Annual Report 2021

PARLIAMENT OF FIJI
PARLIAMENTARY PAPER NO. 157 OF 2023

Rerevaka na Kalou ka doka na Tui

SUGAR RESEARCH INSTITUTE OF FIJI

SUGAR RESEARCH INSTITUTE OF FIJI

ANNUAL REPORT-2021

CONTENTS

SRIF Mission Statement

To advance the industry by excellence in technology transfer emanating from research results through science that supports innovative activities in sugar related industries and to make the Fiji Sugar Industry productive and sustainable

CHAIRMAN'S REPORT

First, please join me in welcoming our new CEO, Professor Santiago Mahimairaja who joined the Institute in March this year. Professor Santiago Mahimairaja is a retired soil scientist and joined Sugar Research Institute of Fiji from Tamil Nadu, India where he had served as the Dean for Tamil Nadu Agricultural University. Professor Santiago Mahimairaja has an impressive background as a highly qualified soil scientist with more than 34 years of leadership experience.

In selecting Professor Santiago Mahimairaja as CEO, the board diligently conducted a comprehensive search before selecting him from a list of highly qualified academics. Among many goals in our search, ensuring financial strength was a priority. We felt Professor Santiago Mahimairaja has the aptitude to build financial stability and operational efficiencies complemented this goal. We are confident with our decision, as well as Professor Santiago Mahimairaja' s ability to guide this Institute to unprecedented heights into the future.

The Board is pleased with the progress achieved during 2021. The highlight of the year was the devastating effects of two cyclones at the beginning of the year that caused massive destruction to the crop in Labasa. Despite the loss in cane production, the industry is on its way to recovery.

I am confident that the Institute is well-positioned to meet the challenges of the future and provide sustainable long-term strategies for the growth across the cane industry, which should in turn drive shareholder returns. We will continue to closely monitor the performance of all our recommendations, ensuring that the industry partners execute the strategies with discipline and integrity which is an integral component of success.

Regular engagement, dialogue with, and feedback from internal and external stakeholders are important to our success and a core element of our business. Understanding stakeholders' views assists our decision-making processes and helps to drive progress towards the achievement of our aims, objectives, and strategy.

I have served on the Board for almost two years as Chairman, and the Institute has progressively delivered on its strategy during that time. While it hasn't been without challenges, we are now in the better position that I have seen. We are all committed to

continuing to create substantial value for our stakeholders, and I look forward to reporting on our progress.

The unprecedented speed and magnitude of change today demands nothing less but to have the courage to challenge convention, explore new directions, spot opportunities, and take interventions to reach strategic goals. Passion in believing that we can achieve great aspirations, such as transforming the industry by continuously striving for excellence. We simply must find ways to do more with less. This is the core of the Institute's business; increasing yields and optimizing the use of scarce resources.

On behalf of the Board of Directors, I express our recognition of the dedication and hard work of the employees. We fully appreciate the continuing commitment and support of our stakeholders. Many thanks to my Board colleagues for their considerable contribution. We all appreciate our employees' dedication, skills, and professionalism in all mill centres. Above all, I would like to thank our loyal stakeholders for their ongoing support.

Prakash Chand
Chairman
31 December 2021

FOREWORD

My warm greetings.

At the outset I would like to sincerely thank and remain grateful to the SRIF Board and the Ministry of Sugar Industry for the wonderful opportunity to head the Sugar Research Institute of Fiji, the sole institution dedicated to sugarcane research in Fiji.

I arrived in this great country amid the Covid-19 pandemic period. I see the experiences during such challenging circumstances to be perfect opportunities. With my 36 years of research back up, I could identify the constraints pertinent to sugarcane farming and key factors for decline in sugarcane production.

Upon recognizing of pressing needs, I have formulated the short term, medium term and long-term goals. The immediate goals included training the scientific staff in order to develop their skills, boosting visibility of SRIF at national and international levels and identifying research priorities. The focus in the medium-term goals is on re-orientation of SRIF research – demand-driven research, productive technology transfer to enable the reach of SRIF technologies to the sugarcane farmers, strengthening of research facilities, development of soil health management technologies. The long-term goals visualize developing climate resilient sugarcane varieties as well as sensitizing the farmers to the SRIF technologies for improving and sustaining sugarcane productivity and production, besides establishing research collaborations with institutes within and outside the country.

Priorities to be assigned as follows:

- ✓ Developing climate resilient, high sugar and high yield sugarcane varieties,
- ✓ Reinforcing scientific human resource development,
- ✓ Revamping, preserving and sustaining the soil health through adoption of Integrated Nutrient Management (INM) practices,
- ✓ Enabling the use of Soil Health Card to monitor soil health of sugarcane farms,
- ✓ Evolving Integrated Pest Management (IPM) and Disease Management (IDM) programmes,
- ✓ Diversification of Crops,
- ✓ Assessing the climate change impact on sugarcane farming and mitigation,
- ✓ Sustainable Sugarcane Initiatives (SSI),
- ✓ Value addition to sugarcane residues (trash) and by-products (mill mud) such as nutrient rich compost and Biochar.
- ✓ Effective technology transfer to upskill and empower sugarcane farmers on best management practices to augment sugarcane production
- ✓ Establishing research collaborations with national and international institutes.

In the recent past the sugarcane farming and sugar industry are facing numerous problems and challenges. The area under sugarcane was declined from 73981 ha (1996) to <35000 ha (2022) with a corresponding decrease in production from 4.379 m.t. to 1.67 m.t. Against all odds, the current productivity stands at only 47 t / ha, significantly lower than the World average of > 90 t / ha. Amidst the dark clouds of issues and limitations there lies the vast scope and hope for improving the sugarcane production substantially and sustainably by adopting scientific technologies. However, a holistic approach and concerted efforts are needed.

The new organogram introduced during the year positions SRIF on a well-defined stand to ensure better functioning. The Annual Report 2021 provides a comprehensive glimpse of research and extension activities of SRIF. Though our accomplishments were hampered during covid-stricken 2021, remarkable progress has been made by all departments at SRIF. My sincere thanks to all staff for their efforts.

