

# A SURVEY OF SMALL-SCALE SUGARCANE FARMERS IN SOUTH AFRICA AND MAURITIUS: INTRODUCING PROJECT METHODOLOGY, INVESTIGATING NEW TECHNOLOGY AND PRESENTING THE DATA

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## Abstract

This paper outlines the procedure followed, technology used and preliminary results derived from an extensive and comprehensive survey of small-scale sugarcane farmers conducted in Mauritius and South Africa. Mauritius and South Africa were concerned about the yield gap between small and large-scale farmers as well as their international non competitiveness within the diminishing preferential markets and rapidly increasing costs of production. A further concern was the apparent lack of adoption of improved technology and practices recommended by the research institutes. This paper reports on some of the preliminary findings of the survey carried out in South Africa. Methodology and appropriate innovative technology was identified to undertake such a complex task capturing data relating to social information, agronomic practices, skills and knowledge. Data was collected, captured and made available for further analysis. More than 900 farmers in South Africa (SA) and 800 in Mauritius (MU) were surveyed using the 'logitech smart pen' technology.

Gaps in knowledge and skills as well as possible areas for further research needs for small-scale farmers were identified. This project has produced extensive data on an important industry client group that will better inform decision-makers on points which were previously largely assumed. It has also firmly asserted the South African Sugarcane Research Institute (SASRI) and the Mauritian Sugar Industry Research Institute (MSIRI) as leaders in this largely unexplored and novel area of extension empathy.

This project was made possible through a European Union (EU) competitive grant fund to conduct agricultural research that would benefit the small-scale farmers of the Southern African Development Community (SADC) region.

*Keywords:* survey, small-scale, research, sugarcane, extension, technology

## Introduction

### *The small-scale sector*

The issue of low productivity on small-scale sugarcane farmers' lands is a major concern in many countries forming part of the SADC region and will become increasingly important in the context of world trade liberalisation and reduced sugar price in the world market. Approximately 35 000 small-scale sugarcane farmers are engaged in sugar production in South Africa. Sugarcane is an important crop generating an estimated 6.5 billion ZA Rands for the industry as a whole, of which more than R1.21 billion is directed into these often

impoverished communities and is a major source of income for rural families. The SA sugar industry offers almost 85 000 direct jobs and many more when subsidiary aligned businesses are considered.

Yield differences between the large-scale and small-scale farmers in South Africa often reach 50% or more. The causes for this gap are largely assumed and have never been confirmed scientifically.

A better understanding must be acquired of existing small-scale farming systems and the farmers for whom extension services need to be relevant and appropriate. The diagnosis of conditions and factors limiting adoption of improved technologies and in the development of decision support tools has long concerned those who have delivered farmer support services. Assisting farmers to increase yields through sustainable production systems, keeping costs of production at a competitive opportunity cost level and ensuring that farming activities have no adverse impact on the environment should be priorities in any developmental research initiatives. There is also a need to promote the development of regional Research Networks and Research Programme Partnerships to deal with problems common to many SADC countries, in the small-scale farmer sectors.

The investigation for this project was undertaken in Mauritius and South Africa, and this paper will report on how the methodology was developed and used in both countries. There will also be a brief report on preliminary South African results.

### **The process and requirements of grant funding**

It is firstly important to introduce the requirements of the grant funding followed by the basic objectives and investigations of this three year project.

In May 2002 an information day was hosted at the Sugar Association, Mount Edgecombe, at which representatives from South Africa, Mauritius, La Réunion, Zimbabwe, Mozambique and Swaziland, together with members of the French foreign ministry, explored the opportunity to answer a call for proposals on collaborative projects in small-scale sugarcane farmer development. The proposed funding of projects would be on a competitive grant system financed by the European Union Community (France) and administered through the Southern African Development Community (SADC).

It was agreed that there was a need in the SADC countries for collaborative research on this struggling and often impoverished agricultural sector. It was decided to form a South African led consortium to submit proposals on behalf of the SADC sugarcane producing countries according to proposed criteria and in line with the four thematic areas of common interest (Table 1). This table shows that the areas of common interest were mostly unanimously agreed. Mozambique was perceived as a fledgling sugar industry in comparison to others represented, and La Réunion was subsequently excluded as a beneficiary of EU funds as it is French territory and as such would not qualify for the European Union grant funding which was required to benefit SADC countries only.

