

**REPORT ON PERFORMANCE REVIEW OF  
SUGARCANE RESEARCH INSTITUTE  
UDA WALAWA, SRI LANKA**

*June – August, 2018*



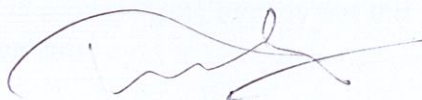
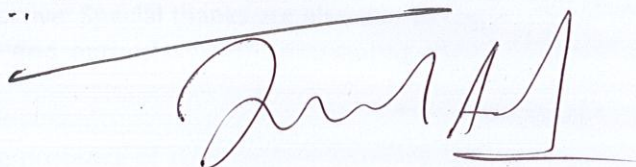
*Sri Lanka Council for Agricultural Research Policy  
Ministry of Agriculture  
114/9, Wijerama Mawatha  
Colombo 07*





## Review Team

1. **Professor S J B A Jayasekera (Chairman)**  
*Former Vice-Chancellor and Professor of Horticulture  
Wayamba University of Sri Lanka*
2. **Dr. Dan Seevaratnam (Member)**  
*Strategic Agribusiness Advisor  
Hayleys Plantation Ltd.*
3. **Dr. Fredrick Abeyratne (Member)**  
*Former Head, Poverty Governance Unit  
UNDP*
4. **Dr. D S P Kurupparachchi (Member)**  
*Department of Biosystems Engineering  
Faculty of Agriculture and Plantation Management  
Wayamba University of Sri Lanka*
5. **Mr. Thilakasena Yaddhige (Member)**  
*Former Executive Director/CEO  
Pelwatte Sugar Industries (Pvt.) Ltd.  
Pelwatte Distilleries (Pvt.) Ltd.*





## **Acknowledgements**

The review team wishes to thank Mr. K Francis Karunasena, Chairman, Dr. AP Keerthipala, Director, Dr. WRG Witharana, Deputy Director (Research and Technology Transfer), Ms. MKAA Amali, Deputy Director (Administration), Ms. DNJN Dissanayake, Accountant, Dr. C Epitawala, Administrative Officer, Principal Research Officers, and all other staff members of Sugarcane Research Institute, Uda Walawe, for making necessary arrangements to carry out this review successfully. The arrangements were organized well and necessary information was made available to the team when needed. The administrative, research and technical staff members were friendly, cooperative and supportive. Special thanks are also due to the other staff members who showed their keenness and enthusiasm for contributing their inputs to the review process during the discussions.

The review team would also like to acknowledge the presence of stakeholders including the representatives from the industry, the sugarcane farmers and the representatives from farmer organizations, who gave their fullest cooperation to the review process.

Finally, we would like to thank Dr. SDG Jayawardena, Chairman, Sri Lanka Council for Agricultural Research Policy (SLCARP), Dr. JDH Wijewardena, Secretary, SLCARP, for their support and Dr. Frank Niranjana, Senior Scientist, SLCARP, for coordinating the activities between SLCARP, SRI and the Review Team, and making all arrangements to carry out this review successfully in a cordial manner without any interruptions.

*SJBA Jayasekera*  
*DV Seevaratnam*  
*FA Abeyratne*  
*DSP Kuruppuarachchi*  
*T Yaddehige*

10<sup>th</sup> September, 2018



## **Executive Summary**

### **Contribution to the Economy**

The Sugarcane Research Institute has taken a lead role in sugarcane research and development in the country since its inception. Even though the institute started its activities 35 years ago, it could make its active contributions only from 1991. Since then SRI has developed many technologies that have made a significant impact on sugarcane production in Sri Lanka. The most outstanding output has come from varieties developed for several agro ecological regions in the country. Presently over 70% of the varieties cultivated by the farmers are the products of the SRI and as a result, national yields have increased by two fold, thus reporting an increase in local sugar production during the past couple of decades. The varietal characteristics developed by the breeders had exhibited a wide range of yield performance and agronomic characteristics. Hence, the scientific program had been relevant in meeting a vital food requirement of the country. However, with the present extent and with another 15 to 20 % yield increase during the next decade or so, it would be rather impossible to become self-sufficient in sugar production by 2030 as planned, since there are no plans to increase the extent under sugar cane.

The industry has been successful in managing a contract grower system. Under this system there are around 15,000 farmers growing an extent of around 17,000 ha. Given that many Sri Lankan small holders of other field crops face marketing problems (especially price fluctuations), the Sugar industry has been able to guarantee a market and a stable price to all sugarcane growers. This is a model that can be emulated by other crop sectors as well.

### **Assessment of the management aspects**

The Director of the Institute is a member of the Board of Governors (BOG) of the SRI and attends meetings regularly to discuss and take necessary actions and decisions in planning and implementation of the research and development activities of the institute. The Director and the divisional heads are involved in planning activities of the institute. Even though the stakeholders do not get involved in setting up strategic plans of the institute, their (mainly the industry, not the farmers) concerns are taken into consideration. Planning of research projects are mainly derived from identified objectives and strategies and the rest, through Industry and Development Officers of SRI. The institute's main source of funding is the Government, and its allocations for capital items had been declining. The institute does not have the mandate to carry out the extension work and mostly depend on the industry which is not under the administrative control of SRI for feedback and outreach. However, steps are now taken to include extension work into the Institute's mandate.

Project management and quality assurance aspects of the institute can be categorized as moderate. The effectiveness of administrative procedures, found to be strong. However there are areas, such as resource allocation at different levels, availability of equipment,



technical staff, capacity building and infrastructure facilities, that are not at optimum level. Furthermore, there is a shortage of research officers trained at PhD level, and most of the research staff are young and lacks experience, with the high turnover. The institute has not been able to retain the senior officers especially after their training. Training of staff at all levels had been poor in the recent past. Little training opportunities were available for research staff at postgraduate level. Also, training provided to technical, administrative and financial officers too have been limited. Hence HRD aspects of the institute had been at moderate level.

The ability of the institution to carry out its mandate is well recognized and equipped with necessary background, support and powers. The SRI has become an important sugarcane research institute in the Asian region and well recognized by the researchers and experts in the region. The physical facilities such as buildings, roads, housing, laboratories, fields, equipment, etc. are in good condition but can be improved further. Sub-stations have been provided with funds for improvement of infrastructure. The institute does monitor and evaluate its own administrative, accounting and R&D activities internally. However, monitoring and evaluation procedures are not fully supported by a Management Information System (MIS). The institute and the substations are not interconnected among each other or through an MIS.

#### **Assessment on Output**

Many technologies have been developed by the institute. The most outstanding outputs are development of high yielding improved sugarcane varieties. The breeding programs of the institute are commendable and approximately 70% of the varieties cultivated by the Sri Lankan sugarcane farmers are products of the institute. The important characteristics of the varieties are high cane and sugar yield, resistance/tolerance to pests, diseases and moisture stress. Further institute's recommendations focused on pest management, agronomic practices as well as fertilizer application. All varieties developed are capable of giving over 120 t/ha under irrigation and 80 t/ha under rain-fed conditions at farmer level. However, No adaptive research trials are conducted and the average yields are less than the potential. Technologies developed are evaluated for their economic feasibility by the Economics division. However, due to limited staff in that division, no extensive surveys have been carried out to evaluate the impact of the adoption of these technologies on the farmers economic, health, education and living conditions. Especially given that institute has a responsibility to support the 2030 SDG agenda, these information are vital.

Technologies developed by the institute are transferred through the industry. The officers of the institute organize limited number of training programs, including field demonstrations, for the industry as well as for the farmers. Although these programs are conducted by the institute, a facility such as a training center or other training facilities are not available within the institute. The institute has prepared several reports, training manuals and advisory leaflets to be distributed among stakeholders. They also disseminate their



recommendations by participating in events (e.g. exhibitions) organized by other organizations such as, schools, universities, provincial councils, other departments and ministries.

Only few researchers in the institute have published their research findings in reputed ISI journals and other journals. Most of them have published in the SRI journal and some have presented and published their findings in international and national conferences, workshops and seminars. A couple of officers have won several awards for their contribution in the field of sugarcane research during the past few years. Though, few researchers have obtained patents for their efforts, the institute has not taken measures to secure patent rights. Steps have not been taken to protect Intellectual Property Rights (IPR) or Breeder's Rights (BR).

All activities done by the institute is service oriented, targeting the sugarcane farmer and the industry. Soil analysis, farmer training programs, demonstrations, in-plant training programs for university students, training programs for school children etc. can be considered as services rendered by the SRI. The Mechanization Technology Division has designed a limited number of equipment and has also produced limited numbers in their work shop to be sold at a subsidized rate to the industry. However, no effort has been made to liaise with outside manufacturers, for mass scale production. The Processing Technology Division has produced a several products which are sold at their welfare shop. However, no efforts have been taken to transfer these technologies to outside manufactures.

The welfare facilities provided to the staff by the institute were at moderate level. Due to delay in obtaining approval for the MOP several benefits that staff should get, have not been materialized, including promotions. There is no system at SRI to appreciate/acknowledge work done by the staff. This also has added to frustrations. The technical staff has no career path to develop. This is an area that needs to be studied by the management and give suitable solutions.

### **Recommendations**

The review team has identified both internally and externally controllable methods to improve management and research output and made a list of recommendations. They are summarized below.

SRI should make improvements to the action plan and strategic plan while maintaining a constant dialogue with the policy makers, administrators, stakeholders, researchers and extension workers. It should also develop a formal monitoring and review process on projects, improve the existing management information system (MIS), develop social interaction through 'Team Building' activities, develop criteria for goal setting and performance appraisals for officers, and take steps to train staff regularly at all levels.



Further, SRI should develop mechanisms to review, evaluate and update its infrastructure, activities and performance regularly. It should encourage scientists to carry out multidisciplinary projects/activities, foreign collaborative projects and ensure that projects do not suffer due to inadequacy of officers, infrastructure, equipment, instruments etc. and scientists/researchers must have access to adequate scientific information. Board of Governors need to fill all vacancies while performing exit-interviews to get feedback on reasons for leaving the institute. As the apex body of sugarcane research and development, need to take steps to maintain strong and efficient links with key partners and stakeholders, and to change the mandate of SRI to establish an extension and training arm with an outreach programme directly reporting to the institute to upgrade the research and extension planning, while establishing a well-equipped Resident Training Centre at SRI, with facilities to train farmers. SRI needs to initiate a system to obtain IPR, BR and patent rights for all technologies developed.

Divisions of SRI should maintain their Vision and Mission in line with the institute's vision and mission and need to introduce staff training on scientific writing and encourage them to publish in ISI journals. 'Article clearing' processes within the Institute need to be expedited.

SRI needs to pay more emphasis on cultivation with less water as water is a limited resource and on using solar power pumps to tap underground water in rain-fed areas without causing damage to water resources or environment and research to reduce chemical fertilizers. It needs to conduct surveys on adaptability, acceptability, and attitudes of farmers on adoption of technology. With reference to SDGs, baseline information of present status of the farmers needs to be documented.

Studies are needed on economic feasibility, consumer preference and marketability for newly processed sugarcane products, and research into milling and sugar recovery aspects. Linkages with the industry for manufacturing and introducing machinery need to be improved. Immediate action is required to initiate/expedite PhD level training of the existing staff in fields of Agronomy, Breeding, Plant Protection, Soil Fertility Management etc. Research laboratories will need better, modern and state of the art infrastructure. Emphasis on mechanization is needed (as labour is getting scarce) to make sugar cane cultivation attractive to younger generation and transfer technology to facilitate their adoption. A team of staff from SRI and Industry should visit other countries to assess the machines, and recommend to import, for use in future.

Action needs to be taken by the administration to get the MOP approved to facilitate certain activities in relation to welfare of the staff and re-visit Schemes of Recruitment (SOR) in relation to promotions of staff, and develop an incentive or a reward scheme for appreciation and recognition of work done by the staff.



## Abbreviations

BOG	Board of Governors
BR	Breeders' Rights
CEO	Chief Executive Officer
DD	Deputy Director
DO	Development Officer
ERP	Eppawala Rock Phosphate
GIS	Geographic Information System
HOD	Head of Department
HRM	Human Resources Management
IAEA	International Atomic Energy Authority
IPR	Intellectual Property Rights
ISI	International Science Index
M&E	Monitoring and Evaluation
MIS	Management Information System
MOP	Manual of Procedures
MPE&KCD	Ministry of Public Enterprise and Kandy City Development
NRC	National Research Council
NRMC	Natural Resources Management Center
NSF	National Science Foundation
PGIA	Postgraduate Institute of Agriculture
R&D	Research and Development
S&T	Science and Technology
SLCARP	Sri Lanka Council for Agricultural Research Policy
SLSC	Sri Lanka Sugar Corporation
SOR	Scheme of Recruitment
SRI	Sugarcane Research Institute
TSP	Triple Super Phosphate



## Table of Contents

<i>The Review Team</i> .....	<i>i</i>
<i>Acknowledgements</i> .....	<i>ii</i>
<i>Executive Summary</i> .....	<i>iii</i>
<i>Abbreviations</i> .....	<i>viii</i>
<i>Table of Contents</i> .....	<i>viii</i>
<i>List of Tables</i> .....	<i>x</i>
<i>List of Annexes</i> .....	<i>xi</i>
<b>1. Introduction</b> .....	<b>1</b>
<b>2. Purpose of Review</b> .....	<b>7</b>
<b>3. Procedure Adopted for Performance Review</b> .....	<b>10</b>
<b>4. Outcome of the Review - Assessment on Management Aspects</b> .....	<b>12</b>
a) Institutional response to external and internal environment in planning organizational strategy: .....	12
b) Planning S&T programs and setting priorities: .....	13
c) Planning S&T/R&D projects: .....	15
d) Project management and maintenance of quality: .....	16
e) Human resource management: .....	18
f) Management of organizational assets:.....	19
g) Coordinating and integrating the internal functions/units/activities:.....	20
h) Partnership in managing information dissemination: .....	21
i) Monitoring, evaluation and reporting procedures: .....	22
<b>Assessment on Output Aspects</b> .....	<b>23</b>
a) Technologies developed: .....	23
b) Technologies transferred to industry/entrepreneurs: .....	23
c) Information dissemination/extension: .....	24
d) Publications: .....	24
e) Patents:.....	24



f) Services: .....	24
g) Staff Training: .....	25
h) Other: .....	25
<b>5. Staff Strength of the Institute .....</b>	<b>26</b>
<b>6. Outcome of the Stakeholder Meeting .....</b>	<b>27</b>
<b>7. Overview of the Institution's Performance and Contribution to National Development .....</b>	<b>29</b>
<b>8. Recommendations .....</b>	<b>30</b>
<i>a. On Management</i> .....	30
<i>b. On Research</i> .....	32
<i>c. General</i> .....	33
<b>9. Annexures .....</b>	<b>34</b>



## List of Tables

<b>Table 1:</b> Assessment of institutional response to external and internal environment in planning organizational strategy.....	12
<b>Table 2:</b> Assessment of planning S&T programs and setting priorities .....	14
<b>Table 3:</b> Assessment of planning S&T/R&D Projects .....	15
<b>Table 4:</b> Assessment of project management and maintenance of quality .....	17
<b>Table 5:</b> Assessment of human resource management .....	18
<b>Table 6:</b> Assessment of management of organizational assets.....	20
<b>Table 7:</b> Assessment of coordinating and integrating the internal functions/units/activities.....	21
<b>Table 8:</b> Assessment of partnership in managing information dissemination .....	22
<b>Table 9:</b> Assessment of monitoring, evaluation and reporting procedures .....	22



## List of Annexures

<b>Annex 1:</b> Map showing SRI and locations of its substations .....	34
<b>Annex 2:</b> Organogram of SRI .....	35
<b>Annex 3:</b> Program Schedule and divisions visited by the review team .....	36
<b>Annex 4:</b> SWOT Analysis of the SRI .....	37
<b>Annex 5:</b> Budget of SRI - 2018.....	38
<b>Annex 6:</b> Staff cadre position of SRI.....	39
<b>Annex 7:</b> Qualifications of scientific, manegerial and technical support staff .....	40
<b>Annex 8:</b> List of recommendations made by SRI .....	41
<b>Annex 9:</b> Training programs .....	43
<b>Annex 10:</b> Services .....	43
<b>Annex 11:</b> List of documents developed by SRI for information dissemination.....	44
<b>Annex 12a:</b> List of publications.....	45
<b>Annex 12b:</b> Summary of publications by SRI Staff (2013 -2017).....	50
<b>Annex 13:</b> Number of Research staff officers and their academic qualifuications .....	50
<b>Annex 14a:</b> Patents by SRI staff (2004-2014) .....	50
<b>Annex 14b:</b> List of awards received by the staff .....	51
<b>Annex 15:</b> Collaborative projects with International Organizations .....	51
<b>Annex 16:</b> Staff of SRI and stakeholders interviewed during the review process.....	52



## 1. Introduction

### Background and History

The Sugarcane Research Institute (SRI) is a statutory body established by the Act of Parliament No. 75 of 1981 (ratified on 29<sup>th</sup> December 1981), for conducting research on cultivation and processing of sugarcane to cater to technical and technological needs for the development of the sugar industry of Sri Lanka, which, until 1981 was undertaken by the Research and Development Division of the Sri Lanka Sugar Corporation (SLSC).