SRIF is totally committed towards developing high yielding varieties and technologies to augment sugarcane production and thus prosperity of sugarcane farmers and the Sugar Industry in Fiji.

My sincere thanks to the Chairman and members of the SRIF Board for their guidance and support. Thanks, are also due to the Ministry of Sugar Industry and stakeholders (FSC, SCGC, SCGF and SIT) for their contributions and continued support.

Let us all continue to work together for sweeter tomorrow.

Prof. S. Mahimairaja
Chief Executive Officer

PARLIAMENT OF FIJI

PARLIAMENTARY PAPER NO. 157 OF 2023

1. INTRODUCTION

SUGAR RESEARCH INSTITUTE OF FIJI

Sugar Research Institute of Fiji (SRIF) is the principal research institution dedicated to sugarcane research, development and technology transfer. The first ever basic scientific station for Sugarcane was established by the Colonial Sugar Refinery (CSR) in the 19th Century (1890s) as an entomology station in Nausori. The research station was later shifted to Rarawai, Ba in 1904 and known as the Agriculture Experiment Station (AES). This was the beginning of what was to become an ever-advancing sugarcane breeding station in the world with the establishment of a leaf and soil analytical laboratory in 1950. It was relocated to Lautoka during 1958.

In 2006 it gained independence from Fiji Sugar Corporation (FSC) through an Act in the Parliament and was renamed from Sugarcane Research Center to Sugar Research Institute of Fiji (SRIF). The areas of research that SRIF undertakes includes:

- ✓ Sugarcane conventional breeding
- ✓ Soil and leaf analytical services
- ✓ Cane analysis for research and investigation purposes
- ✓ Pests and diseases screenings
- ✓ Crop diversification
- ✓ Management of estate commercial farms
- ✓ Effective land utilization
- ✓ Production of disease-free seed-cane
- ✓ Conduct donor financed projects for the benefit of the farmers.

The Institute was successful in securing research grants from the European Union between 2007 and 2018. In this period, SRIF was able to establish its head office and offices at other sub stations located in the four mill areas. The new organogram of SRIF was implemented from July 2021. There are five departments at SRIF and they are briefly presented as follows.

1.1 Department of Crop Improvement

The SRIF is dedicated to breeding cane and producing varieties locally which it does at its Dobuilevu breeding station, which has ideal conditions for natural synchronization of flowering where 70-80% of flowering is achieved without any photoperiod treatment- which is very rare in the world. The SRIF has its own germplasm collection which it keeps upgrading via importation of varieties and introducing clones from its breeding program. The selected list from the germplasm are planted or re-planted into what is referred as flowering beds or plots at the crossing station in Dobuilevu, flowers from which are used to set the desired genetic combinations or crosses.

The seedlings generated from the sugarcane fuzz are nurtured at the Rarawai sub-station and then transplanted in the fields where the evaluation of the seedlings is progressively carried out over three years. During this three-year evaluation the number of seedling reduces as intensive selection pressure is applied to identify elite varieties. The elite varieties are then evaluated in the Genetic x Environment studies at different

mill location for another 3-4 years during which promising varieties are identified and introduced into pre-release program whereby some farmers get the opportunity to cultivate it in their farms and provide feed-back. Once a promising variety is identified, it is planted in large plots and then sent to the mill for what is referred as Large Mill Trial trial after which decisions are made on releasing the variety. So far 19 commercial varieties have been developed and released.

Tissue Culture Laboratory

Fiji is one of the pioneers of the Tissue Culture technique and a tissue culture laboratory was established in the late 1960s. The lab was re-established after renovations with a financial grant from the European Union and reopened in 2019 by the Honourable Prime Minister of Fiji and EU Ambassador in the memory of late Dr. Krishnamurthi, one of the pioneers in plant breeding and tissue culture. Seedlings produced in the lab are hardened in the greenhouses and planted in the field as nucleus plots, which is an equivalent to a mother plot. The material from the nucleus plot will be used to establish distribution plots from which seed cane will be distributed to growers.

1.2 Department of Crop Management

Sugarcane nutrition is important for optimal cane growth and yield. The SRIF conducts fertilizer trials to optimize fertilizer applications for cane growth. It is also carrying out various research projects on Soil health, integrated nutrient management, managing soil acidity by limimg, green manuring and other agronomical practices which are essential for sugarcane. The SRIF is a leading provider of independent analytical services. Its analytical laboratory acts as a link between the sugarcane growers and the industry by providing fertilizer advisory services to the growers and further analytical services required for research projects within the institute. This service is essential due to the rising cost of fertilizers and to maintain optimum production in the future. Optimum application of fertilizer for maximum cane and sugar yield is only possible if we know the status of the sugarcane soil and the plant. The analysis is carried out to provide fertilizer recommendation for optimum production.

The institute through its research programmes, developed integrated weed management programme with the theme “Zero tolerance to Weeds” to reduce weed population in the farms. Herbicides are also tested for its efficacy and recommendation rates for effective chemical weed control. Inundation of sea water in sugarcane farms is common in sugarcane growing close to the coast, which eventually causes soil salinization. Increases in sea level would make these areas difficult for production and possibly abandoning of farms. Research on mitigating salinity will be pursued in future.

1.3 Department of Crop Protection

Crop Protection is one of the important sections of the Sugar Research Institute of Fiji. This department monitors the pest and diseases of sugarcane continuously and advise the farmers on control measures. The Institute has Disease Control Units in all the mill districts that conducts routine inspection of the cane belt and removes any diseased plants. The seed cane certification

schemes have been introduced by SRIF to ensure that the growers are taking the clean, quality, and pure strain of planting materials.

1.4 Department of Technology Transfer

The Technology Transfer initiatives undertaken by Sugar Research Institute of Fiji aims to promote sustainable and profitable sugar cane production in Fiji. SRIF continues to develop new technologies through research and provide much needed technical support to Extension personnel and farmers.

The Technology Transfer initiatives of SRIF include:

- Establishment of Grower Demonstration trials
- Organizing field information days
- Provide Training to FSC Farm Advisors
- Provide Training to Farmers
- Design training manuals, factsheets, audiovisual aids and
- Propagation of hot water treated Seed cane through establishment of Mother plot nurseries.