The SADC secretariat in Gaborone, Botswana, received more than 104 concept proposals that met the fundor's requirements within diverse agricultural fields. This resulted in the preparation and submission of six sugarcane project proposals. The Competitive Grant Fund for Innovative and Regional Collaborative Projects in support of Small-scale Farmers

Development with the acronym of FIRCOP was launched, and a nine member steering committee appointed. The initial intention was for the successful project proposals to utilise an amount of 16 million Euros.

**Table 1. The four thematic areas identified by the SADC consortium members.**

Thematic areas of common interest	Concerned countries	Leading country and institution	Thematic coordinator
<b>WATER AVAILABILITY AND MANAGEMENT</b> Water harvesting and control Water use Irrigation scheduling Drought Irrigation systems	6/6 Swaziland Mauritius La Réunion Zimbabwe South Africa Mozambique	La Reunion (CIRAD)	Mr B Siegmund
<b>REDUCING COSTS OF PRODUCTION</b> Input efficiency Increase in cost of production Cost of production unknown but subsidized Cane haulage input costs Reliance on contractors for harvesting	6/6 Swaziland Mauritius Mozambique La Réunion Zimbabwe South Africa	South Africa (SASRI)	Dr Kathy Hurly Mr Martin Eweg
<b>TRAINING IN TECHNICAL, MANAGERIAL AND FINANCIAL SKILLS</b> Expertise and Training Lack of technical and management training, Technology transfer Organisational sustainability Lack of information and Communication Extension	5/6 Swaziland Mozambique Zimbabwe South Africa Mauritius	South Africa (SASRI)	Dr Kathy Hurly Mr Martin Eweg
<b>PRODUCTIVITY OF PRODUCTION SYSTEMS REDUCE YIELD GAP/INCREASE PRODUCTION</b> Low and declining yield; gap between large and small-scale growers Nutrition Pests and diseases	5/6 Swaziland Mauritius La Réunion Zimbabwe South Africa	Mauritius (MSIRI)	Dr JC Autrey
General co-ordination of the Regional Consortium		South Africa (SASRI)	Mr Martin Eweg

Concept proposals needed to meet the following three criteria in order to be considered:

- Small-scale farmers in SADC states would benefit.
- A clearly defined research element with tangible benefits should exist.
- Institutional collaboration must take place.

*The successful project*

Of the 104 project submissions, only 10 projects were selected to be awarded full proposal status, and only one of the sugarcane consortium projects submitted (the one by Mauritius) was successful, with the project titled:

*'Elaborating a methodology for the diagnosis of conditions and factors limiting adoption of improved technologies by small-scale sugarcane farmers and for the development of decision-making support tools for these stakeholders'*

The defining goals of this project were:

- To seek ways to increase the household income of the small-scale sugarcane farmers. Expected outcome will be a definition of the farming systems and areas in which future small-scale specific research may be required, as well as providing intervention strategies.
- To identify and understand the causes/factors limiting low production levels in small-scale sugarcane farming systems.
- To investigate improved systems and methodologies in small-scale sugarcane production.

Both South Africa and Mauritius are suffering a decline in yield per unit area by sugar producers as well as attrition within the producers. The situation exists where there is an increasing and highly uneconomical gap in the production levels between large and small-scale sugarcane planters/growers.

For this project a research consortium was formed between the Mauritius Sugar Industry Research Institute (MSIRI) and the South African Sugarcane Research Institute (SASRI) of which MSIRI was the beneficiary or lead partner and SASRI the first partner.

The MSIRI was officially contracted to FIRCOP and SASRI was bound through an MOU to MSIRI. All funds were paid by the SADC FIRCOP by allotment to MSIRI, who then passed on the required division to SASRI as per the formal contractual agreement between SADC and MSIRI.