The Institute was formally inaugurated on 29<sup>th</sup> April 1983 by then Hon. Minister of Agricultural Development and Research, Hon. Gamani Jayasuriya, *M.P.* The SRI commenced functioning as an independent institution from 1<sup>st</sup> January 1984 under the purview of the Ministry of Agricultural Development and Research. Even though the institute was established in Kantale at the inception, due to the civil conflict prevailed in the Northern and Eastern regions compelled the authorities to shift the institute to Uda-Walawe during the mid-1980s. However, due to the unsettled conditions prevailed during the late nineteen eighties in the southern region the activities were further interrupted and the institute could carry out its functions effectively, only from early 1990s.

Later the SRI had to function under several ministries such as Ministries of Plantation Industries, Cooperatives, Supplementary Plantation Crop Development, Minor Export Crop Promotion and the Ministry of Sugar Industry Development. Presently, SRI is under the purview of the Ministry of Public Enterprise and Kandy City Development (MPE&KCD).

At present, the SRI conducts several major research and development programs that are being conducted at Uda-Walawe with the support of its sub stations and regional offices. The institute's main research complex is located at Uda-Walawe. There is a liaison office in Colombo. In addition, there is a quarantine farm at Hantana, an arrowing station at Deniyaya and a pathology farm at Siyambalanduwa. There are four regional offices at Buttala, Siyambalanduwa, Badulla, and Hingurana where Development Officers have been posted to carryout extension work by disseminating the knowledge and technologies. In addition, field offices have been established at Kantale and Kilinochchi to undertake activities for revitalisation of sugarcane industry in those areas (annex 1).

The institute is mandated to conduct research on sugarcane cultivation and processing for the development of the sugarcane industry in Sri Lanka. The research, technology transfer and development functions of the institute are carried out by eight technical divisions, namely, Crop Improvement Division, Crop and Resource Management Division, Crop Nutrition Division, Crop Protection Division, Processing Technology Division, Mechanisation Technology Division, Economics, Biometry and Information Technology Division and Technology Transfer and Development Division. Administration and Finance Division provides all administrative and financial management supporting services for smooth functioning of the institute (annex 2).

The institute continues to carry out the research and development functions on the development of new sugarcane varieties for both sugar and energy purposes, crop and land management practices for efficient utilisation of land and other resources for sugarcane



farming, soil management for maintaining soil fertility and soil conditions, pest and disease management for minimising crop losses in an environment friendly manner and development of machinery to reduce costs and to increase profitability of sugarcane farming with minimum damage to the environment. In addition, effective utilisation of by-products of sugar industry, development of co-products and value addition of by-products and co-products are undertaken to diversify the sugarcane industry. The research and development program is focussed mainly on integrated development of the sugarcane industry to meet food and energy security of the country while maintaining environmental sustainability.

Further the institute will also focus on strengthening its man-power for scientific, technical and administrative support along with infrastructure development to undertake sugarcane research, development and extension activities, to continue with its mandated functions.

#### **Vision**

*"To be the centre of excellence in sugarcane technologies and the leader in sugarcane industry development in Sri Lanka".*

#### **Mission**

*"Development and transfer of appropriate sugarcane technologies to enhance competitiveness of and to contribute to expand and develop the local sugarcane industry in a sustainable manner".*

#### **Thrust Area**

The main thrust area of the SRI, in line with the Act of Incorporation of the institute is *"Conducting research on sugarcane cultivation, processing and utilisation of its by-products"*. Under this thrust area, the SRI is conducting research and development activities in following major disciplines.

- Sugarcane Crop Improvement
- Sugarcane Crop and Resource Management
- Sugarcane Crop Nutrition
- Sugarcane Crop Protection
- Mechanisation Technology
- Sugarcane Processing and Product Development
- Dissemination of Knowledge
- Small-scale sugarcane industry development

The crop improvement research programme is the highest priority area of research to develop and release new sugarcane varieties, with high cane and sugar yields, high fibre content (for energy), pest and disease resistance, good ratooning ability and milling qualities, and suitable for cultivation in different agro-ecological regions in the island to increase productivity, profitability and sustainability of local sugarcane industry. In addition, development of varieties suitable for quality jaggery production and appropriate for mechanical harvesting is also incorporated recently in to the program.



The sugarcane crop and resource management focuses on making recommendations on all management practices to maximise the realisation of the genetic potential of the new varieties, i.e., increase sugarcane yields with high quality, minimise costs and adverse effects on environment and to maximise and diversify farms for increasing incomes with greater stability by more efficient utilisation of land, soil and water.

The crop nutrition is to improve and maintain soil conditions required for optimum crop nutrition for improving yield and quality of sugarcane at a minimum cost and also to minimise soil degradation.

The research on crop protection is required to minimise/prevent crop damages due to pests, diseases and weeds, and thereby to improve yield and quality of cane at a minimum cost.

The development and/or introduction of mechanization for sugarcane cultivation, for both small-holders and large scale farmers, would help them to carry out the operations easily and at a minimum cost.

Research on processing and product development is required to improve processing efficiencies of sugarcane and its by-products and to diversify sugarcane-based products to maximise income by increasing sugar recovery, minimising costs, increasing value addition, etc. with minimum adverse effects on the environment.

The knowledge/technologies generated by all research programmes should be evaluated for their economic feasibility and disseminated to sugar companies and growers/millers, etc. and promotion of application of such knowledge/technologies should be undertaken to reap the benefits of the research findings. Development of cottage-level sugarcane-based industries has to be undertaken to help farmers in the areas where sugar manufacture is not carried out, to improve their livelihood.

### **Goals**

The goals of the institute covering the three years, 2017-2019, are as follows.

- Increase productivity and/or reduce costs of cultivation and processing of sugarcane and of its by-products processing
- Expand sugarcane cultivation in traditional areas, and into non-traditional areas
- Increase productivity, reduce costs of cultivation and processing of sugarcane and of its co-products
- Diversify sugarcane land use
- Protect environment
- Transfer technologies and promote their adoption
- Ensure formulation and implementation of appropriate policies and regulatory measures required for the development of the sugar sector by relevant authorities
- Develop human resources with high-calibre scientists and state-of-the art research infrastructure
- Provide access to latest scientific literature whilst providing the staff with congenial working and living environment to enable cutting-edge research in sugarcane and improve research outputs.



## Objectives and Strategies

Based on the above mentioned thrust area and the goals, the institute has developed objectives, and strategies undertaken to achieve them as given below.

- Enhance varietal diversity thus improving commercial attributes suited for local sugarcane plantations by, *developing new improved varieties, importing varieties with desirable traits, recommending and releasing new varieties suitable for specific environmental conditions/farm situations and promoting adoption of new varieties in commercial cultivation*
- Improve sugarcane crop management by, *improving the existing crop management practices, developing new improved management practices, recommending crop management practices according to locational/site specificities and promoting adoption of the recommended crop management practices in commercial cultivation*
- Ensure efficient utilisation of land, soil and water resources with minimum environmental degradation by, *increasing awareness among all stakeholders of the existing situation of the land, soil and water resources and importance of their protection, devising appropriate methods for effective and efficient use of land, soil and water resources with minimum damage to them, incorporating such technologies/knowledge in sugarcane cultivation/processing and intervening with the relevant authorities to ensure adoption of regulatory measures already available or to enact new regulations, if deemed necessary*
- Diversify sugarcane land use by, *identifying suitable crops/livestock for sugarcane-based farming systems, and developing farming methods/systems and promoting adoption*
- Mechanize sugarcane farming by, *identifying areas required for further mechanisation, introducing/modifying available machinery/implements/tools, developing small, medium and large scale machinery/implements/tools suitable for local farm situations, producing recommended machinery/implements/tools or promoting their manufacture, promoting adoption of farm machinery/implements/tools, and developing sugarcane land lay-out /farming practices to facilitate adoption of mechanization technologies*
- Improve processing efficiencies of sugarcane and of its by-products by, *conducting research and extension programmes for increasing cane and sugar yields and for minimising post-harvest losses, advising sugar industry officials and relevant higher authorities on increasing cane and sugar yields and for minimising post-harvest losses, undertaking collaborative studies with sugar mills for effective utilisation sugar industry by-products and safe disposal of them reducing adverse effect on environment, acquiring expertise in sugarcane and its co-products processing, improving cottage-level sugarcane-based industries and exploiting available avenues of the cane-sugar industry as a source of renewable energy /hydro thermal liquefaction*
- Diversify sugarcane-based products by *introducing appropriate sugarcane-based products suitable for local conditions, developing/modifying sugarcane-based products/processes for increased value addition, and promoting technologies on the production of sugarcane-based value-added products and popularising/commercialising those products*
- Increase stakeholder knowledge on sugarcane technology and provide necessary institutional coordination and support for adoption/commercialisation of such



knowledge and obtain feed-back by, *training trainers of the industry, Training farmers/millers, disseminating information to stakeholders using ICT, providing services and facilitating accessibility to necessary inputs for the adoption of recommendations, and conducting regular meeting with stakeholders for identifying their needs and receiving feedback*

- Lead and guide relevant authorities for formulation and implementation of sugar industry policies and regulatory measures by, *advising the government/relevant authorities on the policies and the regulatory measures required for sugar sector development, providing the government/relevant authorities with required information for formulating policies/regulatory measures and monitoring the effectiveness of policies and regulatory measures*
- Ensure high-calibre staff by, *recruiting appropriate staff for each category, improving professional skills of the staff, developing technical collaboration with local and foreign institutions and implementing measures for retaining staff*
- Ensure modern infrastructure and library and information communication technology (ICT) facilities for research, and technology transfer and development and for providing the staff with congenial working environment by, *improving the research infra-structure according to the needs of the research programme and for maximising the efficiency of resource use for the same, improving the capacity of undertaking advanced research, developing infrastructure facilities for technology transfer, improving the library and ICT facilities to ensure easy access to research information and improving housing, transport, recreation and other facilities of the institute*
- Increase output-capacity of scientists and other staff of the institute by, *promoting participatory decision making in research and management, promoting team work, assuring facilities for maintaining job/social status, developing research infrastructure and professional skills, improving social life and recognising good work with rewarding schemes for outstanding performers*

## **Vision 2030**

The Sugar Industry has a vision for 2030 and developed a road map to achieve the targets. Its vision for 2030 is,

***'Integrated development of sugarcane industry for self-sufficiency in sugar and production of green energy for contribution to energy security'***

And the Development Target is to,

***'Achieve 50% self-sufficiency in sugar by 2020 and 100% by 2025'***

(Reference: Presentation made by Director, SRI, 7<sup>th</sup> June, 2018)

**The Targets are,**

1. Increase cane yield under irrigation up to 120 t/ha, under rain-fed 80 t/ha and overall average 100 t/ha,
2. Increase sugar recovery rate up to 10%,
3. Sugar yield up to 10 t/ha,



4. Ethanol yield up to 300 L/t and Bagasse yield by 25% under commercial conditions,
5. Minimise cost of cane cultivation and sugar manufacture at least by 10% from the current level,
6. Increase the level of diversification, both crop and processed products,
7. Management of sugar industry wastes and improving degraded sugarcane lands.

#### Research and Development Road Map to Vision 2030

1. Development of short-duration dual-purpose sugarcane (for sugar and energy)
2. Development of energy cane
3. Development of sugarcane varieties tolerant to drought and suitable for mechanical harvesting
4. Development of sugarcane varieties with high level of nitrogen fixation
5. Development of sugarcane farming practices for facilitation of mechanical harvesting and mechanisation of all farming practices
6. Development of bio-fertilisers using phosphate-solubilising and nitrogen-fixing micro-organisms and factory and distillery wastes as carrier medium for soil improvement and waste disposal
7. Utilisation of plant extracts for control of pests and diseases.
8. Use of biological agents for the management of sugarcane insect pests such as woolly aphid and borers and disease such as smut and white leaf disease (by controlling vectors).
9. Disposal of factory and distillery wastes by environment friendly means.
10. Increasing processing efficiencies and development of value-added products

***(Note: The review team noted that the vision 2030 statement is very optimistic and there is no indication in the above plan to increase the sugarcane extent in the country. With the present extent and with another 15 to 20 % yield increase during the next decade or so, it would be rather impossible to become self-sufficient in sugar production. Hence a decision has to be taken by the relevant authority either to put more land under sugarcane cultivation to achieve self-sufficiency in sugar by 2030 or to achieve a more realistic target in sugar production by 2030).***



## 2. Purpose of Review and its Scope

### *Purpose and Objectives*

The main purpose and objectives of this review were,

- To assess the quality, cost effectiveness, relevance and impact of the scientific programs carried out by SRI in order to ensure that Government funds are being effectively utilized to address the sector needs.
- To look into the appropriateness of the research agenda of SRI in meeting the emerging challenges in the future and in particular with 2030 sustainable developmental goals and also national targets ensuring food and nutritional security.
- To look into all the aspects of SRI functions directed towards research and development, dissemination of technology through extension and services offered to its stakeholders and its impact and usefulness to address the timely needs.
- To identify any deficiency in the procedures adopted by SRI in recognizing the research needs of the sector
- To give advices on effective planning and implementing of future programs of SRI

### *Scope*

To achieve the above objectives the Review Panel paid particular attention to following aspects:

1. The mission of SRI and its interpretation with respect to;
  - SRI's sugarcane research and development activities focusing on immediate and long term needs in Sri Lanka
  - Transferring technological recommendations/Research outcomes to relevant stakeholders.
  - The policies and directive of the SLCARP and the relevant Ministry regarding the appropriateness of Mission of SRI in the light of important changes taking place in production and product development in Sri Lanka
  - Appropriateness of the roles of relevant partners in the formulation and implementation of research strategy and priorities of SRI
  - Conservation of natural resources, impact of SRI practices on natural environment and long -term environmental sustainability.
2. The objectives and relevance of the present program of work, budget and its forward plans for the next five years in relation to;
  - The mandate of SRI and its criteria for allocation of resources and planning procedures adopted by the Institution and the mechanisms for their formulation
  - The rationale for its present allocation of resources among research, extension, information exchange and other activities
3. The content and quality and relevance of the scientific work with particular reference to:
  - The results of research during the past 5 years and their practical applicability and economic feasibility including the impact on the Relevant Sector