The key focus of SRIF's Technology Transfer initiative is to provide capacity building and empowerment training to FSC farm advisors and sugarcane farmers to enable them to adopt Best Management Practices related to Sugarcane Agriculture. Adopting Best Management practices is recommended to increase production for same area and generate more revenue.

1.5 Department of Accounts, Finance and Human Resources

The Department of Accounts, Finance and Human Resources is headed by the Chief Finance Officer (CFO). It plays a major role in managing the accounts and finance of the institute. One Human Resource Officer in this department looks after all issues pertaining to the human resources of the institute.

1.6 SRIF Board

The SRIF Board comprises of the following:

S.No	Name	
1.	Mr. Prakash Chand	Chairman
2.	Ms. Reshmi Kumari	Member (Government Representative)
3.	Mr. Bhan Pratap Singh	Member (FSC Representative)
4.	Mr. Vimal Dutt	Member (Growers Representative)
5.	Prof. Ravi Naidu	Member (Qualified Scientist)
6.	Mr. Ashween	Member (Qualified Scientist)
7.	Mr. Raj Sharma	Member (Business Expert)
8.	Mr. Ronal R Kumar	Board Secretary

BOARD OF DIRECTORS

MR. PRAKASH CHAND
Chairman

MR. BHAN PRATAP SINGH

MR. VIMAL DUTT

MS. RESHMI KUMARI

PROF. RAVENDRA NAIDU

MR. RAJ SHARMA

MR. ASHWEEN RAM

Science Audit Committee

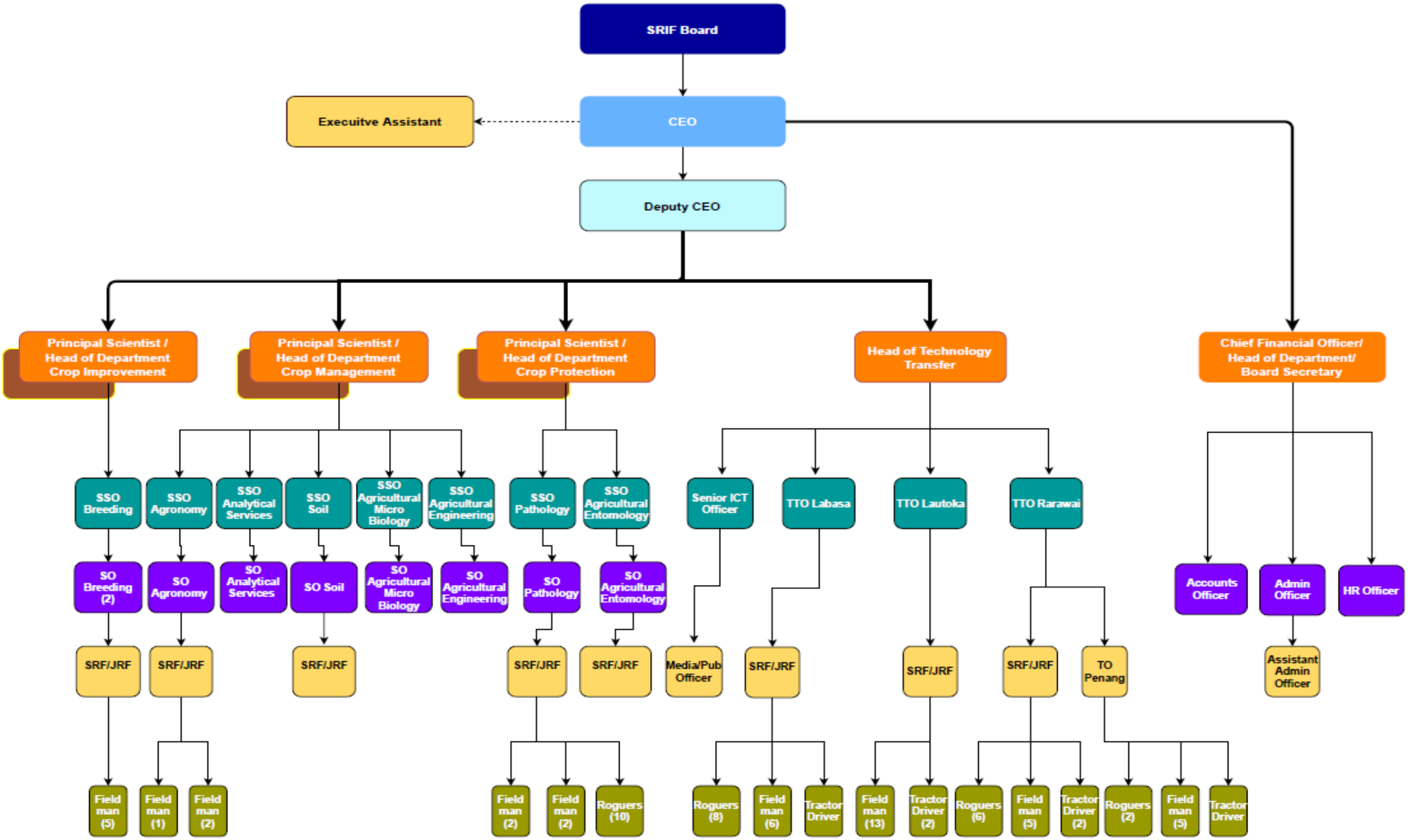
PROF. RAVENDRA NAIDU
Chairman

MR. BHAN PRATAP SINGH

MR. VIMAL DUTT

MR. ASHWEEN RAM

SRIF ORGANOGRAM



SRIF Technical Staff

Office of the CEO

Prof. S. Mahimairaja	-	Chief Executive Officer
Mr. Prem Naidu	-	Deputy Chief Executive Officer
Ms. Sharon Chand	-	Executive Assistant to CEO
Mr. Nitan Kumar	-	Driver cum Admin Assistant