It was agreed that MSIRI would engage researchers from the La Réunion Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) for support and consultancy, and that SASRI would continue to include Zimbabwe and Swaziland in all communication on the project. Project activities were restricted to South Africa and Mauritius with the understanding that all outcomes could benefit other SADC states.

The project was initially required to run over a two year period, but was later extended to three years (Dec 2006 to Dec 2009) and carried a total value of 250 000 Euros (approximately ZAR 3 million) of which 107 000 Euros were own counterpart funded contributions. Each country had a separate budget required to fit the specific institutional system.

The project proposal was approved with the knowledge that stringent requirements were in place when accounting for the use of the funds, as well as for procurement and contracting in both research institutes.

The major part of the project required extensive simultaneous profiling surveys to be conducted amongst farmers in Mauritius and South Africa. Surveys would gather a wide range of data that would be analysed within each country's system and between countries.

## Methodology

### *Literature review*

One of the primary requirements of the project was a comprehensive literature review to determine whether such a project using farmer surveys had been undertaken before. Results from this literature review indicated a dearth of surveys within the sugar growing sectors around the world, and in fact very few research projects of a similar nature had been conducted in the southern hemisphere. This elevated the project status because it was a first of such proportions, while at the same time it appeared to be rather ambitious. Having taken this into consideration, the project proceeded.

Consensus on the number of growers to be surveyed had to be reached. It was agreed that only a percentage of the total could be surveyed. This amounted to 800 (2.5%) growers in Mauritius and 900 (2.6%) growers in South Africa. When these numbers were confirmed as a statistically significant sample, the work began.

### *Development of the survey questionnaire*

Survey questionnaires were adapted from the survey developed by Mr Thulani Masondo, a SASRI Extension specialist, during his post-graduate studies at the University of KwaZulu-Natal (UKZN). Specific attention was given to limiting the number of open-ended questions that would require categorisation, interpretation and preparation before analysis. The questionnaire was revised many times between specialists in Mauritius at MSIRI and those in South Africa at SASRI, with some additional input from UKZN professionals. The outcome was version 17 of a 15 page survey questionnaire that would capture almost 2000 fields of data from each farmer interviewed, and which would significantly contribute to a better understanding of the clients that the respective institutes serve. Initially, each questionnaire took about two hours of interaction with each farmer to fully complete, although as the enumerators became familiar and were able to anticipate some responses, this reduced to approximately an hour.

### *Global positioning of survey data introduces new technology*

Having drafted a survey questionnaire, it was agreed to investigate the possibility of placing Global Positioning System (GPS) coordinates to each questionnaire and thus position the data using a Geographic Information System (GIS). After some investigative research it became apparent that a recently initiated 'logitech smart pen' technology could be used to capture the survey data and transmit the same using GPS enabled cellular technology (Nokia 6110 Navigator) directly into a database via a server. SASRI elected to use this advanced technology system primarily to minimise the need for data entry personnel, who were not available, and the daunting logistics of transferring hard copies of data over an industry that stretched more than 1000 kilometres from South to North. Survey forms were printed on unique pixilated paper that would recognise the pen strokes.

The data transferred on each survey form was encrypted and in excess of 4 kb. The cost of transmission was less than 4 ZAR cents. The SA Durban based private sector Company 'Dataworld' were contracted to provide the necessary technological support and equipment for collection of data. Dataworld subsequently transferred the system to their subsidiary business 'Xcallibre' who completed the work ([www.Xcallibre.com](http://www.Xcallibre.com)). Depicting the survey data on geographical maps generated via the GIS required special functionality and the complexity of this requirement of the project was not fully appreciated at the onset of the

project. Some innovative thinking by the SASRI GIS specialist allowed this to become a reality.

#### *Finalising the questionnaire and identifying the target group*

Focus group meetings were held with stakeholders to review the final questionnaire and to confirm the methodology to be used in pre-selecting the planters/farmers to be surveyed.