- The current and future research plan and the role of the various scientific disciplines therein
  - The degree and extent to which the specific needs of the various stakeholders were studied and analyzed in the formulation of the past and current research plans
  - The information exchange and extension programs and the participation of the research staff therein
  - The adequacy of research support and facilities
  - The management of the scientific and financial resources of the institute and the coordination of its activities
  - Level of national and international recognition of the institute and its scientific staff
  - Cooperation/collaboration with universities, regional and international research organizations
  - Adequacy of publications of research findings
4. The impact and usefulness of the institute activities in relation to:
- The recorded and potential impact of research
  - Cooperation with other research institutes and with national development programs, private sector organizations and other stakeholders
5. Examine the extension program of the institute to determine;
- Its effectiveness in the relevant sector
  - The effectiveness of its information exchange programs and the timelines, quality and relevance of the technologies generated and its publications
  - The effectiveness of transferring technological recommendations based on research outputs
  - Mechanism adopted to get the feedback of stakeholders on research outputs and then planning future R&D
  - The identification of problems and constraints impeding the extension programs/dissemination of technological recommendations to the stakeholders.
6. The quality and effectiveness of the management of the institute in relation to;
- Constitution of research, advisory or sub-committees of the Board
  - Adequacy in coordination to ensure excellence of the research program and related activities
  - Competency and professionalism of the directorate and the senior management of the institute and the definition of roles, organization and quality of the leadership of the institute and rapport with staff
  - Nature of the budgetary review and evaluation processes and the involvement of important stakeholders in the above stability of funding and the relationships between budget, institutes policies and plans and the effectiveness of utilization of resources
  - Procedure for determining staffing requirement at all levels for selection evaluation and compensation of staff
  - Administrative of fiscal, purchasing and supply, personal computers, housing and other facilities including transport and general management services and their effectiveness in supporting the scientific staff



7. Services provided by the institute

- Consultancy and Advisory Services
- Laboratory Services
- Pest Control and Fumigation of warehouses

8. Overall analysis through;

- A SWOT analysis to identify internally controllable and uncontrollable factors



### **3. Procedure Adopted for the Review**

A review team comprising of 5 members, identified by SLCARP in consultation with the SRI were formally appointed to review the progress of the institute. The team was guided by the directions given in the guidelines provided by the SLCARP.

The review process had 5 distinctive phases as below.

1. Preparation for the review
2. Visit of review team to the institute
3. Meeting with the stakeholders
4. Preparation of draft report by Review Team
5. Preparation, submission and presentation of the final review report by the Review Team to SLCARP

#### ***Preparation for the review***

1. After identification of the institute to be reviewed, SLCARP forwarded a copy of the format of Self-Assessment report to the Director, SRI.
2. The institute completed the Self-Assessment Report and submitted to SLCARP.
3. SLCARP and the institution agreed on the composition of the review panel identified from the trained reviewers and appointed them.
4. Copies of Self-Assessment Report were sent to the members of the Review Team to study.
5. Chairman, SLCARP met the Review team and the Director of the institution to be reviewed, separately, in advance of the visit to the institute, to identify lines of inquiry and further information and documentation they need during the review visits. The team also identified individuals and groups they wish to meet during the visit and agreed with the Director on dates and time schedule for the review visit.
6. The dates were as follows:  
**7<sup>th</sup> and 8<sup>th</sup> June 2018** - Visit to SRI, Uda Walawe  
**9<sup>th</sup> June 2018** - Meeting with Stakeholders - farmers, farmer organizations and the industry (annex 3).

#### ***Visit of Review Team to the Institute***

1. Initial meeting of the Review Team with the Chairman (SRI), Director (SRI) and a group of representative staff was held for a briefing by the Chairman of the SLCARP. The Chairman, SLCARP briefed the SRI staff on objectives of the review, clarifying the purpose of the review.
2. A presentation was made by the Director of the SRI on management, operation, organization, major scientific activities of the institution and contributions to national development.
3. The review was conducted based on the documents provided and discussions held with the staff of the institute. Information was gathered through following methods.
  - a) Visiting divisions, laboratories, workshops, fields etc.



- b) Discussions held with members of different categories of staff (scientific staff, administrative staff, finance staff, technical staff, field workers and minor staff).
- c) The uses of multiple methods and crosschecking or 'triangulating' the results were adopted during the review. Triangulation refers to the use of different information sources, methods, types of data, or evaluators to study an issue from different perspectives and thereby arriving at more reliable findings.
- d) Studying the supporting documents submitted by the officers of the institute.
- e) Discussions were held from time to time among members of the review team on the overall observations, findings and conclusions before preparation of the final report.

### ***Meeting stakeholders***

A meeting was conducted with sugarcane farmers and representatives of farmer organizations by inviting them to SRI. Another meeting was held with the industry representatives at the Sevanagala Sugar Factory.



## 4. Outcome of the Review

### Assessment on Management Aspects

#### ***a) Institutional Response to External and Internal Environment in Planning Organizational Strategy***

SRI, being a government institute directly administered by the Ministry of Public Enterprise and Kandy City Development (MPE&KCD), it is the responsibility of the institute to follow government policies and development goals already in place. The Director of the Institute is a member of the Board of Governors (BOG) of the SRI and attends meetings regularly to discuss and take necessary actions and decisions in planning and implementation of the research and development activities of the institute. Further, the mandate of the institute is clear to all and is responsive to changes in government policies and strategies. The institute has identified its own strengths, weaknesses, opportunities and threats and they are being always considered in planning out the activities of the institute in consultation with BOG (annex 4). The Director and the divisional heads are involved in planning activities of the institute. Even though the stakeholders do not get involved in setting up strategic plans of the institute, their (mainly the industry) concerns are taken into consideration, which is an outcome of meetings with the industry and research staff. Over 90% of the funding for the institute is allocated from the treasury funds and less than 10% is obtained from other sources such as CESS, services carried out by the institute, and donor funded research projects that may vary from year to year (annex 5). It was observed that government allocations for capital items had been declining and part of the requirements were fulfilled by using the earned funds. A strategic plan and an action plan of the institute were available at the institute. Further, the thrust areas, goals, objectives, and strategies have been identified by the institute. The institute had not been reviewed recently. The last review was done in 1995.

**Table 1: Assessment of Institutional Response to External and Internal Environment in Planning Organizational Strategy**

Management practice	Level of Practice <i>Strong/ Moderate/ Weak</i>	Comments / Evidence
Government policies and development goals are used/considered to establish goals and plan organizational strategy for the institution	<i>Moderate</i>	<i>No specific outcome indicators identified on how government policy and development goals are incorporated</i>



The organizational mandate (as specified by the relevant Act) is considered in strategic planning	<i>Moderate</i>	<i>Organizational mandate considered for research but extending the mandate to cover technology transfer is under consideration</i>
Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning	<i>Moderate</i>	<i>The weaknesses and threats as lack of research officers, training opportunities not considered. Only the strengths and opportunities considered</i>
Stakeholders needs are taken into consideration in strategic planning	<i>Moderate</i>	<i>Industry requirements are considered. Farmer needs are considered to a lesser extent.</i>
The Board of Governors is involved in strategic planning	<i>Moderate</i>	<i>Limited involvement of BOG in strategic planning</i>
The extent to which staff members are involved in strategic planning	<i>Moderate</i>	<i>The priorities are decided at annual review meetings with the participation of the industry representatives.</i>
Government allocations are considered in strategic planning	<i>Strong</i>	<i>Only Government allocations are considered in strategic planning as alternative funding opportunities are minimal and not always guaranteed</i>
The extent to which policies and plans of the organization are reviewed and updated	<i>Weak</i>	<i>No evidence to show updating of policies. It is the high yielding varieties still mainly targeted. Farmers' other needs are hardly considered.</i>

#### **b) Planning Research Programs and Setting Priorities**

The BOG of SRI considers the national development goals at a moderate level when planning research programs and setting up priorities. The decisions are taken at both Ministerial and Institute levels. The Director and the Heads of Divisions take the responsibility in program planning in line with Ministerial and Institutional decisions. When priorities are discussed and decided, the inputs from stakeholders are taken into consideration on *ad hoc* basis but it is not a regular or standard phenomenon. During the planning stage, requirement of funds and equipment are considered and all measures are taken to request necessary amounts. As a principle, the institute does not generate funds, and it is service oriented in all the activities performed.

When planning programs, the ultimate objective is to develop varieties and technologies that can be given to the stakeholders (principal stakeholder is the farmer and there after the industry). Hence, once a recommendation is developed and proved to be acceptable and economical to the stakeholder, it needs to be commercialized quickly. However, acceptance of new technology is a slow process as the present extension programs do not provide sufficient/efficient service to make them popular quickly and enhance acceptance level. The



institute does not have the mandate to carry out the extension work and totally depend on the industry which is not under the administrative control of SRI for feedback and outreach. The efficiency of the institutional procedure in approving new research programs is moderately effective. It is also noted that area based information on socio economic and commercialization aspects of stakeholders is not available and not used in planning.

**Table 2: Assessment of planning research programs and setting priorities**

<b>Management practice</b>	<b>Level of Practice <i>Strong/ Moderate / Weak</i></b>	<b>Comments/ Evidence</b>
National development goals are considered in planning research programs and setting priorities	<b><i>Moderate</i></b>	No evidence to show
Board of Governors participate in planning and priority setting of program	<b><i>Moderate</i></b>	The Director of the institution has a say in priority settings
The extent to which the staff of the institution participate in programme planning and priority setting	<b><i>Strong</i></b>	The RO's participate in these meetings
Stakeholder interests are considered in programme planning	<b><i>Moderate</i></b>	Limited evidence to show participation of all stakeholders other than Industry personnel (through periodic meetings). Minimal farmer involvement
The extent to which programmes are planned and approved through appropriate procedures	<b><i>Strong</i></b>	Acceptable procedures followed
The extent to which the availability of funds (government allocations and other funds) and generated funds are taken into consideration in planning programmes	<b><i>Strong</i></b>	Government allocations and other funds considered in planning programmes; generated funds are also considered, but it is diminishing now.
The obtaining of necessary equipment is considered in planning programmes	<b><i>Strong</i></b>	It is adequately considered
Stakeholders are represented in the institution's planning and review committees.	<b><i>Moderate</i></b>	Only Industry views and requirements are considered but not sugarcane farmers.
The extent to which socio economic and commercialization aspects are considered in programme planning.	<b><i>Weak</i></b>	The mandate does not allow for commercialization. There is no evidence that area base information of stakeholders available and used in planning.



### c) Planning Research Projects

Planning of research projects are mainly derived from identified objectives and strategies, and the rest through Industry and Development Officers of SRI. Discussions are held once in three months. At these meetings, the requirements and problems of stakeholders (mainly industry) in relation to sugarcane research and production are discussed in detail and research projects are planned accordingly. These can be short term, long and medium term projects. Further, the institutional working groups (within divisions) discuss, prioritize and decide on individual projects. The requirements may be proposed by different groups and depending on the type and the problem, to arrive at a solution or a recommendation may take little more time. At this stage, multidisciplinary approach is not common but some researchers work together in achieving a common goal. Though majority of research officers carryout applied research, there are a few who work or prefer to work on basic research. The projects are carried out on many different disciplines such as, breeding, pathology, entomology, soil and plant nutrition management, climate change, irrigation, farm machinery, economics etc. Formation of formal committees or establishment of research clusters would help to plan and implement individual projects efficiently and allocate resources effectively. Present international links among institutes and scientists rest with few overseas institutes, but need to identify the specific activities to be carried out with them (annex 16). It would be also advisable to seek broader scientific linkages with national and international universities and research institutes in planning and implementation of research activities.

**Table 3: Assessment of Planning Research Projects**

Management practice	Level of Practice <i>Strong/ Moderate/ Weak</i>	Comments/ Evidence
The staff is provided with guidance for project planning	<i>Weak</i>	<i>No sufficient guidance due to lack of senior research staff in most areas.</i>
Previous research results/data are used for planning projects	<i>Moderate</i>	<i>No evidence to show that previous data / results used adequately in Planning projects.</i>
The extent to which the institution follows a formal process for preparation, review and approval of projects	<i>Moderate</i>	<i>Considered at the monthly meetings of Heads of Department. Not clear how much influence each research officer has in this regard</i>
The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning	<i>Strong</i>	<i>Totally depend on strategic and annual plans in project selection/planning</i>



Multidisciplinary projects/activities are encouraged by the institute	<i>Weak</i>	<i>Interdepartmental approach in multidisciplinary projects is weak. Only when a new variety is introduced the breeder and others participate to evaluate its performance.</i>
Foreign collaborations are encouraged and incorporated in planning.	<i>Moderate</i>	<i>Collaborations with Australia, Pakistan, China and Vietnam were observed but activities need to be identified and carried out.</i>
Partnership with private sector is encouraged by the institution	<i>Strong</i>	<i>As the direct links with growers (primary stakeholders) is limited, the institution totally depends on Industry partnership.</i>
The extent to which basic research are considered when planning projects	<i>Moderate</i>	<i>Basic research is considered in planning for climate change adaptation and studies on pests /vector lifecycles in developing effective control methods.</i>
The degree to which adverse effects on environment are considered in planning projects	<i>Strong</i>	<i>Studies on predators of pests and diseases, and effects of climate change are considered</i>

**d) Project Management and Maintenance of Quality:**

Project management and quality assurance aspects of the institute can be categorized as moderate. The effectiveness of administrative procedures, found to be strong. However there are areas, such as resource allocation at different levels, availability of equipment, technical staff, capacity building and infrastructure facilities, procurement procedures that are not at optimum level. In many occasions research officers themselves spend quite a lot of time on calling quotations and preparing relevant documentation on procurement of laboratory equipment and other facilities. Furthermore, there is a shortage of research officers trained at PhD level, and most of the research staff are young and lacks experience, with the high turnover. At each division/discipline there should be at least one or two research officers trained at PhD level. However, at present there is a facility to obtain the services of senior and experienced scientists from recognized institutions in planning research programs at divisional level. The support staff also lacks training and updating on new techniques and equipment handling. Program reviews and discussions are held from time to time. Every effort is been taken to complete projects on time as scheduled. However, due to above mentioned factors and insufficient availability of facilities to access scientific literature, data bases, journals and other electronic material through internet and printed information, the projects have suffered to a certain extent.