Department of Crop Improvement

Mr. Amit Raj Sing	-	Senior Scientific Officer (Breeding)
Mr. Ilisoni Vorelevu	-	Senior Scientific Officer (Breeding)
Ms. Kaashvi Goundar	-	Scientific Officer (Tissue Culture)
Mr. Shazil Hassan	-	Scientific Officer (Breeding)
Mr. Sanmogam Gounder	-	Scientific Officer (Breeding)
Ms. Rusila Baleidromo	-	Junior Research Fellow (Tissue Culture)

Department of Crop Management

Ms. Nazeea Bano	-	Senior Scientific Officer (Agronomy)
Ms. Doreen Pillay	-	Senior Scientific Officer (Analytical Services)
Ms. Ronika Mala	-	Junior Research Fellow (Analytical Service)
Ms. Nikhilta Goundar	-	Junior Research Fellow (Analytical Service)

Department of Crop Protection

Ms. Nalini Prasad	-	Senior Scientific Officer (Pathology)
Ms. Binita Padayachi	-	Scientific Officer (Entomology)
Mr. Ashneel Kumar	-	Junior Research Fellow

Department of Technology Transfer

Mr. Abinesh Kumar	-	Technology Transfer Officer (Lautoka)
Mr. Renil Kumar	-	Technology Transfer Officer (Labasa)
Mr. Pedro Rounds	-	Senior ICT Officer
Mr. Kalivati Valetini	-	Scientific Officer (Agronomy)
Mr. Faizal Ali	-	Media Publication Officer

Department of Account, Finance & Human Resources

Mr. Ronal Kumar	-	Chief Finance Officer
Ms. Ashna Devi	-	Human Resource Officer
Ms. Nitika Natasha	-	Accounts Officer
Ms. Anshika Mala	-	Assistant Administrative Officer

SIRF Sub-Centre Ba

Mr. Amit Raj Singh	-	Officer-in-Charge
Mr. Ilisoni Vorelevu	-	Senior Scientific Officer (Breeding)
Mr. Ashneel Kumar	-	Junior Research Fellow

SRIF Sub-Centre Labasa

Mr. Renil Kumar	-	Officer-in-Charge
Mr. Kalivati Valetini	-	Scientific Officer (Agronomy)
Ms. Ronika Mala	-	Junior Research Fellow

SRIF Sub-Centre Penang and Breeding Centre Dobuilevu

Mr. Shazil Hassan	-	Officer-in-Charge
Mr. Sanmogam Goundar	-	Scientific Officer

2. RESEARCH & DEVELOPMENT

2.1. DEPARTMENT OF CROP IMPROVEMENT

Summary

- A total of 554 crosses, including 313 bi-parental crosses and 241 poly-crosses were made at Dobuilevu breeding station.
- Pollen fertility test was conducted in 120 clones to determine the parental clones as strong males or females and added in the parent database.
- A total of 8027 genetically segregating seedlings generated from 211 crosses made during 2000 were planted in stage 1 trial.
- Based on high HR Brix and better field stand, 760 seedlings were selected from 8470 seedlings and were planted in stage 2 trial. Among these selections, 134 seedlings showed more than 23 % HR Brix.
- In LF 2018 stage 2 trial, 45 clones were selected among 332 test clones based on juice quality parameters and field assessment and planted in stage 3 trial.
- In LF 2013 stage 4 trial, LF 13-468 was found to be performing well for cane yield and juice quality traits in one plant and two ratoon trials conducted across all the test locations viz., Drasa, Rarawai, Rakiraki and Labasa. In addition, LF 13-454 and LF 13-116 were also found to be superior compared to the standards.
- Among the 18 clones of LF 2015 series tested in Rarawai and Labasa, LF 15-458 performed well for cane yield and % POCS in one plant and one ratoon trials.
- Farmer Field Trial indicated that LF 09-1707 was better with 135 t/ha of cane yield, 16 tonnes/ha of sugar yield and 13.06 % POCS compared to the standards Mana, Kaba and Naidiri.
- LF 13-468 performed better in FFE conducted in all the four locations namely Rarawai, Penang, Drasa and Labasa. in one plant and one ratoon crops.
- The pre-release clone LF 11-233 showed better POCS (14.79 %), Cane purity (87.2%), Pol in cane (15.96 %) in Large Mill Test conducted in Rarawai mill compared to the mill average on 07.10.21.

Breeding Programme

Sugarcane variety development program of Sugar Research Institute of Fiji (SRIF) aims at developing genetically improved varieties of sugarcane for the Fijian sugar industry. This program comprises of several distinct stages (Table 1), each of which is key to create, select, test, and release a new variety for commercial production. For the program to be successful, each of these steps must be scrupulously followed each year. About 4000-8000 new seedlings are planted each year as potential future varieties by SRIF. The breeding cycle takes between ten and twelve years, but every year new varieties are tested for their suitability to be released. The newly bred varieties are continuously compared with the major commercial varieties in every selection stage to ensure that they improve profitability of sugar industry.

Table 1. Sugarcane varieties (LF varieties) development program of SRIF

Year	Stage	Month/Activity	Description Plot size, replication	Selection Criteria
1	1	Nov/Dec- plant seedlings		
1	1	Sep/Oct-select and plant stage 2	Single stools – free stooling Seedlings planted 60cm apart	Brix Field observation for growth, pest & disease
2	2	Jul –pre-brix Aug- small mill sampling and plant stage 3	Single lines 1row x 6m	Pre – brix Final - %POCS and field observation
3	3	Sep – small mill sampling. Selection for stage 4 trials.	Observation plot 4rows x 4m	%POCS, plot yield and field observation
4	4	Sep- plant stage 4 seedbed		
4	4	Sep- provide seed cane for disease screening seedbed	Disease screening	
5	4	Apr/May- plant trial	Adaptation trial (G x E) 4rows x 4m 2 replications Multiple locations (4)	
6 **7** **6-8**	4 4	Jun/Jul – evaluate plant crop Jul - evaluate 1st & 2nd ratoon crop Identify varieties for FFE in 1st ratoon		Small mill sample analysis data- brix, purity, % fibre, cane and sugar yield Disease rating
8		Sep- plant large mill trial (LMT) seedbed	Seedbed established based on stage 4 P, R data.	
9		Apr/May – plant LMT trial		
10		Apr/May	Agronomic characteristics studies	
10		Jul	Conduct LMT	
11		Apr	Release a variety	

POCS- Pure Obtainable Cane Sugar, LMT- Large mill trial, P- Plant, R- Ratoon, S – 2nd Ratoon

2.1.1. Maintenance of germplasm and making desirable crosses for selection of varieties and identification of genetic stocks

Objectives:

- To maintain, characterize and use of germplasm in breeding program for the development of superior varieties.
- To augment the breeding gene pool with the addition of foreign varieties and genetics stocks identified in the breeding programs.
- To make desirable crosses for selection of varieties and identification of genetic stocks.