A stratified selection rather than random, within all the mill areas was decided upon in order to eliminate the possibility of overtly excluding any significant groupings of small-scale sugarcane farmers. Selection criteria were applied by 'Infowave' the SA sugar industry appointed outsourced service provider managing statistical data (Table 2). These criteria meant that only farmers with SA identity numbers (IDs) were included, at least 50% of these were females, 40% below the age of 40 (considered as youth in South Africa) and if possible, all mill areas in SA to have 2.6% of the total small-scale growers surveyed. Selection required respondents to have delivered within the previous two seasons. Similar selection criteria were used for Mauritius.

**Table 2. Stratification of selection criteria used to select the South African sample group.**

Extract 1000 small-scale black sugarcane farmers from the total (2.6%)
Select from mills 61, 62, 65, 66, 67, 70, 71, 72, 73, 75, 77, 78 and 80.
Only select growers with valid SA identity numbers – used to calculate age.
Use age of 40 years as the split point for young and old growers.
Select equally from male or female and young or old growers.
Select only growers who have delivered in either the 2007 or 2006 seasons. If deliveries in both seasons then take the average.
Split grower list into mill area, gender, age and cane tonnages.

The 13 mill areas in South Africa and three factory supply areas in Mauritius provided 1700 survey respondents. Mauritius was, for various technical reasons, unable to get the 'smart pen' technology to function satisfactorily and was concerned that they would not receive adequate support from the Durban based companies of Dataword and Xcallibre. Because MSIRI had staff available to conduct surveys it was decided that Mauritius revert to the tried and trusted method of data collection by hand, with this then being transferred and captured into the database.

#### *Using the smart pen technology to conduct the surveys*

South Africa used the higher cost advanced technology and selected enumerators through a defined process including personal interviews of UKZN graduates to undertake the field work. Six graduates were contracted from 164 applicants to capture the data over a four month period from April to July 2008, which, despite the logistical challenges, worked well (Figure 1). It was agreed that female surveyors or enumerators would be contracted as they would have a tendency for neat handwriting required by the system, and a greater propensity to derive an empathetic response from the farmers, leading to more accurate and usable data than their male counterparts. Surveyors were given in-house training in surveying methodology, statistical analysis and terminology used in the sugarcane agricultural sector, as none of the surveyors were agricultural graduates.

Survey forms were printed in English and the enumerators were required to translate the questions into the local Zulu language and capture the written responses in English. The use of external surveyors further added to the expectation that the farmers would more willingly share some sensitive data that may not otherwise have been shared with internal sugar industry personnel. MSIRI having used their personnel in the process may not have enjoyed the same level of unencumbered responses that South Africa did. This may be difficult to determine.



**Figure 1. The group of 16 UKZN graduates who participated in the initial training from which the six enumerators were selected for work in South Africa.**

#### *Data capture*

Once the questionnaire and systems had been pre-tested and adjustments made, work began simultaneously in both countries. The South African returns were annotated in real-time on the website each day at SASRI by Tumelo Tsephe, an assistant research officer, who made any final corrections or adjustments that the handwriting recognition software was not able to decipher. The system allowed the inclusion of lexicons and terminologies that are common to the SA industry, as well as the inclusion of rules that would allow immediate critical path information to be included upon omission before the surveyor and farmer being surveyed had parted.

#### *In the field*

The logistics of arranging for the safe transport and accommodation of enumerators, and also ensuring that the farmers would be at home when surveyors visited their region, was facilitated by the many SASRI and Milling Company employees as well as the Department of Agriculture and Environmental Affairs (DAEA) extension staff engaged in the SASRI/DAEA Joint Venture agreement. There was a provision for the substitution of selected growers to be surveyed should a surveyor deem it necessary. Surveyors were paid monthly upon receipt of each completed questionnaire received by the server, at a rate of R100/survey. This system minimised the administrative work required in monitoring progress and performance of people who were operating independently in the field and many kilometres away from SASRI.