**Table 4: Assessment of Project Management and Maintenance of Quality**

Management Practice	Level of Practice	Comments/ Evidence
	Strong/ Moderate/ Weak	
The effectiveness of the procedures for resource allocation at different levels (organization, divisions, programs etc.)	<i>Strong</i>	<i>Resource allocation seems satisfactory and there were no complaints from any party.</i>
Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects	<i>Moderate</i>	<i>More Infra-structure facilities and latest equipment needed to meet future challenges. No custom built laboratories.</i>
The effectiveness of administrative procedures and support for project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)	<i>Weak</i>	<i>Procurement process is not satisfactory due to frequent delays in procedures, caused due to lack of qualified staff.</i>
Formal monitoring and review processes are used to direct projects towards achievement of objectives	<i>Moderate</i>	<i>Monthly HOD meetings to review progress of activities.</i>
The extent to which the researchers are supported by the required technical/field staff.	<i>Strong</i>	<i>The available support staff gives strong support but the numbers are not sufficient</i>
Ensuring that established field/lab methods, and appropriate protocols are used	<i>Strong</i>	<i>The standard laboratory methods and protocols used.</i>
Research projects/ S&T activities are completed within the planned time frame.	<i>Moderate</i>	<i>Some projects are extended due to reasons beyond control of ROs (e.g. Wild boar damage)</i>
Ensuring that researchers have access to adequate scientific information (scientific journals, internet, international databases, advanced research institutes, universities etc.) that strengthens the quality of research.	<i>Weak</i>	<i>No adequate internet facilities and access to scientific information especially the scientific journals.</i>
The extent to which quality assurance practices are followed by the institutions	<i>Moderate</i>	<i>Lacking in areas like food processing. No evidence of following any standard quality assurance practices e.g. 5S.</i>



Ensuring that researchers have access to computers and necessary software	<i>Moderate</i>	<i>Access to computers is adequate but necessary software seems inadequate.</i>
---	-----------------	---

**e) Human Resource Management:**

The institute recruits staff directly (for all permanent carders). The records revealed that the institute has not been able to retain the senior officers especially after their training. This has created a serious problem within the institute and the situation has been aggravated as no recruitments were done during the past year or two. It has resulted in shortage of staff in all categories as many cadre vacancies exist in the institute (annexes 6 and 7). It is important for the institute to identify the reasons (both pull and push factors) for leaving by conducting exit-interviews. Further, training of staff and retaining them have become a serious problem, as the available opportunities for training are little. The Human Resources Management (HRM) aspect of the institute is not strong but can be identified as moderate. The selection procedure for training is based on seniority and/or subject oriented. However, most of the officers are nominated by the institute. The working environment is maintained reasonably well and staff is provided with moderate facilities, however, issues such as child care, when officers have to visit other areas, were brought up. Absenteeism is not a serious problem in the institute. Staff performance appraisals have not been conducted in the past. There is no formal system for such appraisal established in the institute. It was evident that when officers go on leave (overseas, maternity etc.) and retirement no prompt action is taken to appoint suitable people to continue the work and therefore, the whole division suffers.

**Table 5: Assessment of Human Resource Management**

Management Practice	Level of Practice  Strong/ Moderate/ Weak	Comments/ Evidence
The institution maintains and updates staff information in a database (including bio data, disciplines, projects, experience, publications,)	<i>Weak</i>	<i>No dedicated HRM functions assigned. Need to focus on goal setting, performance evaluation, reward and recognition, career path planning, exit interviews to address internally controllable HR issues.</i>
The institution, plans and updates its staff recruitments based on programme and project needs	<i>Moderate</i>	<i>Institution has requested cadre increase in areas where growth is anticipated to cope up with emerging issues in the Industry.</i>
The effectiveness of the selection procedures and the schemes of recruitment (SOR).	<i>Moderate</i>	<i>Guided by SOR, but there are anomalies for certain technical cadres for promotional prospects.</i>



Training is based on institution and program objectives and on merit.	<i>Moderate</i>	<i>Job requirements are considered in selecting for training, but need to consider the merit also in selecting for training programs</i>
The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.	<i>Weak</i>	<i>As an approved MOP is not in place, all promotional prospects and incentives are being withheld resulting huge frustration in all grades especially among TOs who has no promotional prospects. Staff needs clear understanding on present status of MOP.</i>
The effectiveness of staff performance appraisals	<i>Weak</i>	<i>No criteria developed for goal setting and performance appraisals</i>
The effectiveness of rewards and incentive schemes in motivating the staff	<i>Moderate</i>	<i>Reward scheme needs to be revisited to motivate officers</i>
The effectiveness of managing staff turnover, absenteeism and work interruptions.	<i>Moderate</i>	<i>There is no effective method especially to handle frequent staff turnovers and any work interruptions. In the absence of exit-interviews exact reasons for staff frustrations cannot be ascertained.</i>

**f) Management of Organizational Assets:**

The ability of the institution to carry out its mandate is well recognized and equipped with necessary background, support and powers. The SRI has become an important sugarcane research institute in the Asian region and well recognized by the researchers and experts in the region. The physical facilities such as buildings, roads, housing, laboratories, fields, equipment, etc. are in good condition but can be improved further. Sub-stations have been provided with funds for improvement of infrastructure.

Steps have not been taken to protect Intellectual Property Rights (IPR) or Breeder's Rights (BR). Though the institute has produced many sugarcane varieties that are already been cultivated by the farmers in Sri Lanka, IPR or BR have not been obtained by the authorities of the SRI. Seed canes of some varieties have even been given to private sector for them to multiply and sell to the farmers with a profit margin.

Income generation is not a mandate of the institute. Therefore, funds are not generated (or no programs are designed to generate income) at the institute. However, limited funds have been generated by providing services (e.g. Soil analysis) to the stakeholders.



**Table 6: Assessment of Management of organizational assets**

Management Practice	Level of Practice	Comments/ Evidence
	Strong/ Moderate/ Weak	
The ability of the institution to carry out its mandate as per its vision and mission	<i>Moderate</i>	<i>Certain amendments have been proposed to ascertain its mandate and to assign statutory powers. Eg. Mandate for sugarcane extension activities.</i>
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.	<i>Strong</i>	<i>In the main station</i>
Vehicles and equipment (lab, field and office) are properly managed and maintained.	<i>Strong</i>	<i>Well maintained, however need additional facilities for group transport (mini bus)</i>
The effectiveness of procedures to ensure that equipment are in working order	<i>Moderate</i>	<i>Repairs for the equipment takes time</i>
The effectiveness of the institution's overall strategy in generation and proper utilization of funds	<i>Moderate</i>	<i>Fund generation is limited as it is more a service organization. Utilizing funds allocated is good but no incentive for fund generation as the institute cannot use such funds</i>
The extent to which the intellectual property rights of the institute are protected	<i>Moderate</i>	<i>Patents have been obtained for some findings (E.g. Machinery). IPR and BR not obtained for many recommendations. Recognition or a reward scheme could encourage researchers on this line.</i>

**g) Coordinating and Integrating the Internal Functions/Units/Activities:**

No formal evaluation of the institute or divisions had taken place during the past several years. However, effective internal communication and coordination mechanisms are in place. Director, DDs and Divisional Heads regularly meet and discuss overall direction and coordination of the institute. The different divisions and substations are assigned with functions and responsibilities that are clearly defined. The R&D activities done and results achieved are reported and documented. The research outputs are presented and discussed at different forums where officers of all divisions and industry representatives are present.



**Table 7: Assessment of Coordinating and Integrating Internal Functions/Units/Activities**

Management Practice	Level of Practice	Comments/ Evidence
	<b>Strong/ Moderate/ Weak</b>	
The extent to which institution is evaluated internally	<b>Moderate</b>	<i>Internal evaluation is present but no periodic external evaluation</i>
The effectiveness of internal communication and coordination mechanisms	<b>Weak</b>	<i>Improvements needed. Many officers and workers indicated that little communication and understanding exist among divisions.</i>
Responsibilities of research and management staff are clearly identified	<b>Strong</b>	<i>No overlaps</i>
Effectiveness of using appropriate reporting procedures and feedback in management at different levels	<b>Moderate</b>	<i>Monthly meetings of the research staff to review progress of research. But no indications of reporting and feedback mechanisms</i>

**h) Partnership in Managing Information Dissemination:**

The institute does not have the mandate to disseminate information generated by them directly to the main primary stakeholder, i.e., sugarcane grower. Therefore, the information is disseminated through the industry. Even though, there are limited links through Development Officers (DO), the linkage between the institute and the farmer is not strong, and it does not work efficiently to meet the stakeholder requirements on time. The only formal system to get the feedback and deliver the solutions to the stakeholder is through the industry, where researcher and industry meet and discuss researchable problems and solutions on a common platform on quarterly basis. However, farmers do not participate at these meetings. If solutions cannot be given then and there, the institute will be committed to undertake an in-depth study before providing a solution to the problem. Further, the institute has taken necessary measures to disseminate information and recommendations to their secondary stakeholders such as, undergraduate and postgraduate students, students from Schools of Agriculture, Technical Colleges, school children, national and international researchers, etc.



**Table 8: Assessment of Partnership in Managing Information Dissemination**

Management Practice	Level of Practice	Comments/ Evidence
	Strong/ Moderate/ Weak	
The institution systematically plans and performs dissemination of information	<i>Moderate</i>	<i>Periodic interactions with the Industry</i>
The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information	<i>Moderate</i>	<i>Only with the industry</i>
The effectiveness of institutional procedures for technology transfer	<i>Moderate</i>	<i>Only through the industry and DOs. Farmers are not satisfied with this mechanism</i>
The effectiveness of the system to obtain feedback from different types of stakeholders	<i>Moderate</i>	<i>Only from the Industry through its own extension service and from periodic meetings, but not much from growers</i>

**i) Monitoring, Evaluation and Reporting Procedures:**

The institute does monitor and evaluate its own administrative, accounting and R&D activities internally. However, monitoring and evaluation procedures are not fully supported by a Management Information System (MIS). The institute and the substations are not interconnected among each other or through MIS. There is an understanding of activities within the divisions and substations of the institute. The results of projects are adequately discussed internally and procedures are in place to report them through reports, seminars, conferences etc. The results further used in future project planning and decision making. The inputs of stakeholders are not entertained in monitoring and evaluation process.

**Table 9: Assessment of Monitoring, Evaluation and Reporting Procedures**

Management Practice	Level of Practice	Comments/ Evidence
	Strong/ Moderate/ Weak	
The institution monitors and evaluates (M&E) its own activities periodically	<i>Strong</i>	<i>Internal annual reviews, quarterly reviews with the industry, and monthly HOD reviews</i>



M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and Results).	<i>Weak</i>	<i>No evidence. Though there is a IT officer at SRI, he needs assistance and commitment to install IT systems</i>
The extent to which S&T results and other outputs are adequately reported internally (e.g. through reports, internal program reviews, seminars).	<i>Moderate</i>	<i>More internal information disseminations is required.</i>
External stakeholders contribute to the M & E process in the institution	<i>Weak</i>	<i>Not much involvement of the Industry or other stakeholders</i>
The extent to which the results of M&E are used for project/research planning and decision-making.	<i>Moderate</i>	<i>Up to a moderate level as indicated in annual reports</i>

### **Assessment on Output**

#### ***a) Technologies developed:***

Many technologies have been developed by the institute. The most outstanding outputs are development of high yielding improved sugarcane varieties (annex 8). The breeding programs of the institute are commendable and approximately 70% of the varieties cultivated by the Sri Lankan sugarcane farmers are products of the institute. Still there is a liking for the time tested variety, CO 775. The important characteristics of the varieties are high cane and sugar yield, resistance/tolerance to pests, diseases and moisture stress. Further institute's recommendations focused on pest management, agronomic practices as well as fertilizer application. All varieties developed are capable of giving over 120 t/ha under irrigation and 80 t/ha under rain-fed conditions at farmer level. However, No adaptive research trials are conducted and the average yields are less than the potential. There are also several improved breeding lines in the pipeline, already tested for desired characteristics and ready to be released in the near future. Breeding is a continuous process and institute has made its significant contribution to maintain its mandate as in the past by developing high yielding varieties to suit the farmers' requirements (annex 8).

Technologies developed are evaluated for their economic feasibility by the Economics division. However, due to limited staff in that division, no extensive surveys have been carried out to evaluate the impact of the adoption of these technologies on the farmers economic, health, education and living conditions. Especially given that institute has a responsibility to support the 2030 SDG agenda, these information are vital.

#### ***b) Technologies transferred to industry/entrepreneurs:***

The SRI has established systems and procedures to transfer recommendations to the farmers and other stakeholders (improved varieties and other research outputs) through the industry. Once the varieties are recommended, breeders produce necessary quantities of breeders' seed and hand them over to the industry for multiplication and distribution of seed. Further the institute distributes limited quantities of breeders' seed to farmers who are involved in seed production and sale.



Similarly, the other recommendations and technologies developed by the institute are transferred through the industry. The officers of the institute will organize limited number of training programs for the industry as well as for the farmers (annex 9). Although these programs are conducted by the institute, a facility such as a training center or other training facilities are not available within the institute. The research staff serves as the resource persons for these programs. The SRI funds are utilized for these programs.

**c) Information dissemination/extension:**

The institute has prepared several reports, training manuals and advisory leaflets (annexes 10 and 11) to be distributed among stakeholders. These documents give detail description of recommendations and technologies developed by the institute. Further the institute organizes field demonstrations for the stakeholders. They also disseminate their recommendations by participating in events (e.g. exhibitions) organized by other organizations such as, schools, universities, provincial councils, other departments and ministries.

**d) Publications:**

Only few researchers in the institute have published their research findings in reputed ISI journals and other journals. Most of them have published in SRI journal and some have presented and published their findings in international and national conferences, workshops and seminars. Some have developed their recommendations and technologies into monographs and reports (annexes 12a and 12b).

**e) Patents:**

Few researchers have obtained patents for their efforts. Being a government organization, all technologies developed and released are given to the stakeholders free of charge. Though the institute has developed varieties and distributed all over Sri Lanka, neither the breeder nor the institute has taken any measure to secure patent rights. It was also observed that breeders' seeds of some popular varieties are given to the industry free of charge. The same group of seed producers sells the seed at a higher price to farmers after multiplication. Institute does not operate as a 'fund generating' organization as it is the policy of the SRI (annex 14a).

**f) Services:**

All activities done by the institute is service oriented, targeting the sugarcane farmer and the industry. Soil analysis, farmer training programs, demonstrations, in-plant training programs for university students, training programs for school children etc. can be considered as services rendered by the SRI. The Mechanization Technology Division has designed a limited number of equipment and has also produced limited numbers in their work shop to be sold at a subsidized rate to the industry. However, no effort has been made to liaise with outside manufacturers, for mass scale production. The Processing Technology Division has produced a several products which are sold at their welfare shop. However, no efforts have been taken to transfer these technologies to outside manufactures.



**g) Staff training:**

Training of staff at all levels had been poor in the recent past. Little training opportunities were available for research staff at postgraduate level. Hence HRD aspects of the institute had been at moderate level (annex 13). Though short term training on technological aspects had been effective, researchers' training needs on research management, HRM, project management etc. have not been looked after. Training for technical officers on handling and calibration of scientific instruments and their maintenance, laboratory maintenance, Labor management and farm management are areas to be considered. Financial officers need to be trained on financial management, and administrative officers too need training on administration related issues. Further, leadership training programs can also be considered for all categories of officers.

**h) Other:**

*Awards* - Officers have won several awards for their contribution in the field of sugarcane research during the past few years (annex 14b).

*Rewards* – A cash reward scheme is in place for appreciation and recognition of work done by the officers (One lifetime reward and two rewards for contribution during previous two years are made bi-annually).

*Welfare* – The welfare facilities provided to the staff by the institute were at moderate level. Due to delay in obtaining approval for the MOP, several benefits that staff should get, have not been materialized.

*Incentives* – There is no system at SRI to appreciate/acknowledge work done by the staff (other than research staff). This also has added to frustrations. The technical staff has no career path to develop. This is an area that needs to be studied by the management and give suitable solutions.

*Delays in Promotions* – It was noted that most staff members have not got their promotions on time due to delay in obtaining approval for MOP.



## 5. Staff Strength of the Institute

The present situation of the staff strength is not satisfactory. It is important to maintain a strong core of PhD level researchers in each salient areas of research. Out of a total of 28 scientific staff members, only 5 are qualified with PhDs and 5 others have MPhil degrees. Ten are qualified with MSc degrees (annex 13). Further, the institute has not been able to maintain its full capacity of the carder during the past few years (annex 6). This situation has adversely affected the research and development programs of the institute. Further, resignations of experienced researchers from the institute have aggravated the situation. The recruitment of staff for all categories had been delayed. The promotions to higher grades, too, had been delayed leading to frustration among the officers which is detrimental for the national development in the long run. Efforts should be taken by the management to look in to the avenues for postgraduate training positions leading to PhD, for the research staff.