Work done:

Germplasm represents the sum total of genes available in the species and is the basis for the creation of new cultivars in sugarcane breeding. Characterization and utilization of diverse germplasm as parents aid the development of new and superior cultivars with high sugar content, better agronomic characteristics and resistance to pests and diseases. In 2021, 14 breeding/flower beds were raised at Dobuilevu for producing the required number of flowers for making targeted crosses. A total number of 678 individual breeding clones were planted and maintained in the flowering beds (Figure 1). Out of these 678 clones, only 414 clones (86 males and 328 females) flowered (61 %) in the 2021 crossing season. Germplasm maintenance was continued in 2021 in Drasa and Rarawai. It is recommended to replant the germplasm to avoid admixture by volunteers in the next year.

Fig 1. Field view of the Flowering of parental clones at Dobuilevu Breeding Station

2.1.2 Hybridization for generating variability, selection of varieties and identification of genetic stocks

Objective:

- To identify desirable cross combinations for commercial breeding programme and development of genetic stocks

Work done:

Crossing season in 2021 was marked by significant challenges. COVID-19 restrictions led to unforeseen difficulties in the crossing program. Fijian government issued a Stay-at-Home Order in late April to combat the spread of COVID-19 and the Sugarcane Breeding Station was managed with minimal support staff who were staying close to the station, hence many flowers could not be utilized at the beginning of the crossing season. The flowering season began in the fourth week of April in 2021, a little earlier than the previous two years and ended on the first week of July. A total of 554 crosses, including 313 bi-parental crosses and 241 poly-crosses were made. Poly-cross male flowers were set up in two temporary tents. The breeding shed was fully utilized for bi-parental crosses. During the year 2021, crossing was mostly focused on breeding for commercial canes, so no *interspecific* or *intergeneric* crossings were made.

This year pollen fertility tests were carried out on some of the clones to determine the sex of the parental clones i.e., clones displaying less than 10% pollen stain were used as female, between 10-20% were used as both and more than 20% stained pollen were used as male (Mcintyre and Jackson, 2001). Sex of the clones would mostly be determined based on anther dehiscence and the flowers of the clones with more opened anthers were designated as male. Sugarcane breeding station maintains 628 diverse parental clones for commercial breeding program. During the year 61% of the clones flowered. A total of 554 crosses were made in 2021 in spite of COVID-19 restrictions that were in place at the beginning of the crossing season (Appendix 1). Pollen fertility tests were conducted in clones to determine the parental clones as strong males or females.

2.1.3 Fluff sowing and breeding selection stages

***Fuzz Sowing*:** A total of 211 packets of fuzz were sown in 2021 which was from the 2020 crossing season. The percentage germination of fuzz was relatively high (75%) and approximately 10,000 seedlings were produced (Table 2). The number of seedlings that germinated per cross ranged from as low as one to more than a hundred.

Table 2. Summary of Fuzz Sown and Germinated

Type of Crosses	No of Crosses Sown	No of Crosses Germinated	Germination (%)
Poly-cross	153	135	88.2
Bi-parental cross	58	24	41.4
Total	211	159	

A total of 88.2% of poly – crosses fuzz sown were germinated in comparison to 41.4% germination of bi-parental crosses. Historically, fuzz from poly-crosses is more viable than a bi-parental combination. However, the germination percentage of bi-parental crosses have drastically improved in the last few years probably due to the use of new crossing solution during the crossing.

Potting of seedlings: Potting of the seedlings was carried out 3 months after the first hardening phase since the fuzz sowing. Seedlings' stability was tested against durability by running the fingers through the leaves of young seedlings to check durability and erectness. The post-potting plan was designed appropriately to arrange trays from high to low seedling density.

It was noted that 22 crosses produced more than 100 seedlings per cross. Two female varieties (LF98 – 1098 and LF00 – 1137) produced more than 500 seedling (Table 3) The LF98 – 1098 produced 760 seedlings from 9 crosses, which constituted approximately 10 % of the total seedling. Approximately 96% of parental combinations that produced more than 100 seedlings were from poly–crosses. A male variety, LF05-1379 produced the highest seedlings in bi-parental crosses in combination with LF00-1096.

Table 3. Cross combinations that produced more than 100 seedlings

S.No.	Parent			Est. germination count after sowing	Actual number of seedlings planted as stage 1 trial
	Cross #	Female	Male		
1	404	LF98 – 1098	POLY – 93	100	143
2	412	LF02 – 1120	POLY – 96	50	143
3	131	LF98 – 1098	POLY – 32	65	142
4	126	LF05 – 36	POLY – 30	60	141
5	333	LF98 – 1098	POLY – 74	60	139
6	135	LF00 – 257	POLY – 33	100	138
7	21	LF00 - 1127	POLY – 11	150	136
8	24	LF03 - 24	POLY – 13	150	130
9	15	LF00 - 1135	POLY – 8	50	128

10	18	LF00 - 1135	POLY – 10	100	128
11	394	LF02 - 781	POLY – 90	150	126
12	436	LF02 - 342	POLY – 101	200	120
13	183	LF00 - 257	POLY – 42	150	119
14	206	LF02 - 781	POLY – 50	100	117
15	49	LF00 - 1096	LF05 – 1379	150	116
16	232	LF03 - 396	POLY – 55	30	113
17	414	LF05 - 272	POLY – 97	150	113
18	447	LF05 - 36	POLY – 104	60	113
19	25	LF00 - 1082	POLY – 13	100	108
20	198	LF02 - 781	POLY – 47	65	107
21	303	LF70 - 4848	POLY – 70	100	104
22	230	LF02 - 403	POLY – 54	100	102

Stage 1 Trial

Stage 1 trial is the seedling stage of the plant breeding program. The seedlings from the crosses are planted side by side in the field along with the standards, 100 seedlings per row. The selection criterion is limited to the highly heritable character i.e., sugar which is estimated on the basis of the HR brix. Brix is a measure of total soluble solids in cane juice which includes sucrose as a major component. In addition to HR Brix, the physical appearance of the cane, the natural incidence of pests and diseases, and agronomic desirability were also considered during the selection process.