*Type of data captured*

The fields in which data were captured include:

- Socio-demographic profile (geographic and personal details).  
Sugarcane farming  
Knowledge/education/training  
Organisational support/membership/services provided  
Constraints to production
- Resources  
Land/availability and disposition  
Land ownership  
Labour  
Finance and credit
- Sugarcane husbandry  
Land preparation and planting  
Crop nutrition  
Variety/cultivar choice  
Weed control type/training/use of herbicides  
Insect pests and diseases/training/control measures  
Irrigation and drainage  
Harvesting and transport  
Conservation and environment protection
- Communication
- Household/farm expenses and income
- Decision making

*Validation of results*

Validation of the 941 survey results was undertaken in August 2008 immediately after the completion of formal surveys, where a random selection of 2.5% of respondents were re-surveyed using an independent person who had not been involved in the initial procedure. Responses were compared which revealed a high level of correlation between first and second survey, giving ample confidence in the results.

## Results

The data captured in the survey was extensive and the need for and process of data mining and interpretation by experienced biometricians and agronomists or extensionists, cannot be overstated. In preparing this project and related activities many assumptions based on experience of stakeholders and sugar Industry personnel had to be made. The survey data is both qualitative and quantitative in nature and requires a suitable query base. This is being prepared by MSIRI in Mauritius.

The project mid-term review conducted by reviewers from France, South Africa and Botswana took place in September 2008. The review process was extensive and made use of a commonly used matrix weighted evaluation table to determine the level to which the various

project dimensions had complied. The review of the project achieved the following results (Table 3).

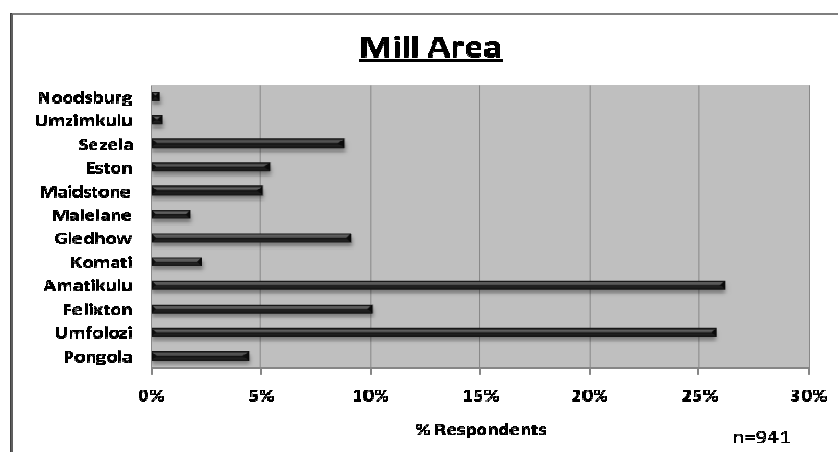
**Table 3. Mid-term review results.**

Evaluation category	Mid-term project review score	Total possible score
Management	4.2	5
Technical coherence	4.3	5
Scientific evaluation	4.6	5
Environmental impact	4.1	5
<b>Total</b>	<b>17.2</b>	<b>20</b>

The overall score of 17.2/20 (Excellent) ascribed to this project gives an 86% satisfaction level.

A few selected responses from preliminary data from the socio-demographic responses of surveyed growers will be presented for discussion, excluding open-ended question responses. The remaining available data will be interrogated and mined over a period of time in order to highlight trends and obvious gaps, as well as indicate country profile differences.

The respondents to be surveyed were selected in each mill area as 2.6 % of the total in that area, with the greatest number (>25%) from the Amatikulu and Umfolozi mill areas respectively (Figure 2).