## 6. Outcome of Stakeholder Meetings

As part of the review process, the Review Team had meetings with stakeholders representing farmers, farmer organizations and the industry. The meetings were held at SRI and the Sevenagala Sugar mill.

The stakeholders discussed matters pertaining to their own organizations/experiences and came up with suggestions how SRI can make changes to its outlook by making significant contribution to develop cordial and beneficial collaboration with the stakeholders. Every stakeholder actively participated in the discussions which were carried out in a cordial and friendly manner. Although certain areas highlighted by the stakeholders were not within the purview of SRI mandate, the key points that have relevance to SRI are highlighted below.

### *Farmers and Farmer Organizations:*

- a. Close collaboration between SRI and farmers is necessary. Most of them are unaware of activities carried out by SRI and/or experiencing difficulties in contacting SRI officials for advice or assistance. Hence, a formal mechanism needs to be developed to create more coordination between SRI and the farmers. Most activities with farmers are carried out in an informal basis using their personal contacts.
- b. SRI needs to establish demonstration plots to disseminate their technology among farmers. Presently it is happening through the industry but not effective enough. Establish more adaptive research programs in farmer fields.
- c. SRI needs to strengthen its farmer training programs for the benefit of majority of farmers.
- d. The variety CO 775 is popular among farmers and more ratoon crops can be harvested.
- e. Some farmers reported that the variety SL 96 128 is more susceptible to diseases than CO 775. Hence, harvesting period of SL 96 128 is critical (need to harvest at the correct time).
- f. Milling capacity is low in the factory and harvesting period gets extended which contributes to a yield loss due to over maturity of the cane. Hence, there is a need for industry to improve their capacity to accommodate the full crop within the harvesting period without any delay. Farmers should be informed with the harvesting plan (cutting plan) in advance.
- g. Variety SL 98 2524 is a straight and does not lodge, but manual harvesting is difficult.
- h. Sugarcane farmer should be equipped with modern machinery to overcome the shortage of manpower in the area. Harvesters, cane loaders, inter-cultivators, rotavators are some of the items mentioned. These may be imported from other countries.
- i. There is a shortage of healthy planting material in the area. Some planting material distributed among farmers is contaminated with diseases. There is no mechanism for certification as in other crops. Well organized planting material propagation, certification and distribution mechanism should be introduced for sugarcane cultivation.
- j. Soils of farmer fields need to be tested before application of fertilizers to avoid wastage through application of excess amounts of fertilizers.
- k. Farmers prefer urea instead of ammonium sulphate.



- l. Farmers wanted re-introduction of Glyphosate for weed control (on the bunds etc.), as poor weed management has caused significant yield reduction during the past few years. Effective weed control methods are critical in sugarcane cultivation.
- m. Need for a more interactive web site with more information on sugarcane cultivation and production aspects, and make it closer to average sugarcane farmer.
- n. Wild elephants and porcupines have become serious pests in sugarcane cultivation. However, farmers have managed to control wild boar.

### **Industry**

- a. There is scope for further improvement of relationship between SRI and the industry.
- b. SRI research work on sugarcane breeding, cultivation and other agronomic practices are well acknowledged by the industry.
- c. Assistance of SRI is needed to work out problems related factory aspects and on sugar processing (mill extraction and efficiency).
- d. SL 96 128 gives 44% heavier canes and more juice with higher sugar content than average.
- e. Industry accepts that there is a problem in milling capacity in their factory. Due to poor milling capacity and delay in milling, approximately 4% of juice yield is lost between harvesting and milling. Approximately there is a delay of 4 to 5 months. July, August and September are the best months to harvest. But it gets extended up to January.
- f. Average farmer cane yields recorded are, 105 T/ha under irrigation and 65 T/ha under rain-fed conditions.
- g. In the absence of Glyphosate, new effective weedicide needs to be introduced and recommended.
- h. Industry needs more machinery, such as Harvesters, Cane Loaders, Inter-cultivators and Winch mounted tractors. SRI should work on these and make suitable recommendations. A team comprising a group of staff from SRI and the Industry may visit countries in the region where machinery are being extensively used by the farmers, and identify appropriate machines to be used in Sri Lanka, after conducting a thorough testing on suitability of the same to Sri Lankan conditions.
- i. In rain-fed areas ground water can be tapped using solar-powered water pumps to irrigate the crop. Recommendation from SRI is needed on this matter.
- j. Under Sevanagala sugar factory, there are 35 extension officers engaged in extension work. Under each officer there are 250 assigned farmers. These extension officers need training on agricultural extension methodologies and sugarcane cultivation technology to carry out their work more efficiently and effectively.
- k. Industry possesses hot water treatment facility for treating seed cane for planting purposes. The capacity of the treatment plant is 1 T/hr. This capacity may not be sufficient to meet the demand during the planting season.



## 7. Overview of the Institution's Performance and Contribution to National Development

The SRI has taken a lead role in sugarcane research and development in the country since its inception. Even though the institute started its activities 35 years ago, it could make its active contributions only from 1991. Since then SRI has developed many technologies that have made a significant impact on sugarcane production in Sri Lanka. The most outstanding output has come from varieties developed for several agro ecological regions in the country. The breeding programs conducted by the institute is commendable and presently over 70% of the varieties cultivated by the farmers are the products of the SRI. As a result of adoption of these varieties for cultivation by the farmers, national yields have increased by two fold, thus reporting an increase in local sugar production during the past couple of decades. The varietal characteristics developed by the breeders had exhibited a wide range of yield performance and agronomic characteristics.

The significant achievements of the institute during the period from early 1990s include development and release of 18 elite sugarcane varieties for commercial cultivation and recommendation of low-cost planting methods (spaced planting, spaced transplanting and lateral shoot multiplication, rapid propagation methods) of sugarcane and production of disease-free planting material, soil fertility management practices including chemical fertilizer application, green manure cropping and use of bio-fertilizers, integrated management of weeds in sugarcane plantations, integrated management of sugarcane pests, particularly by biological means, hot-water treatment methods for elimination of disease-causing pathogens (white leaf disease), methods for improvement of drainage conditions and efficient utilization of rainwater and irrigation water and management of sugarcane ratoon crops. The institute was able to control two major pest outbreaks (*Pyrrilla* in 1992 and Woolly Aphid in 2006) biologically, sustaining the cultivation. The institute has developed few small-scale farm implements for mechanization of sugarcane farming to reduce cost. To diversify sugar industry by increased value added products, SRI has produced high-quality jaggery with different flavors and ingredients such as peanut, cashew and sesame. Further, utilization of factory and distillery wastes such as filter-mud and bagasse for bio-fertilizer production, production of fruit-flavored sugarcane drinks etc. have been demonstrated.

The knowledge and technologies developed have been transferred to sugar companies and growers by conducting training programs, demonstrations, and through extension materials and publications.

The industry has been successful in managing a contract grower system. Under this system there are around 15,000 farmers growing an extent of around 17,000 ha. SRI and the industry have a sound relationship, to disseminate the technologies to the farmers as well as a feedback mechanism with reference to problems in the industry. Given that many Sri Lankan small holders of other field crops face marketing problems (especially price fluctuations), the Sugar industry has been able to guarantee a market and a stable price to all sugarcane growers. This is a model that can be emulated by other crop sectors as well.



## 8. Recommendations

### A. On Management

#### Internally Controllable -

- a. Make improvements to the action plan and strategic plan of the institute with inputs from all relevant parties including the emerging trends in the sugarcane industry.
- b. Develop awareness among all staff members, on institute's mandate and responsibility and to act accordingly. The institute has a bigger responsibility and a major role to play at national level in all aspects of sugarcane research and development.
- c. Maintain a constant dialogue with the administrators, stakeholders (farmers and industry), researchers, extension workers, policy makers etc. and get their inputs in strategic planning and prioritizing research.
- d. Develop a formal monitoring and review process on project basis towards achievement of objectives.
- e. Board of Governors should look into the reasons for delay in promotions of some staff members as it has led to frustration and has adversely affected the output of the staff.
- f. Improve the existing management information system (MIS) of SRI to enable all administrative, managerial, executive and other staff to get the full benefit. Introducing '5s' system is further recommended.
- g. Publish newsletters periodically in all three languages and disseminate research information throughout the country.
- h. Develop social interaction within SRI community through 'Team Building' activities such as, Out-bound and Leadership training, for all staff members so that they could participate together to develop avenues to build bridges of understanding and mutual respect.
- i. Develop criteria for goal setting and performance appraisals for officers.
- j. Perform exit-interviews to get feedback on reasons for leaving the institute.

#### Externally Controllable -

- a. Develop a mechanism to review, evaluate and update the institute's policies and plans periodically, either externally or internally.
- b. Develop a mechanism to generate funds from programs conducted by the institute. Programs can be conducted regularly for different groups and funds generated should be used for future research and development activities of the institute (e.g. Soil testing) and also for welfare activities.
- c. Encourage scientists to, carryout multidisciplinary projects/activities, foreign collaborative projects, apply for external research grants from NSF, NRC, IAEA, CARP, develop partnerships with private sector and give due recognition to researchers involved in such projects.
- d. Ensure that projects do not suffer due to inadequate officers, infrastructure, equipment, instruments, facilities, space etc.



- e. Ensure scientists/researchers have access to adequate scientific information that strengthens the quality of research. SLCARP may take the initiative in establishing a national resource centre for downloading important scientific publications from organizations such as Science Direct, Springer, Blackwell etc., and make them available to the researchers.
- f. Develop a mechanism to train staff regularly at all levels (Administrative, Accounting, Research, Technical etc.). Postgraduate training at PhD level is critical for researchers. One or two PhD level trained officers for each division are a must. Most divisional Heads are not PhD holders.
- g. It was noted that the 'Manual of Procedures' (MOP) is not updated and approved by the Ministry. It has taken long years. This needs serious attention of all administrative staff and the BOG to get the MOP approved, to make decisions and take actions without any delay. Educate the staff on present status of MOP and take actions to correct this situation.
- h. Board of Governors need to fill all vacancies with qualified staff as early as possible.
- i. As the apex body of sugarcane research and development in Sri Lanka, develop a mechanism to maintain strong and efficient links with key partners and stakeholders for sharing and dissemination of information and also to obtain feedback.
- j. The Ministry and the BOG should take immediate action to expedite the implementation process to change the mandate of SRI, by establishing an extension and training arm for SRI.
- k. Lack of direct outreach activities appears to be a major constraint regarding a realistic feedback for research planning. More interactions are needed at field level with farmers and the industry. Hence, develop an outreach programme directly reporting to the institute to upgrade the research planning. Further, establishment of well-equipped Resident Training Centre at SRI, with facilities to train farmers is recommended.
- l. Initiate a system to obtain IPR, BR and patent rights for all technologies developed by the institute, including varieties.
- m. Need to re-visit/study the cadre positions, qualifications and career paths of technical officers, assistants etc. Make all technical officers clear about their SOR and the promotion scheme.
- n. There is a shortage of vehicles at SRI. Some are old and need repairs. It is recommended that institute take action to purchase few vehicles for the use of research staff as they have to travel to different parts of the country for research purpose.



## B. *On Research:*

### *Internally Controllable*

- a. Maintain vision and mission of individual divisions in line with the institute's vision and mission statements in order to design and plan for potential research problems that could emerge in the near future.
- b. Introduce staff development programs to meet the requirements urgently needed, in view of the fact that future threats on sugarcane production are not assessed or predicted.
- c. Staff should be trained in scientific writing and need to encourage researchers to publish their findings in ISI journals. The article clearing process within the Institute need to be expedited.
- d. Need to research and develop an efficient weed management practice especially in the absence of an effective weedicide.
- e. Need to pay more emphasis on sugarcane cultivation with less amount of water as water becoming a scarce resource.
- f. Action should be taken to research on using solar power pumps to tap water in rain-fed areas without causing damage to underground water resources.
- g. Need for research to reduce chemical fertilizers and save foreign exchange by using nanotechnology, coated urea etc. Ways of increasing efficiency of local sources of plant nutrients such as Eppawala apatite and more efficient ways of using sugar bagasse need to be worked out.
- h. Even though economic feasibility studies have been conducted on SRI's introduced technology, it is recommended that the adaptability, acceptability, attitudes of farmers for adoption etc. be studied. Also, with reference to SDG's baseline information of the present status of farmers is needed to be documented in line with the indicators developed by the Department of Census and Statistics.
- i. The economic feasibility, consumer preference and marketability for newly processed sugarcane products need to be carried out. These studies may be done in liaison with both Economics and Technology Transfer Divisions.
- j. The processing division should research into milling and sugar recovery aspects.
- k. Services of Mechanization Division are limited mostly for repairs and maintenance work of the institute. Given the huge demand for mechanization, this division has to be more pro-active in designing, fabrication, testing of appropriate technologies. Its linkages with the industry for manufacturing and extension need to be improved. Service of an experienced Mechanical Engineer is vital.
- l. Wild boar damage in research fields is a serious issue. It seems there is no easy answer. Management should give serious consideration to protect all research fields from this pest. It needs to be a combination of several applications, including good wire mesh for netting with a short concrete wall so that animals cannot break-in, an electric fence and a better security personnel with guns etc. Value of research plots cannot be compensated by surcharging from security personnel/firms. (E.g. valuable breeding lines).
- m. A reward scheme is in place for appreciation and recognition of work done by the officers. This area needs to be looked into for a better reward scheme.



### Externally Controllable

- a. It is absolutely imperative for the development of research programs and, by and large, the development of the SRI, the institute should have PhD level scientists in the fields of Agronomy, Breeding, Plant Protection, and Soil Fertility Management. Immediate action is required to initiate PhD level training of the existing staff in above areas.
- b. Although the basic equipment for research is available, with the anticipated demand for extensive R & D activities with the targeted productivity improvement of sugar industry, the research laboratories will need better, modern and state of the art infrastructure. As the work load will be increasing the space available for most laboratories is insufficient. Hence, expansions are needed for laboratories in the near future.
- c. Emphasis on mechanization is needed as labour is getting scarce to make sugar cane cultivation attractive to younger generation, through use of solar powered water pumps, weeders, inter-cultivators, ridgers, loading machines, winch mounted tractors, combined harvesters etc. Institute can take the initiative with the support of industry in identifying, importing, testing appropriate machinery already developed in other countries. The machinery should be tested under local conditions before recommending to the farmers.
- d. The knowledge and technologies generated should be transferred to sugar industry and farmers in a formal manner and necessary facilitation for their adoption should be done. Developing social interaction between SRI Officers and the officers from the industry to build understanding and respect is important. Further the institute should also get involved in cottage-level sugarcane industry in areas where sugar manufacture cannot be carried out.
- e. It is recommended a team of staff from SRI and Industry visit countries in the region to assess the availability of machines, that suit Sri Lankan Conditions and recommend to both SRI and the industry to import, test and make available for the industry. This is important, as there is already an acute labour shortage and the next generations of farm families are not willing to work manually in sugarcane fields.