The seedlings are selected based on equal or higher brix compared to the standards (commercial varieties) and are advanced as Stage 2. In some cases, clones with lower brix are also considered based on their appeal i.e., agronomic desirability in terms of stalk height, thickness, tillering, and vigor. No biochemical evaluation is carried out in this stage due to the larger number of seedlings and the limited number of cane stalks/seedlings.

LF2021: The LF2021 Stage 1 was planted at Rarawai Estate field 6 from the 9th to the 12th of November 2021. A total of 8027 seedlings were evenly distributed within 4 beds. Each bed consisted of an 84 x 12 meters plot with 20 seedlings per plot. The planting plan was designed in such a way as to segregate the number of seedlings per cross throughout the furrow from bed one to bed four to make the evaluation easy. During planting, crosses with a high number of seedlings were planted first followed by the crosses with a lower number of seedlings. The field

received an ample amount of rainfall prior to planting and during planting. Seedling's survival percentage was relatively high (more than 90%). No fertilizer was applied during planting however weeds were controlled after planting.

LF2020: The trial was planted in November 2020, with 8370 seedlings. The trial was well managed with proper timely crop husbandry practices. Bed 5 was badly affected by a flood that resulted in heavy lodging and the seedlings in this bed recorded comparatively low HR brix. However, throughout the trial, a few distinctive features were portrayed by some seedlings and were found to be very promising. HR Brix was documented which would be helpful in the evaluation and selection for advancement to Stage 2.

Selection: Based on individual sett brix data, a total of 760 seedlings were selected and planted as LF2020 Stage 2 in field 7, Rarawai estate (Table 4).

Table 4. Categorisation of seedlings selected in relation to HR Brix

Standard varieties	Standard average brix	Selection range (brix)	No of varieties selected
VIWA	23.0	23.0 ≥	134
KABA	22.0	22.0 – 22.9	214
NAIDIRI	21.0	21.0 – 21.9	343
MANA	20.0	20.0 – 20.9	66
		18.0 – 19.9	3
Total	-	-	760

Stage 2 Trial

Stage 2 trial is the first clonal stage after selection from the seedlings. The selected seedlings from Stage 1 are advanced to this trial and given an index number that becomes its identity for the rest of the breeding program. The selection and evaluation are carried out in the Plant crop.

The first part of the evaluation in Stage 2 is to conduct brixing on all clones as well as the standards and also record the phenotypic characters and agronomic desirability i.e., the growth, appeal, stalk height, stalk diameter, flowering, and tillering. The clones are selected on the basis of the above parameters compared to the standard varieties (commercials). This stage is known as preliminary selection.

The selected clones are sampled along with the standards and brought to the small mill where biochemical analysis is done. The final selection is based on the biochemical data (Brix %, POCS %, Fibre %), and field observations which are noted during brixing in the field compared to the standards. These selected clones are then advanced to the observation plots.

LF2018: The trial was 14 months old; it was affected by a flood after planting in 2020 and in early 2021. The flood caused heavy lodging in some parts of the field. Six stalk samples of the 332

clones were sent to the small mill for biochemical analysis. Thorough plot-by-plot assessments were conducted prior to and during sampling to identify clones with good features. Preliminary observations were recorded and preliminary selection was carried out based on the field data.

The final selection was carried out on the 332 test clones based on the biochemical data received from the small mill test as well as the data recorded during field assessment. Based on these Data, 45 clones were selected and advanced to Stage 3 (Table 5). This was approximately 14% of the total stage 2 population.

Table 5. Number of varieties selected based on POCS % range.

Selection Range (%POCS)	Variety selected
≥ 15	5
14.00 – 14.99	8
13.00 – 13.99	14
12.00 – 12.99	10
11.00 – 11.99	6
≤ 11.00	2
Total	45

The average POCS for the three standards used was between 10.55 – 15.2. Four test clones; viz., A120, A123, B6, and B10 had high POCS but low field ratings were also identified for further analysis or an addition to the gene pool for using as parents. The field was burnt by arson hence the trial was ploughed out before any further action was taken.

Stage 3 Trial

The ultimate goal of sugarcane breeding is to develop genetically improved varieties that have a positive impact on the sugar industry. In the early, segregating generations the breeder selects the progeny of the crosses so as to remove those with undesirable or inferior genotypes and progressively move toward a smaller number of elite lines. This third stage is the largest part of a breeding program and involves identifying the products of genetic segregation and recombination and identifying the elite genotypes as quickly as possible while minimizing the risk of failing to retain a superior line.

LF2016: The trial got burnt by arson. Evaluation and selection will be carried out in 2022.

LF2017: The trial was burnt by arson. Evaluation and selection will be carried out in 2022.

2.1.4. Advanced stage selection and Pre-release programme

In 2020-2021 season, the following series were in Stage 4 were evaluated and Farmer Feel Effect (FFE) and Large Mill Trial (LMT) were conducted (Table 6).