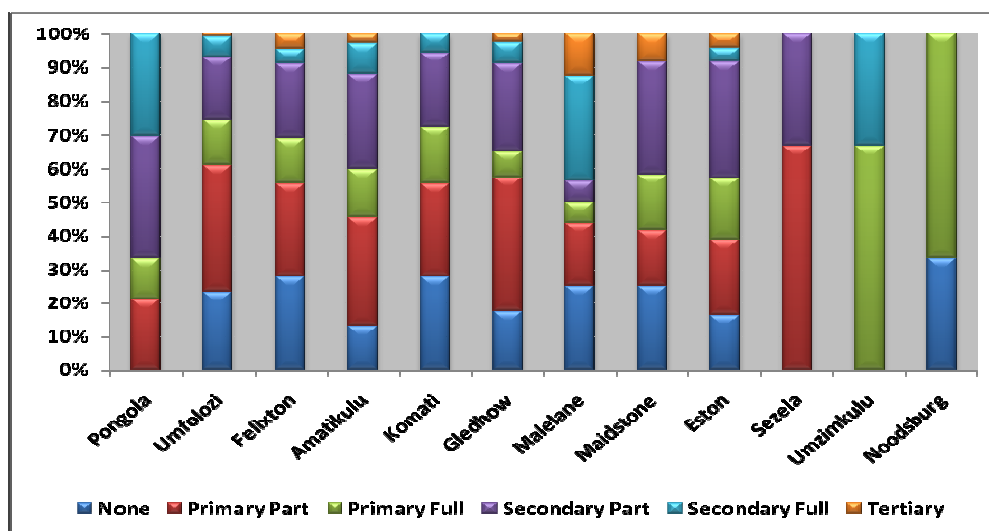
**Figure 2. Mill area and percentage of respondents in relation to the total (n=941) of surveyed farmers.**

Figure 3 gives a clear indication of the levels of education by mill area, with Table 3 identifying that there are low levels (<36%) of formal education in most mill areas except for Noodsburg, whilst full secondary and tertiary education were greatest in Malelane and Maidstone. Pongola recorded 52% secondary education and Umfolozi 45% primary (Table 4). The education level was further stratified into full and part for primary and secondary (Figure 3). It has yet to be determined whether there is a significant correlation between level of schooling and adoption of technology and best practices in the farming systems.

The hypothesis of superior levels of education having a positive impact on household income and thus poverty alleviation in terms of technology adoption in the farming systems, will have to be tested using the data.

**Table 4. Education levels of respondents in each mill area.**

South African mill area	Number of respondents	Education			
		No formal	Primary	Secondary	Tertiary
Pongola	42	9	11	22 - 52%	0
Umfolozi	242	77	110 - 45%	53	2
Felixton	95	30	37	24	4
Amatikulu	246	55	103	82	6
Komati	22	9	8	5	0
Gledhow	86	20	38	26	2
Malelane	17	5	4	6	2
Maidstone	48	39	4	4	1
Eston	51	10	20	19	2
Sezela	83	80	2	1	0
Umzimkulu	5	2	2	1	0
Noodsberg	4	2	2	0	0
Total	941	35.92%	36.24%	25.82%	2.02%



**Figure 3. Breakdown of the various levels of education by mill area.**

Whilst the number of farmers surveyed in Amatikulu and Umfolozi were significantly more than in other mill areas, the % female farmers were greatest at Eston and Gledhow. Gender represented 60% female and 40% male, which is in line with expectations, given that selection criteria required a 50% equal gender selection (Figures 4 and 5).

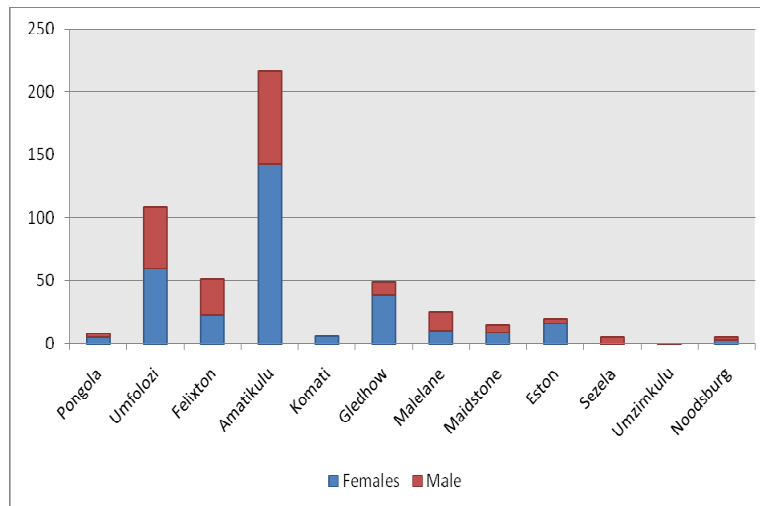


Figure4. Gender division by mill area.

