.406*	.328	X	
X14 = Adoption (scores)	-.390*	.207	.208	.343	-.020	.287	.428*	.438*	.410*	.440*	.393*	.331	.746**	X

Significant at *p < 0.05 and **p < 0.01

Factors related to farmers' technical knowledge

Except farmer's age the other variables were positively and significantly related to the technical knowledge of farmers (Table 1).

Multiple regression analysis revealed that five independent variables were significant predictors of farmer's knowledge level. These were farmer's perception on FA's role, cane extent, formal education, farmer's office visits and sugarcane farming experience. The computed coefficient of multiple correlation (R) value of these five independent variables together and the dependent variable was 0.820 and R^2 was 0.672. In other words, 67.2% of the variation in the farmer's knowledge level could be accounted for by the combined effect of these five independent variables (Table 2).

As the factors affecting knowledge could vary under different localities as well as modes of operations, analysis was done to identify the most significant factors in each group. In the contract group, farmers' perception on the FA's role, credibility and cane extent, extension communication group meetings showed positive and significant relationship with the farmer's knowledge level (Table 3). Farmers' perception on the FA's role accounted for 35.1% of the variation in the farmer's knowledge level. Farmers' perception on the FA's role and cane extent significantly predicted farmer's knowledge level according to the multiple regression analysis ($R = 0.693$ and $R^2 = 0.480$) (Table 4).

In the non-contract group, formal education level was positively and highly significantly related to the knowledge level (Table 5) and it accounted for 27.6% of the variation in the knowledge level according to the multiple regression analysis ($R = 0.526$ and $R^2 = 0.276$) (Table 6). This suggested that education encouraged individual farmer to see and understand farming practices in a proper way even though minimum level extension communication network existed. The frequency of farmer's office visits also showed positive and significant relationship to the knowledge (Table 5). High frequency of farmer's office visits indicates individual farmer's enthusiasm in sugarcane farming under non-contract farming situation. This provided more opportunity to get information on sugarcane farming and had resulted in increasing knowledge of farmers even where minimum farmer education activities were provided compared to the other farmers.

Formal education and farmer's office visits together accounted for 41.3% of the variation in farmer's knowledge level (Table 6).

Social participation was also positively and highly significantly related to the knowledge level and further farmer's office visits as well (Table 5). This implies socially active farmers have high enthusiasm

in sugarcane farming and hence more opportunity to get information and enhance knowledge.

The relationship of social participation and formal education with the knowledge among farmers in this non-contract sector perhaps is the result of their closeness to traditional extension environment rather than to commodity development approach like in the contract groups.

Factors related to adoption

In the overall sample, technical knowledge level of farmers was positively and significantly related to the farmers' adoption level (Table 2). Similar results have been earlier reported (Kashem and Hussain, 1992; Wirasinghe, 1977; Mahaliyanaarchchi, 1996).

The variables related to farmer's exposure to extension communication activities viz., extension communication score, frequency of AAs' field visits and farmer's office visits, and farmer's perception scores on the role and credibility of AA/FA were also significantly related to the adoption level of farmers in the total sample. Niranjana *et al.* (1991), and Bandara and Sivayoganathan (1996) also reported that extension contacts were positively related to adoption.

Personal factors namely formal education, farming experience, cane extent and social participation were also positively and highly significantly related to adoption. Similar relationships between formal education and adoption had been earlier reported (Kashem and Hossain, 1992; Gabunda and Barker, 1993; Mbata, 1994; Sharma, 1997).

The multiple regression analysis revealed that only technical knowledge level was a significant predictor of farmer's adoption. The computed coefficient of multiple correlation (R) value of this independent variable and the dependent variable was 0.798 and R^2 was 0.638. Thus, 63.8% of the variation in the adoption was accounted for by the farmer's technical knowledge alone.

In the contract group, knowledge was positively and highly significantly related to the adoption level (Table 3). Extension communication and farmer's perception of input service, FA's role, and the credibility of FAs were also positively and significantly related to the adoption level (Table 3).