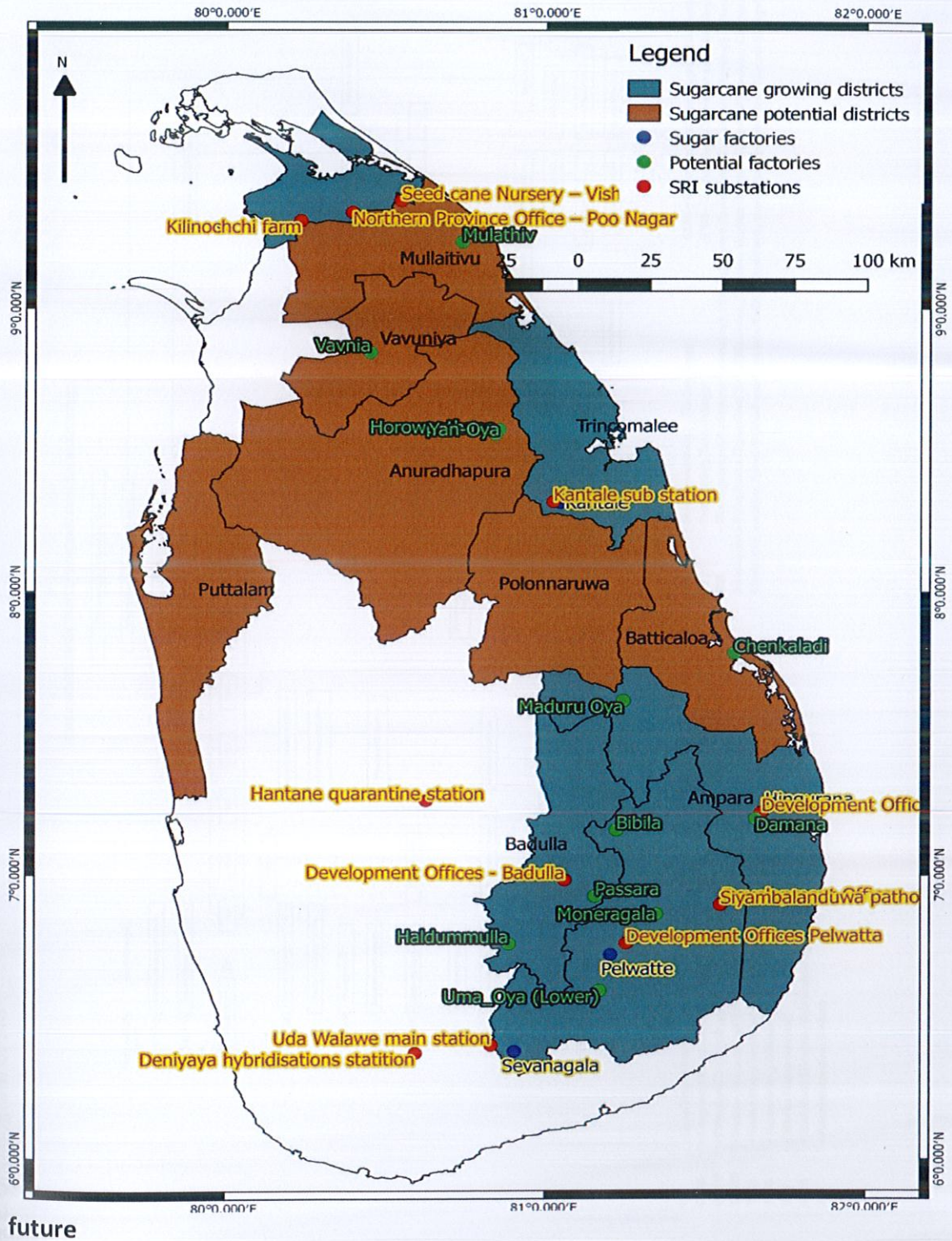
### **C. General**

- a. 'Manual of Procedures' (MOP) - In absence of an approved MOP has caused frustration among staff. Hence, immediate action needs to be taken by the BOG and the administration to provide common facilities in relation to welfare of the staff at SRI.
- b. The workers specially working in the processing sections and laboratories need to be attired in a professional manner.
- c. There need to be periodic meetings to enhance the knowledge base of the workers by making aware about activities of all divisions.
- d. Also the management might want to re-look at the transfer systems among divisions that took place recently which is also a reason for frustration among staff.
- e. Possibility to have a child/day care center within SRI should be looked in to.



## 9. Annexes

Annex 1: SRI sub-stations, present sugarcane growing areas and potential areas for









**Annex 3: Program for the External Review of Sugarcane Research Institute from 07<sup>th</sup> to 09<sup>th</sup> June 2018**

**06<sup>th</sup> June 2018**

- 07.00 pm      Arrival of the members of the review panel, Chairman, Secretary and Senior Scientist of SLCARP (Accommodation at CBs of SRI and NAQDA, Uda Walawe)
- 08.00 pm      Dinner at CB, SRI

**07<sup>th</sup> June 2018**

- 06.30 am - 08.30 am    -      Visit to SRI research and foundation seed farms at Uda Walawe
- 08.30 am - 09.30 am    -      Breakfast at CB, SRI
- 09.30 am – 12.30 pm    -      Meeting with all staff officers of SRI at the Conference room, SRI  
*Welcome – Chairman, SRI*  
*Introduction to review – Chairman/Secretary, SLCARP*  
*Presentation on SRI – Director, SRI*  
*Discussion – Chairman/Review Team to conduct*  
*(Tea will be served during the session)*
- 12.30 pm - 01.30 pm    -      Lunch at CB, SRI
- 01.30 am – 03.00 pm    -      Meeting with the staff of the Crop and Resource Management Division and inspection of the lab
- 03.00 pm – 04.30 pm    -      Meeting with the staff of the Crop Nutrition Division and inspection of the lab
- 04.30 pm - 06.00 pm    -      Meeting with the staff of the Crop Improvement Division and inspection of the lab

**08<sup>th</sup> June 2018**

- 08.30 am - 10.00 am    -      Meeting with the staff of the Crop Protection Division and inspection of the lab
- 10.00 am - 10.30 am    -      Tea
- 10.30 am - 11.30 am    -      Meeting with the staff of the Mechanization Technology Division and inspection of the workshop and the hot-water treatment plant
- 11.30 am - 12.30 am    -      Meeting with the staff of the Processing Technology Division and inspection of the lab and the jiggery processing unit
- 12.30 pm - 01.30 pm    -      Lunch at CB, SRI
- 01.30 pm - 02.30 pm    -      Meeting with the staff of the Economics, Biometry and IT Division
- 02.30pm - 04.00 pm    -      Meeting with the staff of the Technology Transfer and Development Division. (Tea will be served during the meeting)
- 04.00 pm - 04.45 pm    -      Meeting with the staff of Accounts section
- 04.45 pm - 05.30 pm    -      Meeting with the staff of the Administration section



### 09<sup>th</sup> June 2018

- |                     |   |   |
|---------------------|---|---|
| 08.30 am – 10.15 am | - | Meeting with farmers and representatives of farmer organizations  |
| 11.00 am – 01.30 pm | - | Visit to Lanka Sugar Company (Pvt.) Ltd.- Sevanagala<br>Meeting with the CEO, General Manager, DGM (Plantations,<br>Factory and Distillery) |
| 02.30 pm – 03.00 pm | - | Lunch at CB, SRI  |
| 03.00 pm            | - | Departure   |

### **Annex 4: SWOT Analysis of SRI**

#### ***Strengths***

- i. Improved Infra-structure
- ii. Available Knowledge base
- iii. Availability of dedicated young staff
- iv. Improved links with the farming community
- v. Genetic resources
- vi. Well-developed breeding programme
- vii. Breeder's seed stock
- viii. Disease-eliminated seed-cane production capability
- ix. State of the art nursery to supply seed cane
- x. Laboratory and screen house facilities at main research stations
- xi. Well focused result oriented research programs to fulfill national goals

#### ***Weaknesses***

- i. Lack of provisions in the SRI Act for technology transfer, development and regulatory functions
- ii. Insufficient funds for research and development
- iii. Shortage of experienced and trained staff
- iv. Remote location
- v. Poor remuneration and inadequate facilities for staff
- vi. Procedural barriers
- vii. Lack of modern scientific infrastructure for advanced research
- viii. Insufficient land for research
- ix. Lack of overseas training opportunities
- x. Lack of incentives for staff
- xi. Lack of regular replacement/repair of scientific equipment/instruments, tractors and farm machinery and vehicles
- xii. Weakness of the sugar industry in decision making process on research and development activities
- xiii. Inadequate library, laboratory and field facilities for research

#### ***Opportunities***

- i. Potential for improving productivity
- ii. Potential for diversification
- iii. Stable market



- iv. Favourable effects of climate change and potential for carbon trading and as a source of renewable energy
- v. Wide adaptability and suitability to undeveloped dry and intermediate zone areas
- vi. Demand for sugarcane cultivation in non-traditional areas and opportunities for expansion
- vii. Ornamental and edible value
- viii. Placement of SRI and sugar industries under one ministry
- ix. Mutually beneficial links with international institutes
- x. Being an important commodity in the country, assured market for the produce
- xi. Increasing demand for sugar
- xii. Market creation of sugar based value added products
- xiii. Strong international research network and collaboration
- xiv. External sector incentives (regional trade agreements and bi-lateral/multi-lateral agreements)
- xv. Research networking with universities, private sector and NGOs

#### **Threats**

- i. Disorganised industry
- ii. Absence of implementation of approved policies and lack of master plan for the sugar industry development
- iii. Competition from other crops
- iv. Misconceptions on sugarcane
- v. High capital requirement
- vi. Frequent changes of Ministries under which SRI has to work
- vii. Environmental factors (Climate change, floods and droughts) affecting the cultivation
- viii. Younger generation shifting from sugarcane farming
- ix. Research experts leaving the institution
- x. Increasing cost of production with inflation
- xi. Banning Glyphosate
- xii. Wild boar damage

#### **Annex 5: Budget of SRI (2018)**

Description	Rs. Million
<b>Income:</b>	
Treasury grant	350
Treasury grant for Kantale and Kilinochchi projects	10
SRI (Generated)	109
<b>Total</b>	<b>469</b>
<b>Expenditure:</b>	
Recurrent	285
Capital	174
Kantale and Kilinochchi projects	10
<b>Total</b>	<b>469</b>



Description	Allocation (Rs Million)			
	CF	GF	MF	Rs. Million
Recurrent	260	25	-	285
Capital	90	84	10	184
<b>Total</b>	<b>350</b>	<b>109</b>	<b>10</b>	<b>469</b>

(Note: CF – Consolidated funds; GF – Generated funds, MF – Ministry funds)

#### Annex 6: Staff Cadre Position at SRI (as at 31<sup>st</sup> December, 2017)

Staff category	Salary code	Designation	Cadre	No. in position		
				According to approved cadre	Personal to person in position	According to PA Circular 15/2014**
Senior Manager	HM 2-3	Director	01	01	-	-
Senior Manager	HM 1-3	Deputy Director (R&TT)	01	01	-	-
		Deputy Director (A)	01	-	-	-
		Principal Research Officer	05	02	-	-
		Principal Technology Transfer Officer	01	-	-	-
Senior Academic/ Research	AR2	Senior Research Officer	04	03*	-	-
		Senior Technology Transfer Officer	01	-	-	-
Academic/Research	AR1	Research Officer	16	16	-	-
		Technology Transfer Officer	01	01	-	-
Manager	MM 1-2	Accountant	01	01	-	-
		Internal Auditor	01	01	-	-
		Assistant Director (Administration)	01	01	-	-
Junior Manager	JM 1-2	Accounting Officer	01	01	-	-
		Administrative Officer	01	01	-	-
		Procurement Officer	01	-	-	-
		Development Officer	05	05	-	-
		Farm Superintendent	01	01	-	-
		Works Superintendent	01	01	-	-
Operational/ Instructional	MA 4	Documentation officer-cum-Translator	01	-	-	-
Management Assistant-Technological	MA 2-2	Technical Officer	20	20	-	-
		Store Keeper	01	01	-	-
		Book Keeper	01	01	-	-
		Inspector of Works*	-	-	01	-
Management Assistant-Non-Technological	MA 1-2	Management Assistant	18	18	-	-
		Telephone Operator/Receptionist	01	01	-	-
		Works Supervisor*	-	-	01	-
Primary-Level Skilled	PL 3	Driver	12	12	-	-
		Tractor Driver	02	01*	-	02
		Electrician	02	02	-	-
		Welder	01	01	-	-
		Fitter	01	01	-	-
		Blacksmith	01	01	-	-
		Carpenter	02	02	-	-



		Mason/Plumber Mechanic	01 01	01 01	- -	- -
Primary-Level Semi-Skilled	PL2	Lab/Field Attendant Water Pump Operator Circuit Bungalow Keeper	09 03 01	09 03 01	- - -	01 - -
Primary-Level Unskilled	PL 1	General Worker Lorry/Bus Cleaner Office Peon/Messenger	69 01 01	65* 01 01	- - -	- - -
		Worker	-	-	16	25
Total			193	179	18	28

Note: \* Arrangements have been made to fill vacancies. \*\* Personal to the person in position.

### Annex 7: Qualifications of Scientific, Managerial and Technical Support Staff

Name	Designation	Qualifications
<b>Scientific:</b>		
Dr A P Keerthipala	Director/Chief Executive Officer	BSc (Agric.), MPhil, PhD
Dr W R G Witharana	Dep. Director (Research & Technology Transfer)	BSc (Agric.), MPhil, PhD
Dr A Wijesuriya	Principal Research Officer	BSc (Agric.), MPhil, PhD
Dr M S Perera	Principal Research Officer	BSc (Agric.), MPhil, PhD
Mr A L C De Silva	Senior Research Officer	BSc (Agric.), MPhil
Mr K A D Kodituwakku	Senior Research Officer	BSc (Agric.), M Agri.
Ms B D S K Ariyawansha	Senior Research Officer	BSc (Agric.), MPhil
Ms A M M S Perera	Research Officer	BSc, MSc
Dr (Ms) D Manel	Research Officer	BSc (Agric.), MSc, PhD
Mr K H D Abeyratne	Research Officer	BSc (Agric.)
Mr L M J R Wijayawardhana	Research Officer	BSc (Agric.) MPhil
Mr. B R Kulasekera	Research Officer	BSc (Agric.)
Mr G A A Chaturanga	Research Officer	BSc (Agric.)
Mr K P Wickramasinghe	Research Officer	BSc (Agric.), M Phil
Ms V K A S M Wanasinghe	Research Officer	BSc (Sp), MSc
Mr. H A S Weerasinghe	Research Officer	BSc, MPhil, MSc (NRM), MI Biol.
Ms K M G Chanchala	Research Officer	BSc (Agric.), MSc
Ms S M T A Maralanda	Research Officer	BSc (Agric.), MSc
Mr K T Ariyawansha	Research Officer	BSc (Agric.), MSc
Mr Y A P K Dayasena	Research Officer	BSc (Agric.), MSc
Ms M G G N Sewwandi	Research Officer	BSc (Eng.)
Mr D P W Pottawela	Technology Transfer Officer	BSc (Agric.), PG. Dip. (BA)
Mr R A P A Ranatunga	Development Officer	Dip. (Agric.)
Mr S N Wickremasinghe	Development Officer	BSc (Agric.), MSc
Mr W G M S Weragoda	Development Officer	BSc (Agric.), MSc
Mr M K P C Gunawardene	Development Officer	BSc (Agric.), MSc
Mr A P Karunathilake	Development Officer	BSc (Agric.)
Ms A N W S Thushari	Research Officer	BSc (sp)
<b>Managerial:</b>		
Ms D M J N Dissanayake	Accountant	B Com, MBS
Mr P K N Priyadarshana	Assistant Director (Administration)	BSc (Adm.), CBA
Dr C Epitawala	Administrative Officer	PhD (Moscow)
Mr S P Y Muneendra	Internal Auditor	ICA (intermediate) MAAT
Mr I B Kodagoda	Accounting Officer	B Com
Mr H P R Kumara	Procurement Officer (up to 18.05.2017)	BB Mgt.
Mr P R B Chandrasena	Farm Superintendent	BSc (Agric.), MSc