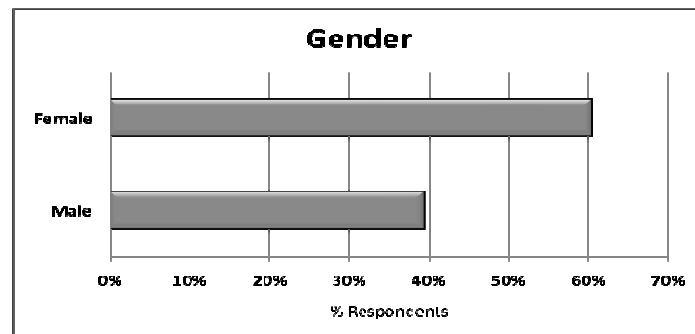


Figure 5. Gender disposition.

Equally, age had an expected outcome, with the majority of farmers being senior in age and few young farmers, despite the attempt to pre-select on equal split of young and old divided at age 40 years (Figure 6). Age and gender were further separated into factory areas. A result regarding the ‘at home’ status question asked of those interviewed indicated that in excess of 80% of respondents were of this status.

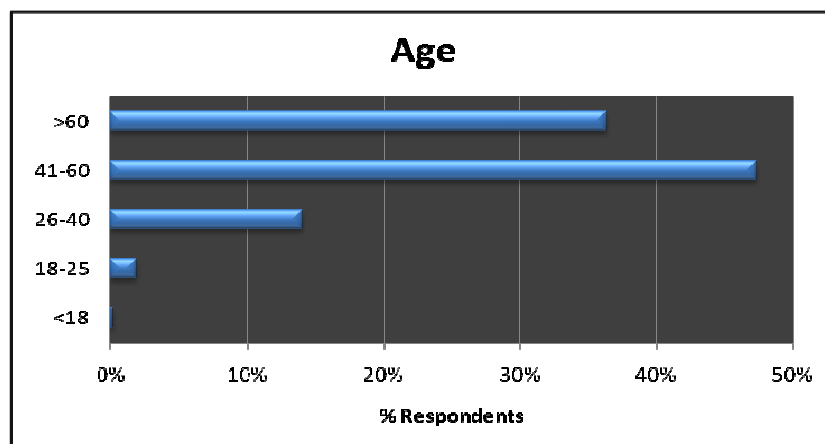


Figure 6. Age disposition.

The results of this extensive survey will be captured in a GIS database accessible to researchers and extension personnel alike, to be used as a tool when developing ideas or research projects.

An interesting outcome from the section on agronomic practice was the response to the question on whether or not farmers had ever replanted their fields. A few more than 50% admitted that they had replanted, as shown in Figure 7, which would suggest that despite being in sugarcane farming for a number of years (60% of respondents admitted to having been in sugarcane farming for more than 10 years), there was a low replant rate amongst small-scale farmers.

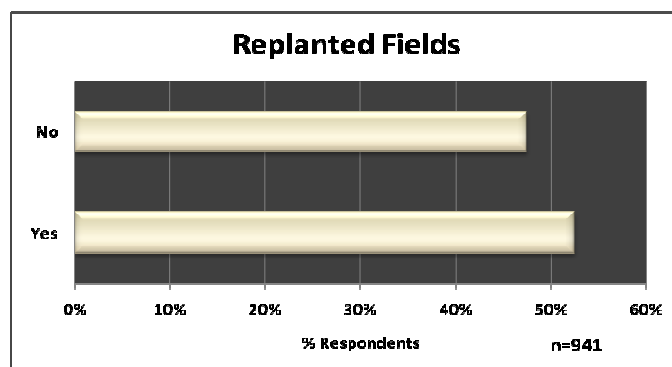


Figure 7. Response to the question, 'Have you ever replanted your field?'

## Discussion

The value in having a data source of this nature and magnitude cannot be underestimated, as it is data of this type that can be used when making confident recommendations to the South African sugar industry that will have far reaching impacts for all service providers. The data represents farmer responses and not the perceived knowledge and ideas of sugar industry employees, or other industry connected bodies. According to the McCarthy (2007) report, the fabric of sugar growing communities has been woven over many years and there is no doubt that sugar growing has had far reaching influences on the development of the rural people.