Table - 4 : Stepwise multiple regression: Sugarcane farming knowledge by selected independent variables (contract group)

Step	Variable entered	Multiple R	Coefficient of determination R^2	Per cent of variation
1	Perception of FA's role	0.592	0.351	35.1
2	Cane extent	0.693	0.480	48.0

Table - 5 : Correlation Matrix of 13 selected variables (The Non-contract outgrowers)

Variable	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1 = Age	X													
X2 = Education	-.346	X												
X3 = Farming experience	.156	.130	X											
X4 = Cane extent	.002	.158	.409*	X										
X5 = Social participation (score)	-.047	.159	.230	-.068	X									
X6 = Farmer's office visits (frequency)	.441*	.380*	.397*	.261	.311*	X								
X7 = AA/FA's visits (Frequency)	.401	-.211	.145	.111	.306	.625**	X							
X8 = Perception of AA's role (Scores)	-.126	-.159	.352	.112	.229	.236	.669**	X						
X9 = Input services (scores)	-	-	-	-	-	-	-	-	X					
X10 = Extension communication (score)	.175	-.017	.304	.170	.520**	.850**	.849**	.458*	-	X				
X11 = Credibility of AA (scores)	-.245	-.290	.077	-.139	.223	.205	.367	.431*	-	.228	X			
X12 = Yield	-.448	.386	-.065	.236	.088	-.201	-.296	.055	-	-.200	.082	X		
X13 = Knowledge (score)	-.264	.434*	.239	.276	.661**	.461*	.360	.350	-	.572**	.224	.417*	X	
X14 = Adoption (scores)	-.017	.355	.298	.602**	.490*	.459*	.292	.246	-	.479**	.141	.375	.779**	X

Significant at *p < 0.05 and **p < 0.01

This confirms the need for facilitative environment to be created by the industry along with communication contacts for the adoption even in the contract outgrower system even though they have freedom for taking individual decisions and have access to other extension services and input market. Farmer's age was negatively and significantly related to the adoption level (Table 3). Farm to home distance was also negatively and highly significantly related to the adoption level (Table 3).

In the non-contract group also, knowledge and the frequency of farmer's office visits were positively and highly significantly related to the adoption level (Table 5) and the latter variable accounted for 15.9% of the variation in the adoption ($R = 0.399$ and $R^2 = 0.159$). Two personal variables showed positive and highly significant relationships to the adoption level. They were cane extent and social participation (Table 5). Similar observation with regard to social participation had been made by Wilkening (1952) in the traditional farming situations.

Table - 6. Stepwise multiple regression; Sugarcane farming knowledge by selected independent variables (non-contract group)

Step	Variable entered	Multiple R	Coefficient of determination R^2	Per cent of variation
1	Formal education	0.526	0.276	27.6
2	Frequency of farmer's office visits	0.643	0.413	41.3

CONCLUSION

These results clearly show that extension communication activities are significantly related to farmer's knowledge and adoption among the outgrower farmers. Farmers' adoption and knowledge are also inter-related. Furthermore personal factors such as farm size, education level, farming experience, social participation also showed positive relationship to knowledge level and adoption. But, differences in the contribution of personal factors and communication to knowledge were observed under the different types of extension services provided.

In the contract set-up where farmers were provided with more organised service, farmers' adoption and knowledge were related to extension communication mainly and to only two personal factors. Cane extent and education positively and home distance negatively related to adoption. However, in the non-contract situation where extension service were poor, the situation was different and a dominant role of personal factors in relation to knowledge and adoption could be observed. The farmers who were socially active, and

having comparatively higher formal education, showed more contacts with AA/FA, as well as improved knowledge level compared to others. Further it showed that farmers cultivating larger extent of land and socially more active were in the higher adoption level. This finding confirms the claim of Hossain and Crouch (1992) who found that adoption of farming practices by those who were more active in formal organisations and had higher formal education was higher in the traditional farming set-up.

The main methods of extension communication namely AA/FA's field visits and farmer's office visits had given more weightage to marketing and input coordination activities and less attention to farmer education. As a result, the majority of farmers had medium level knowledge and adoption even in the contract setup and low level in the non-contract system. So, it is important to make use of AA/FA's contacts along with group methods and farmer's office visits efficiently to reduce the knowledge gap among farmers as well as to increase overall knowledge level that will help achieve higher adoption level under the present extension service. But, organized extension services to increase knowledge under facilitative environment will be needed to enhance adoption level of non-contract farmers.

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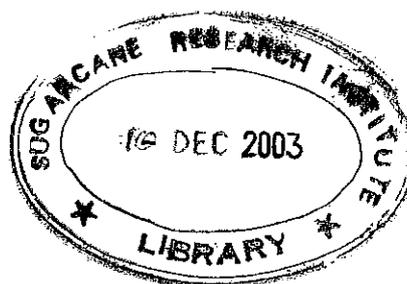
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