Table 6. Summary of Advance stages selection and Pre-release program conducted with locations

Series	No. of clones	Type	Status	Locations
LF2015	20	Advance Stage 4	1R	Rarawai, Labasa
LF2013	13	Advance Stage 4	2R	Rarawai, Drasa, Dobuilevu, Labasa
LF2014	20	Advance Stage 4	Plant	Rarawai, Drasa, Penang, Labasa
LF2011 **LF2013**	1 5	Farmer Feel Effect (FFE)	Review Planted for feedback	Rrawai, Drasa, Labasa, Dobuilevu Mota
LF2011	1	Large Mill Trial (LMT)	Carry out mill trial	Rarawai, Drasa

Year 2020-2021 posed a lot of challenges whereby trials in Labasa sustained damages from TC Yasa and Ana as well as seed bed for LF2017 and LF2016 series could not be established due to Stage 3 trials being burnt by arson. However, the following trials were evaluated:

- LF2013 series second ratoon crop in Drasa, Rarawai, Penang and Labasa.
- LF2015 series first ratoon crop in Rarawai and Labasa.LF2014 series Stage 4 was planted at Drasa, Rarawai, Dobuilevu and Labasa.

The main selection criteria used for evaluating the test clones:

- Sugar yield (tsha) which is measure of POCS % multiplied by cane yield divided by 100. This is used because it takes into consideration both POCS and cane yield.
- Per cent Fibre (%)
- Field characteristics

All the trial data for respective station is consolidated by clones and replicates and mean of values for each clone across replications calculated and presented in a Table 7. The varieties were then ranked based on sugar yield compared to standards.

LF2013: This trial was planted at all mills in 2018 with 13 varieties and standards in 4 replicates using RCBD trial design. The trial is in 2nd ratoon and the data from Plant, 1st ratoon and 2nd ratoon crop is discussed below.

A trial was planted in Field 5 at Rarawai Estate in 2018 with 13 test varieties and another imported variety R570. Commercial varieties Mana and Naidiri were used as standards. The field had rich river soil with high sand content. The trial was maintained well and the sampling for small mill and plot weighing done in a timely manner.

Table 7. Performance of LF2013 test varieties with standards in 2 ratoon and 1 plant crops at Rarawai

Variety	%POCS			Cane (ton/ ha)			Sugar (ton/ ha)		
	(P)	(1R)	(2R)	(P)	(1R)	(2R)	(P)	(1R)	(2R)
MANA	12.49	12.65	12.92	112	103	69	14	13	9
NAIDIRI	13.93	14.24	14.45	121	98	77	17	14	11
R570	12.23	12.31	13.10	130	77	86	16	9	11
LF13-468	12.70	12.54	14.19	109	106	75	14	14	11
LF13-468	11.44	12.78	13.77	119	107	77	14	13	11
LF13-454	12.40	13.16	13.12	140	99	72	17	13	9
LF13-116	12.50	13.95	14.52	98	108	67	12	15	10
LF13-410	13.20	12.77	14.40	90	102	61	12	13	9
LF13-485	12.71	13.85	13.15	104	108	67	13	15	9
LF13-427	12.20	14.24	14.05	108	113	79	13	16	11
LF13-452	13.88	13.62	13.95	102	63	46	14	9	6
LF13-441	13.48	13.84	15.24	95	62	71	13	9	11
LF13-460	11.87	13.34	12.65	74	80	83	9	11	11
LF13-238	13.39	13.13	13.81	92	90	60	12	12	8
LF13-405	13.42	13.34	14.53	78	91	42	8	12	6
LF13-543	10.45	13.05	12.34	93	65	46	10	8	6

The varieties LF13-468, LF13-454 and LF13-116 were found to be consistently performing well in all crop cycles (P, 1R and 2R) (Table 8). LF13-468 was planted in duplicate since it's promising attributes were realized in early selection stages and showed similar results across different stages. Other important characteristics of the LF13-468 are moderate to profuse flowering, purplish cane with sheath hair. Other promising varieties viz. LF13-454 and LF13-116 will also be monitored and considered for farmer feel effect and decision will be made to either use as parent in breeding programs or considered for commercialization along with LF13-468.

Another trial was planted at Field 24 Drasa Estate and had medium fertile soils. This trial had poor germination and stools were sent from seed bed at Rarawai for gap filling in this trial. All other trial maintenance work was done in a timely manner as well as sampling for small mill and plot cane yield were also done as per schedule.

Table 8. Performance of LF2013 test varieties with standards in 2 ratoon and 1 plant crops at Drasa

Variety	%POCS			Cane (ton/ ha)			Sugar (ton/ ha)		
	(P)	(1R)	(2R)	(P)	(1R)	(2R)	(P)	(1R)	(2R)
MANA	11.69	12.83	12.45	71	73	80	8	9	10
NAIDIRI	9.80	12.03	14.54	66	83	72	6	10	10
LF13 – 468	10.18	10.39	13.49	95	75	66	10	8	9
LF13 – 468	11.54	10.15	11.74	85	103	53	10	10	6
LF13 – 454	11.56	13.33	14.94	74	74	69	8	10	10
LF13 – 116	11.13	13.44	12.66	88	80	70	10	8	9
LF13 – 238	10.56	11.13	13.74	53	83	74	5	9	10
LF13 – 405	11.35	11.89	12.37	83	76	63	9	9	8
LF13 – 410	9.25	11.12	13.98	69	58	44	7	7	6
LF13 – 427	10.67	12.20	14.02	87	58	46	9	6	6
LF13 – 441	9.98	13.23	13.51	43	75	66	4	10	9
LF13 – 452	10.45	12.41	13.54	77	67	47	8	8	6
LF13 – 460	9.36	11.42	13.84	93	88	56	9	8	8
LF13 – 468	9.97	11.56	13.38	75	80	64	7	7	8
LF13 – 485	11.57	13.40	12.44	73	71	64	8	10	8
LF13 – 543	9.63	11.09	11.53	66	54	43	6	6	5

In this trial, varieties LF13-468, LF13-454 and LF13-116 were again found to be performing well in comparison to the standards (Table 8). LF13-468 was planted in duplicate since it's promising attributes were realized in early selection stages and showed similar results across different stages. While sugar yields dropped in the 2R, it was attributed to more gaps and poor establishment of ratoon crop possibly due to damages during harvesting by mechanical harvester hence damaging ratoons and absence of a full-time staff to monitor post-harvest cultivation. The varieties which had shown better results would be assessed at other mill trails and confirmed for Farmer Feel Effect program.

The third trial was planted in a farmer's cane farm at Dobuilevu, Ra which had poor soil. The trial was established well and the trial maintenance work was done in a timely manner. Sampling for small mill and plot weighing were also done in a timely manner. The data collected in the 3 crop cycles is summarized in Table 9.