Mr G S K Dahanayake	Works Superintendent	BSc
<b>Technical Support</b>		
Mr A P J Mohotti	Senior Technical Officer	-
Ms A L C Kumari	Senior Technical Officer	-
Mr R A Premachandra	Senior Technical Officer	-
Mr D Weerasinghe	Senior Technical Officer	-
Ms L D D P Gunarathna	Technical Officer	Dip. (Agric.)
Mr W G Nimal	Senior Technical Officer	-
Mr P B G S Sandanayaka	Senior Technical Officer	Dip (Agric.)
Mr I P Manawadu	Technical Officer (from 04.07.2017)	Dip (Agric.)
Mr. G S Udawatte	Technical Officer	-
Ms. W A S Wijesuriya	Technical Officer	Dip (Agric.)
Ms. S M A D Kumari	Technical Officer (from 15.11.2017)	Dip (Agric.)
Ms L M M Obeyesena	Technical Officer	Dip. (Agric.)
Mr M K D Ubesena	Technical Officer	-
Ms B N L Kumaranayake	Technical Officer	Dip. (Agric.)
Mr A S M A Fernando	Technical Officer	NDT
Mr W M Anurapala	Technical Officer	-
Ms M A R I Perera	Technical Officer	Dip.(Agric.)
Mr W K D S Karunarithna	Technical Officer	Dip. (Agric.)
Mr. K G S U R Bandara	Technical Officer	HNNT,CCNA

### Annex 8: List of recommendations made by SRI

#### Varieties Developed

SL 7103

SL 7130

<u>Year</u>	<u>Varieties released</u>
1993	SL 83 06, SLI 121(F 148)
2001	SL 86 13, SL 88 116
2002	SLT 88 238
2009	SL 89 1673, SL 92 4918, SL 92 4997 SL 92 5588
2011	SL 95 4033, SL 95 4430, SL 96 328
2012	SL 90 6237, SL 95 4443, SL 96 128
2015	SL 98 2524
2017	SL 0095, SL 00 352, SL 00 603, SL 00 652, SL 04 624

#### Cheaper Planting Methods Developed

##### *Spaced planting*

Seed -2t/ha

70% cost saving on planting

##### *Spaced transplanting*

Seed – 2 t/ha or cane tops

50-70% cost saving on planting

##### *Rapid Propagation Methods*

Lateral shoot multiplication (1:240)

SP/STP (1:40)



*In-vitro micro propagation*

#### **Fertilizer and Soil Management**

Fertilizer recommendations

Practices for soil rehabilitation-green manure cropping

Use of factory and distillery wastes for composts

#### **Biological Pest Management**

**Pyrilla**

-*Epiricana melanoleuca*

**Sugarcane Woolly Aphid**

-*Dipha apidivora* (adult and larvae)

-*Micromus igorothus* (all stages)

-Tobacco extract

#### **Disease Management**

Hot water treatment of seed-cane and nursery management

Production of disease-free planting material by meri-clonning

#### **Ratoon Crop Management**

Optimum replanting cycles

-*Replanting after declining yield below the break-even level*

Management practices

-*Stubble shaving*

-*Gap filling*

-*Fertilizer application*

#### **Machinery Introduced**

Tyne cultivator – 1 ha/day

Disc molder – 0.6 ha/day

Furrow opener – 2 ha/day

Fertilizer applicator – 3 ha/day

Hot-water treatment method of seed cane

#### **Sugarcane based Farming Systems**

Intercropping

Cowpea, green gram, black gram, soybean and chilies: 400-450 kg/ha

Ground nut: 950-1050 kg/ha

Sweet melon and cucumber: 5000-6000 kg/ha

Rotational farming

Sugarcane-Livestock integration

**Promoting soil fertility management, rehabilitating degraded sugarcane lands and increasing water use efficiency by farmers.**

**Reducing cost of production by promoting spaced planting and spaced transplanting.**

**Improvement of cane quality by increasing farmer knowledge and adoption of best management practices.**

**Increasing profitability by promoting adoption of best management practices of sugarcane**



### **Annex 9: Training programs conducted**

1. Certificate course in sugarcane technology
2. National certificate course in sugarcane cultivation practices
3. Field officers' skills development course in sugarcane
4. Productivity improvement course in sugarcane farming

### **Annex 10: Services**

- Dissemination of knowledge to farmers, field officers and students
  - Promoting new improved sugarcane varieties among cane growers.
  - Promoting Tyne cultivator, furrow opener and disc moulder for sugarcane cultivation.
  - Promoting intercropping with sugarcane, and integrated cropping systems for providing an additional source of income.
  - Promoting soil fertility management, rehabilitating degraded sugarcane lands and increasing water use efficiency by farmers.
  - Reducing cost of production by promoting spaced planting and spaced transplanting.
  - Improvement of cane quality by increasing farmer knowledge and adoption of best management practices.
  - Increasing profitability by promoting adoption of best management practices of sugarcane
  - Reducing yield losses by improving knowledge and adoption of pest and disease management.
  - Improving sugarcane farmers' knowledge and skills on entrepreneurship development.
  - Providing training/services at requests of sugar companies/other institutions, conducting exhibitions
- Providing foundation seed cane/mer-icloned plants
- Providing farm implements and machinery services
- Recording and providing agro-meteorological data
- Crop protection services
  - Pest and disease surveys
  - Advisory services
  - Releasing bio-control agents
  - Quarantine
  - Analytical services – soil, plant, sugar, etc.
- Providing technical and policy guidelines for sugarcane industry development



## **Annex 11: List of documents developed by SRI for information dissemination**

### **Audio-visual Materials and Extension Publications on Sugarcane Cultivation (2012-17)**

#### **Advisory videos**

- Hot-water treatment of seed-cane (15min.)
- Sugarcane jaggery production (12 min)
- Cane quality improvement (25min)
- Planting techniques (12 min)
- Ratoon crop management (15min)
- Intercropping with sugarcane (12min)

#### **Advisory Publications**

- Sugarcane farmer manual

#### **Advisory pamphlets**

- Advisory pamphlet no.03 - Jaggery and syrup production (revised)
- Advisory pamphlet no.03 - Jaggery and syrup production (revised – Tamil)
- Advisory pamphlet no.04 - Control of white disease (revised)
- Advisory pamphlet no.04 - Control of white disease (revised - Tamil)
- Advisory pamphlet no.08 - Control of smut disease (revised)
- Advisory pamphlet no.09 - Control of leaf scald disease (revised)
- Advisory pamphlet no.09 - Control of leaf scald disease (revised –Tamil)
- Advisory pamphlet no.11 - Control of woolly aphid (revised)
- Advisory pamphlet no.11 - Control of woolly aphid (revised – Tamil)
- Advisory pamphlet no.13 - Inter cropping with sugarcane (revised)
- Advisory pamphlet no.14 - A guide to grow sugarcane in mid-country intermed. zone (Tamil)
- Advisory pamphlet no.15 - Ratoon management (revised)
- Advisory pamphlet no.16 - Control of smut disease (Tamil)
- Advisory pamphlet no.17 – Control of Shoot borer
- Advisory pamphlet no.17 – Control of Shoot borer (Tamil)
- Advisory pamphlet no.18 – Small-scale farm machinery
- Advisory pamphlet no.18 – Small-scale farm machinery (Tamil)

#### **Information sheets**

- Information sheet 2015/01 - Cane variety SL 90 6237
- Information sheet 2015/02 - Cane variety SL 95 4443
- Information sheet 2015/02 - Cane variety SL 96 128
- Information sheet 2017/01 - Cane variety SL 98 2524
- Information sheet 2017/02 - Cane variety SL 00 95
- Information sheet 2017/03 - Cane variety SL 00 354
- Information sheet 2017/04 - Cane variety S L 00 603
- Information sheet 2017/05 - Cane variety SL 00 652
- Information sheet 2017/06 - Cane variety SL 04 624
- Information sheet 2017/07 - Cane Quality Improvement
- Information sheet 2018/01 - Weed management



**"Puwath Hasuna" SRI Newsletters**

Volume 05 issue 01 (2013)

Volume 06 issue 01 (2015)

Volume 07 issue 01 (2016)

Volume 08 issue 01 (2017)

**Articles Published in Sinhala National Newspapers**

1. Divaina on 9<sup>th</sup> January 2017
2. Divaina on 10<sup>th</sup> January 2017
3. Divaina on 15<sup>th</sup> June 2017
4. Wevili Saviya Paper Supplement – Dinamina on 22<sup>nd</sup> September 2017
5. Wevili Saviya Paper Supplement – Dinamina on 17<sup>th</sup> November 2017
6. Wevili Saviya Paper Supplement – Dinamina on 16<sup>th</sup> January 2018

**Annex12a: Publications made by SRI staff Research**

**2013**

Kodithuwakku, K.A.D. (2013). An economic study of potential production promoting sugarcane and sugar policies in Sri Lanka: some recommendation in the light of India and Thai policy lesions. A thesis submitted for MAgR. Fiji, University of South Pacific.

Piyathinga, A.L.I., Chandrassena, G. and Thushari, A.N.W.S. (2013). Study on the Effects of Selected Plant Extracts on Sugarcane Smut Pathogen (*Ustilago scitaminea*), Proceedings of the 04<sup>th</sup> Research Symposium held from 12<sup>th</sup> to 13<sup>th</sup> December 2013 at the Uva Wellassa University. pp 44 – 46.

Rathnayaka, R. M. B. S., Wijesuriya, A., and Alwis, L. M. H. R. (2013). Determination of Optimal Auxin and Cytokinin Levels for Meristem Culture of Sugarcane (*Saccharum* Hybrid Spp.): Variety SL 96 328. Proceedings of the 04<sup>th</sup> Research Symposium held from 12<sup>th</sup> to 13<sup>th</sup> December 2013 at the Uva Wellassa University.

Supuni, L. B. S., Wijesuriya, A., and Alwis, L. M. H. R., (2013). Evaluation of Sugarcane Germplasm for Development of Core-collections for Directional Breeding of Sugarcane (*Saccharum* hybrid spp.). Proceedings of the 04<sup>th</sup> Research Symposium held from 12<sup>th</sup> to 13<sup>th</sup> December 2013 at the Uva Wellassa University.

Wijayawardhana, L.M.J.R., De Silva A. L. C. and Witharama, W.R.G. (2013). Assessment of Water Requirements of Sugarcane, Banana and Paddy in Sevanagala. A paper presented at the 69<sup>th</sup> Annual Session, Sri Lanka Association for the Advancement of Science, Colombo.

**2014**

Abeyrathna, K.H.D., Ariyawansa, K.T. and Ariyawansa, B.D.S.K. (2014). Design and Fabrication of a Two-Wheel Tractor-mounted Fertiliser Applicator for Sugarcane Smallholders in Sri Lanka.



- Proceedings of the International Conclave on Sugar Crops: Sweeteners and Green Energy from Sugar Crops: Emerging Technologies. February 15-17, held at the Indian Institute of Sugarcane Research, Lucknow, India. pp183.
- Ariyawansha, B.D.S.K. (2014). Adaptability of some sugarcane varieties in different environments in Sri Lanka. In: A.P.Keerthipala (ed) Proceedings of the 5<sup>th</sup> Symposium on Plantation Crop Research "Towards a green plantation economy". Sugarcane Research Institute (70190), Sri Lanka. pp 39-52.
- Ariyawansha, K.T. and Abeyrathna, K.H.D. (2014) An Analysis of Ridge and Furrow Profile Conversion Efficiency of the Two-Wheel Tractor-Mounted Furrow-Opener in Sri Lankan Sugarcane Fields. Proceedings of the International Conclave on Sugar Crops: Sweeteners and Green Energy from Sugar Crops: Emerging Technologies. February 15-17, held at the Indian Institute of Sugarcane Research, Lucknow, India.
- Ariyawansha, K.T. and Abeyrathna, K.H.D. (2014) Energy Requirements for Base Cutting of Selected Sugarcane Varieties in Sri Lanka. In: A.P. Keerthipala (ed) Proceedings of the 5th Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka.
- Ariyawansha, B.D.S.K. and Perera, A.L.T. (2014). Assessment of Varietal Stability of Sugarcane in Sri Lanka: Proceedings of International Conclave on Sugar Crops: Sweeteners and Green Energy from Sugar Crops: Emerging Technologies. February 15-17, 2014, held at Indian Institute of Sugarcane Research, Lucknow, India. pp. 110.
- Chanchala K.M.G., Wanasinghe, V.K.A.S.M., Ariyawansha, B.D.S.K. and Hemachandra, K.S. (2014). Relationship between the incidences of Sugarcane White Leaf Disease and the Population Dynamics of Its Vector, *Deltocephalus menoni* (Homoptera: Cicadellidae), in Sri Lanka. In: A.P. Keerthipala (ed) Proceedings of the 5th Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, pp 143-149.
- De Silva, A.L.C., Wijesuriya, A., and Wijayawardhana, L.M.J.R. (2014). Genetic Potential of Sugarcane (*Saccharum* spp. Hybrid) and its Wild Relatives (*Saccharum spontaneum* and *Erianthus arundinaceus*) for Improvement of Shoot and Root Growth and Stomatal Resistance. In: A.P. Keerthipala (ed) Proceedings of the 5th Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, pp 53-61.
- Kanatiwela-de Silva, C., Thushari, S, Dickinson, M. and Udagama, P. (2014). Phylogenetic evaluation of Sugarcane White Leaf Disease and Sugarcane Grassy Shoot Diseases in Sri Lanka. Proceedings of the 70th Annual sessions of the Sri Lanka Association for the Advancement of Science. Colombo, Sri Lanka.
- Keerthipala, A.P. (2014). Sugarcane Production in Sri Lanka: New and Emerging Field Technologies to Enhance Sugarcane Productivity. Proceedings of the International Conclave on Sugar Crops and SugarFest-2014 held from 15<sup>th</sup> to 17<sup>th</sup> February 2014 at the Indian Institute of Sugarcane Research, Lucknow, India.
- Keerthipala, A.P. (2014). Restructuring the Sugar Industry of Sri Lanka: Role of Sugarcane R&D. Paper presented at the International Sugar Conference (IS-2014) held from 25<sup>th</sup> to 28<sup>th</sup> November 2014 under the theme *Green Technologies for Sustainable Growth of Sugar and Integrated Industries in Developing Countries*, in Academic Exchange Centre of Guangxi Academy of Agricultural Sciences (GXAAS) in Nanning, China.