The many open ended question responses will require some categorisation and intuitive analysis in order to extract the real restrictions that farmers face as different from those perceived. This type of analysis is being conducted in Mauritius and results are anticipated by the end of 2009. The results of this work will be disseminated when it has been through the raw data analytical procedure. Trend lines and comparative analyses will be most useful to those outside the research arena, whilst protection of the raw data by project partners is an imperative.

There is an indication that the education levels of farmers are lower than expected, with almost 36% having no formal education (Table 3). The number of female respondents (farmers) is higher than expected at 60% and the average age of the farmers selected for survey was 51 years. It must, however, be pointed out that the selection criteria used in the stratified sample selection required at least 50% women. Correlation between literacy/education level and income or even response to the survey questions has not yet been sufficiently analysed to report on.

Gaining an appreciation of the many possible factors that may influence growers in their replanting practices, the reasons for not replanting in this sector will be an interesting element of the data mining. There are undoubtedly many more scenarios that will develop with analysing beyond the common general statistical analyses.

### **Conclusions**

This paper has illustrated the value and stringent requirements involved with attracting and then delivering on grant funding. It has also shown that collaboration, particularly across the SADC countries, will provide a more valuable output. Sharing learning experiences with other neighbouring, albeit non-participating countries, has enriched experience and encouraged these countries to conduct surveys of their own.

The project has produced an extremely valuable database, a first in both the South African and Mauritian sugar industries, that can be used to inform decision makers and work programmes of all service providers. Understanding the reality of the small-scale grower will certainly assist in the design of interventions, be these monetary, agronomic or educational. In addition, this data was acquired at a very reasonable cost as a result of the EU support.

Using the smart 'logitech' pen as a data capture method provided a level of superior, accurate data that would not have been achievable in the South African context should the old fashioned methodology have been used.

Because the project delivered beyond the project requirements it has increased the credibility of both organisations (SASRI and MSIRI) that may lead to future EU funded investments for South Africa and Mauritius.

Data from this extensive work is being requested from not only within the sugar industry players, but also from external institutes. The CSIR is requiring access to these data for a project determining the impact of sugarcane as a bio-fuel on poverty alleviation.

Future analysis of the data will no doubt assist in providing an insight into ways of increasing the household income of the small-scale sugarcane farmers, defining the farming systems and future research areas, as well as providing intervention strategies.

Identifying and understanding the causes/factors limiting low production levels in small-scale sugarcane farming systems, is a more complex matter and will only be fully understood when the data has been mined and the intrinsic responses understood.

Investigating improved systems and methodologies in small-scale sugarcane production, will again be more apparent upon results being released and possibly the need for future work will be exposed.

From these preliminary results, it would appear that there is an important role for sociologists to investigate how best to interact with our resource poor farmers who mostly require development in a context that is not related only to farming husbandry or systems.

### **Acknowledgements**

- TSB Sugar and Illovo Sugar Ltd dedicated extension service staff who assisted with the logistical arrangements, without which this project would not have been realised.
- SASRI Extension specialists John Neen, Thulani Masondo, Francis Phewa, William Gillespie, Bongu Bhengu and Sifiso Mkhwanazi were of great support.
- The KZN DAEA were also able to support the field work through the extension officers who are dedicated to the Joint Venture extension partnership, and in particular made available the time of the validation surveyor Ms Nana Mkhwanazi.
- Special mention must be made of the overall project leadership by Mr Gopal Pillay, the head of Extension at MSIRI, who managed to keep this project on track despite the difficulties of physical distance and delays that were experienced from the SADC office directorate.
- It is further highly appreciated that Dr A Angé the SADC appointed Technical Adviser/Coordinator, supported this project more than expected.
- The value of the support received from the European Union via the French Government is acknowledged in funding a project of this nature. Although data will be useful in assisting each country to make informed decisions regarding support to the small-scale farmers, collaborative co-operation and interaction has been raised to a new level, possibly leading to future work.

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