- Kodituwakku, K.A.D. and Keerthipala, A.P. (2014). Indian and Thai Production-Promoting Sugar Policies and their Applicability to Sri Lanka. In: A.P. Keerthipala (ed). Proceedings of the 5<sup>th</sup> Symposium on Plantation Crop Research "Towards a green plantation economy". Sugarcane Research Institute (70190), Sri Lanka. pp 381-392.
- Maralanda, S.M.T.A., Chandrasena, G. and Priyadarshani, G.V.G. (2014). Isolation and evaluation of Indigenous Yeast Strains for Improving Sugarcane Molasses Fermentation Efficiency in Sri Lankan Alcohol Distilleries. In: A.P. Keerthipala (ed) Proceedings of the Fifth Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, 307-315.
- Perera, A.M.M.S., Wijesuriya, A., Jayasekara, G.A.U. and Ariyawansa, B.D.S.K. and Jayasinghe, W.H. (2014). An Assessment of the Size of Meristem Ex-plant for Elimination of Sugarcane Bacilliform Virus. In: A.P.Keerthipala (ed). Proceedings of the 5<sup>th</sup> Symposium on Plantation Crop Research "Towards a green plantation economy". Sugarcane Research Institute (70190), Sri Lanka, pp 63-70.
- Priyadarshani, G.V.G., Chandrasena, G. and Maralanda, S.M.T.A. (2014). Isolation and Characterisation of Phosphate-solubilising Bacteria for the Production of Bio-fertiliser. In: A.P. Keerthipala (ed) Proceedings of the Fifth Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, pp 253-262.
- Thushari, A.N.W.S. and Ariyawansa, B.D.S.K. (2014). Identification of Different Sugarcane Smut (*Ustilago scitaminea*). Strains in Sri Lanka, Proceedings of International Conclave on Sugar Crops: Sweeteners and Green Energy from Sugar Crops: Emerging Technologies. February 15 - 17, 2014 held at Indian Institute of Sugarcane Research, Lucknow, India, pp 138 – 139.
- Thushari, A.N.W.S. and Ariyawansa, B.D.S.K. (2014). Evaluation of some Brazilian sugarcane varieties for resistance to Leaf Scaled disease pathogen in Sri Lanka In: A.P.Keerthipala (ed). Proceedings of the 5<sup>th</sup> Symposium on Plantation Crop Research "Towards a green plantation economy". Sugarcane Research Institute (70190), Sri Lanka, pp 187-191.
- Thushari, A.N.W.S., Piyatunga, A.L.I. and Chandrasena, G. (2014). Efficacy of Soil Bacteria in Controlling Sugarcane Smut Disease Fungi *Ustilago scitaminea* pp 321-325. Proceedings of the 5<sup>th</sup> IAPISIT Conference IS 2014, 25<sup>th</sup> - 28<sup>th</sup> November, Nanning, P.R. China.
- Wanasinghe, V.K.A.S.M., Chanchala, K.M.G. and Kumarasinghe, N.C. (2014). An Assessment of Major Pests of Sugarcane in Sri Lanka. In: A.P. Keerthipala (ed) Proceedings of the 5<sup>th</sup> Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, pp 135- 141.
- Wanasinghe, V.K.A.S.M., Chanchala, K.M.G., Witharama, W.R.G and Kumarasinghe, N.C. (2014). The Effects of Intercropping Cowpea, Ground nut, Gingili and Sweet Melon on Termite Damage on Sugarcane in Sri Lanka. Souvenir de Presentation IS-2014, International Conference IS 2014 on 25-28 November 2014 in Nanning, P.R. China, p 132.
- Weerasinghe, H.A.S., Chandana, H.L.N. and Gunaratne, G.P. (2014). pH Buffering Capacities of Sugarcane-growing soils at Sevanagala, Sri Lanka. Proceedings of the 5<sup>th</sup> Plantation Crop Research Symposium, 15<sup>th</sup>-17<sup>th</sup> October 2014, Colombo, Sri Lanka.
- Weerasinghe, H.A.S., Seneviratne, G. and Chandrasiri, K.P.N.K. (2014). Fungal-bacterial biofilms for



sugarcane trash decomposition. Proceedings of the International Conclave on Sugar Crops, Sweeteners and Green Energy from Sugar Crops: Emerging Technologies, 15-17 February 2014, Indian Institute of Sugarcane Research, Lucknow, India.

Wijayawardhana, L.M.J.R., De Silva, A.L.C., and Witharama, W.R.G. (2014). Optimising Planting Schedules of Sugarcane for Saving Irrigation water in Sevanagala and Uda Walawe, Sri Lanka. In: A.P. Keerthipala (ed) Proceedings of the 5th Symposium on Plantation Crop Research – "Towards a Green Plantation Economy". Sugarcane Research Institute, Uda Walawe, 70190, Sri Lanka, pp 105- 110.

Wijesuriya, A., Ariyawansa, B.D.S.K. and Perera, A.L.T. (2014). Estimation of Heritability of Sugarcane (*Saccharum* spp. Hybrid) Yield Components through Analysis of Poly-Cross Families. Proceedings of International Conclave on Sugar Crops: Sweeteners and Green Energy from Sugar Crops: Emerging Technologies. February 15-17, 2014, held at Indian Institute of Sugarcane Research, Lucknow, India. p 107.

## 2015

Chanchala, K.M.G., Wanasinghe, V.K.A.S.M., and Hemachandra, K.S. 2015. Survival of the *Deltocephalus menoni* (Homoptera: Cicadellidae), the Vector of Sugarcane White Leaf Disease in Sri Lanka on Alternative Host Plants. Sugarcane Sri Lanka, Vol. 02.

Keerthipala, A.P. 2015. Sri Lanka Sugar Production Challenges and Development. Paper presented at the 3<sup>rd</sup> TTC Annual International Sugarcane Conference held on 16<sup>th</sup> July 2015 in Nha Trang City, Vietnam.

Keerthipala, A.P., and Weragoda, N.V.T.A. 2015. Potential of Sugarcane as a Source of Green Energy in Sri Lanka. Paper presented at the Energy Symposium Sri Lanka 2015 held on 26<sup>th</sup> June 2015 at Hotel Hilton, Colombo, Sri Lanka.

Kodituwakku, K.A.D. 2015. *Gain Profit by Cultivating Sugarcane (Sinhala)*. Puwath Hasuna 2015 March, Sugarcane Research Institute, Uda Walawe, Sri Lanka.

Kodituwakku, K.A.D. and Keerthipala, A.P. 2015. Competitiveness of sugarcane at Gal-Oya. Economic Publication Series 12, Sugarcane Research Institute, Uda Walawe, Sri Lanka.

Weerasinghe, H.A.S., Abeysinghe, N.S., and Ariyawansa, B.D.S.K. 2015. The Effects of High-grade Eppawala Rock Phosphate as a Phosphorous Substitute on Yield and Quality of Sugarcane in Sri Lanka. Sugarcane Sri Lanka, Vol. 02.

Wijayawardhana, L.M.J.R., De Silva, A.L.C., W.R.G. Witharama, W.R.G. and W.G. Nimal, W.G. 2015. Analysis of Consecutive-day Maximum Rainfall at Uda Walawe, Sri Lanka. Sugarcane Sri Lanka, Vol. 02.

Witharama, W.R.G., Wijewardena, L.M.J., and Chaturanga, G.A.A. 2015. Effect of a Mixture of Diuron 80% Wp and Glufosinate Ammonium 150g./l Wsc(Basta) in Controlling Weeds in Sugarcane. Sugarcane Sri Lanka, Vol. 01.

Witharama, W.R.G., De Silva, A.L.C., and Wijewardena, L.M.J.R. 2015. Krismat 75 WG, A Novel Herbicide for Early and Late Post-Emergence Weed Control in Sugarcane. Sugarcane Sri Lanka, Vol. 02.



## 2016

Afghan, S., Shahzad, A., Afzal, M., Iqbal, Z., Shahzad, S., and Wijesuriya, A. (2016). Sugarcane improvement in Pakistan through traditional and modern breeding technologies. Proceedings of the International Society of Sugar Cane Technologists, Volume, 29, 1665-2016.

Ballagalla, D. N., Wijesuriya, A., Ranathunga, N. P., and Perera, A. M. M. S. (2016). Near-optimal levels of 2,4-Dichlorophenoxyacetic acid and Indole acetic acid for *in-vitro* direct regeneration of shoots from sugarcane (*Saccharum* spp. hybrids) leaf tissues. Proceedings of Tropical Agricultural Research and Extension, University of Ruhuna. 112 – 116.

Dapange, M. and Bhat, S. (2016). Identification of differentially-expressed transporter genes under moisture deficit stress in sugarcane (*Saccharum* spp. hybrids). Proceedings of the sixth symposium on plantation crop research, November 2 -4, BMICH, Colombo 15-24.

Keerthipala, A.P. (2016). Development of Sugar Industry in Sri Lanka. Sugar Tech, Vol. 18, No.08.

Weerasinghe, H.A.S., Ariyawansa, B.D.S.K., and Wijesuriya, A. (2016). Response of Sugarcane (*Saccharum* hybrid spp.) Varieties SL 96 128 and SL 96 328 to Nitrogen, Phosphorous and Potassium under Irrigation at Uda Walawe, Sri Lanka: A Preliminary Analysis, Sugarcane Sri Lanka, Volume.03, Sugarcane Research Institute of Sri Lanka.

Wijayawardane, L.M.J.R., De Silva, A.L.C. and Witharama, W.R.G. (2016). Evaluation of alternate-row furrow irrigation technique for supplementary irrigation of sugarcane, Proceedings of the 6<sup>th</sup> symposium on plantation crop research.

Wijesuriya, A., Jayamali, L. B. C., Perera, A. M. M. S., and Wijesuriya, B. W. (2016). Optimal plot and sample sizes for efficient assessment of varieties in sugarcane (*Saccharum* spp. hybrids) crop improvement. Proceedings of the sixth symposium on plantation crop research, November 2-4, BMICH, Colombo. 45-55.

## 2017

Balagalla, D.N., Wijesuriya, A., Ranathunge, N.P. and Perera, A.M.M.S. 2017. "Protocols for *In-vitro* Direct Plant Regeneration from Leaf Tissues for Micro Propagation of Sugarcane", Tropical Agricultural Research, vol. 29, (pp.7).

Kodituwakku, K.A.D. 2017. Factors Effecting Quantity and Price of Sugarcane and Sugar Production in Sri Lanka. Sugarcane Sri Lanka, Volume 03, Sugarcane Research Institute. Uda Walawe, Sri Lanka.

Kodituwakku, K. A. D., and Keerthipala, A. P. 2017. Economic Assessment of Sugarcane Cultivation in Sri Lanka for the Year 2017/18. Uda Walawe, Sri Lanka: Economic Publication Series 17, Sugarcane Research Institute.

Kodituwakku, K. A. D., and Keerthipala, A. P. 2017. Profitability of Sugarcane Comparing with Other Competitive Crops in Rain-fed and Irrigated Sugarcane- Growing Regions of Sri Lanka for the Year 2017/18. Uda Walawe, Sri Lanka: Economic Publication Series 18, Sugarcane Research Institute.

Manel Dapange and Sumangala Bhat. 2017. "Physiological responses of commercial sugarcane (*Saccharum* spp. hybrids) varieties to moisture deficit stress tolerance" Indian Journal of Plant Physiology (pp 1-8).



Perera, A.M.M.S., Attanayaka D.P.S.T.G. and Wijesuriya A. 2017. "Assessment of genetic diversity among *Saccharum spontaneum* genotypes using SSR markers" Wayamba University Research Congress – 2017. Wayamba University of Sri Lanka, Makandura, Gonawila, Sri Lanka.

Weerasinghe, H. A. S., Ariyawansa, B.B.S.K., and Wijesuriya, A. 2017. Response of Sugarcane (*Saccharum* hybrid spp.) Varieties SL 96 128 and SL 96 328 to Nitrogen, Phosphorous and Potassium under Irrigation at Uda Walawe, Sri Lanka: A Preliminary Analysis. Sugarcane Sri Lanka, Volume.03, Sugarcane Research Institute (forthcoming).

Wijesuriya, A., Jayamali, L.B.C., Perera, A.M.M.S., Wijesuriya, B.W. 2017. Optimal Plot and Sample Sizes for Sugarcane (*Saccharum* spp. Hybrid) Varietal Assessment". Sugarcane Sri Lanka, Volume.03, Sugarcane Research Institute (forthcoming).

Wijayawardhana, L.M.J.R., De Silva, A.L.C., and Chathuranga, G. A. A. 2017. A New Device for Demarcating Furrow Lines for Sugarcane Cultivation on Undulating Terrain. Proceedings of the 73<sup>rd</sup> Annual Sessions, Sri Lanka Association for the Advancement of Science, Colombo, Sri Lanka. In: Ranil D. Guneratne (ed). Pp- 13.

#### Annex 12b: Publications by SRI staff (2013-2017)

Type	2013	2014	2015	2016	2017	Total
Journal papers	-	-	06	02	06	14
Conferences/Symposia	04	24	02	05	04	39
Books/Book Chapters	-	-	-	-	-	-
Postgraduate Thesis	01	-	02	-	02	05
Other	-	-	02	01	04	07
<b>TOTAL</b>	<b>05</b>	<b>24</b>	<b>10</b>	<b>08</b>	<b>14</b>	<b>65</b>

#### Annex 13: Number of Scientific staff officers at SRI and their academic qualifications

Qualifications	No.
PhD	5
MPhil	5
MSc or equivalent	11
Basic Degree or equivalent	7
<b>Total</b>	<b>28</b>

#### Annex 14a: Patents by SRI Staff (2004-2014)

Date & Year	Patent	Number
30.06.2004	Non-stop cultivator with leaf spring safety device	13352
05.02.2007	Hybrid hot water treatment plant to control seed borne pests and diseases of seed-cane	14391
05.02.2007	An offset whole sugarcane harvester for two-wheel tractor	14392
09.07.2008	Four-wheel tractor mounted sugarcane combined harvester	15040
28.08.2013	Easily movable irrigator for irrigating sugarcane	17311
22.05.2014	Force measuring device for cutting, shearing, chopping and penetration of sugarcane material	17685
22.05.2014	Reversible disc moulder	17686



#### **Annex 14b: List of awards received by the staff of SRI**

Mr. H.A.S. Weerasinghe (Research Officer In-Charge) won the Award for the Best Research Paper (Sugar Sector - 2014) at the 5<sup>th</sup> Plantation Crop Research Symposium, Colombo, Sri Lanka – Title: pH Buffering Capacities of Sugarcane-growing soils at Sevanagala, Sri Lanka (15<sup>th</sup>-17<sup>th</sup> Oct. 2014).

Mr. H.A.S. Weerasinghe (Research Officer In-Charge) won the first place (Certificate of Merit) as the best poster at the technical session II under the theme Agriculture, Mechanisation, Processing, Value addition, Energy and Socio-economic initiatives at the International Conclave on Sugar Crops and Sugar Fest 2014, 15 -17 Feb. 2014, Indian Institute of Sugarcane Research, Lucknow, India.

Mr. H.A.S. Weerasinghe (Research Officer In-Charge) was awarded an International Travel Grant by National Science Foundation, Sri Lanka (20.01.2014) to cover registration fee and airfare (Rs. 172,810.00) to participate at the International Conclave on Sugar Crops and Sugar Fest 2014, 15 -17 Feb. 2014, Indian Institute of Sugarcane Research, Lucknow, India.

Ms V.K.A.S.M Wanasinghe, Research Officer-In-Charge) won an award for the poster on the Effects of Intercropping Cowpea, Ground nut, Gingili and Sweet Melon on Termite Damage on Sugarcane in Sri Lanka. At the IS-2014, International Conference IS 2014 on 25-28 November 2014 in Nanning, P.R. China.

#### **Annexure 15: Collaborative projects with International Organizations (MOUs signed)**

- Sugarcane Research and Development Board, and the Sugarcane Research Institute, Faisalabad, Pakistan
- Sugar Research Australia from 2014 to 2023
- Thanh and Thanh Group in Vietnam in 2015
- Yunnan Academy of Agricultural Sciences and the Yunnan Sugarcane Research Institute, China from 2017 to 2021
- Sugarcane Research Institute in Vietnam
- Sugarcane Research Institute in Cuba



**Annex 16: Staff of SRI and stakeholders interviewed during the review process**

<b>No.</b>	<b>Division/Unit/Group</b>	<b>No. of Participants</b>
01	Chairman	01
02	Director	01
03	Deputy Director (Research)	01
04	Crop Improvement	15
05	Crop and Resource Management	06
06	Crop Nutrition	13
07	Crop protection	14
08	Mechanization Technology Division	12
09	Processing Technology	05
10	Economics, Biometry and IT	03
11	Technology Transfer and Development	10
12	Accounts	13
13	Administration	29
14	Farm Laborers	24
15	Farmers and Farmer Organizations	25
16	Development Officers and Factory Staff	05
	<b>TOTAL</b>	<b>177</b>