Table 9. Performance of LF2013 test varieties with standards in 2 ratoon and 1 plant crops at Penang

Variety	%POCS			Cane (ton/ ha)			Sugar (ton/ ha)		
	(P)	(1R)	(2R)	(P)	(1R)	(2R)	(P)	(1R)	(2R)
MANA	10.35	12.62	9.51	99	101	83	10	13	8
NAIDIRI	11.22	15.39	12.34	87	91	71	10	11	9
KABA	10.98	13.61	12.94	114	112	90	13	15	12
LF13-468	9.62	12.49	10.75	131	109	71	13	13	8
LF13-468	8.96	10.99	9.77	131	114	75	12	13	7
LF13-116	9.37	11.27	8.97	104	119	82	10	13	7
LF13-454	8.75	12.08	11.71	121	107	103	11	9	12
LF13-427	11.67	12.44	12.18	98	101	74	12	12	9
LF13-485	10.67	13.24	11.37	100	103	85	11	14	10
LF13-238	11.71	12.03	12.71	49	66	77	6	8	10
LF13-405	9.40	12.51	10.69	77	91	79	7	8	8
LF13-410	9.54	12.70	10.64	82	101	67	8	13	7
LF13-441	10.38	13.93	11.96	85	90	67	9	12	8
LF13-452	10.49	13.08	11.81	68	77	67	7	10	8
LF13-460	8.20	11.37	11.69	114	108	101	9	9	12
LF13-543	7.73	12.30	9.71	86	102	84	7	13	8

The varieties (LF13-468, LF13-116, LF13-454, LF13-127 and LF13-485) were found to be performing well in all crop cycles compared to the standards (Table 9). LF13-468 again showed promising results as observed in other mills whereas LF13-468, LF13-454 and LF13-116 performed similar to the standards. LF13-468 together with LF13-116 and LF13-427 can be seen to be comparable to the best standard in both crops and varieties LF13-543, LF13-410 and LF13-441 were comparable to the lowest standard in the 1st ratoon crop. The variety LF13-454 can be seen to be comparable to the lowest standard in the Plant crop. The above varieties would be assessed for other traits in terms of appearance, appeal, growth and other physical attributes before being recommended for farmer feel effect.

A stage 4 trial of LF2013 series was planted on 15th June 2018 in Seaqaqa. Unlike above trials, there were only 9 varieties planted in 4 replicates as 4 other varieties did not establish well in the seed bed and enough seedcane was not available to plant. Each replicate had 3 commercial standard varieties. The plot size was 4 rows by 6 meters. The 2nd ratoon crop trials were abandoned and not evaluated due to extensive damage sustained by TC Yasa and Ana in Vanua Levu in late 2020 and early 2021, respectively.

Table 10. Performance of LF2013 test varieties with standards in 1 ratoon and 1 plant crops at Labasa

Variety	%POCS		Cane (ton/ ha)		Sugar (ton/ ha)	
	(P)	(1R)	(P)	(1R)	(P)	(1R)
NAIDIRI	13.85	13.20	67	83	9	11
QAMEA	13.68	13.63	63	71	9	10
RAGNAR	13.93	13.75	63	69	9	9
LF13-452	13.03	13.33	61	75	8	10
LF13-468	13.20	13.43	60	74	8	10
LF13-405	13.98	13.85	58	70	8	10
LF13-116	12.95	13.55	58	67	7	9
LF13-485	12.23	12.68	69	72	8	9
LF13-238	12.85	13.75	56	63	7	9
LF13-441	12.03	13.28	55	65	7	9
LF13-543	11.75	12.08	59	67	8	8
LF13-427	13.30	12.70	57	62	8	8

None of the test clones was found to be superior compared to the best standard Naidiri (Table 10).

LF2015 Stage 4

Only 2 trials were planted for this series due to insufficient seed cane in the Stage 3 trial as seed bed was not established due to Stage 3 trial being burnt in the previous year. A total of 18 clones were planted in RCBD with 4 replicates in Rarawai and Labasa. The results from both trials are discussed below. This trial was planted in Field 6 at Rarawai Estate in 2019 which has rich alluvial soil and maintained well. The trial Sampling and plot weighing were carried out in time as per schedule and the results from the trial is presented in Table 11.

Table 11. Performance of LF2015 test varieties with standards – Rarawai

Variety	%POCS		Cane (ton/ ha)		Sugar (ton/ ha)	
	(P)	(1R)	(P)	(1R)	(P)	(1R)
MANA	9.49	13.87	82	66	8	9
NAIDIRI	13.70	16.21	106	77	14	13
VIWA	13.37	14.80	76	93	10	14
LF15-458	11.95	15.12	147	108	18	17
LF15-418	13.55	15.24	102	84	14	13

LF15-321	13.21	15.06	142	89	19	13
LF15-111	12.77	15.62	118	90	15	14
LF15-196	10.17	13.97	143	80	15	11
LF15-259	14.31	16.61	116	75	16	12
LF15-011	11.75	15.09	74	53	9	8
LF15-250	12.67	13.36	98	70	12	9
LF15-308	11.19	14.14	114	75	13	11
LF15-386	13.30	14.89	91	57	12	9
LF15-387	13.64	15.88	122	68	17	11
LF15-398	13.56	15.66	114	57	15	9
LF15-427	13.19	15.32	72	58	9	9
LF15-432	12.07	14.71	67	76	8	11
LF15-447	14.09	15.69	111	72	16	11
LF15-451	14.1	15.9	79	51	11	8
LF15-492	10.75	15.51	81	58	9	9
LF15-98	12.91	16.35	79	50	10	8

The varieties LF15-458, LF15-418, LF15-321, LF15-111, LF15-196 and LF15-259 were found to be comparable to the best standard (Table 12). These varieties will be evaluated for consistency in the 2nd ratoon before identifying any variety for the farmer feel effect program.

A stage 4 trial of LF 15 series was planted in August 19th 2019 in SRIF Estate, Labasa Sector. Total of 18 varieties were planted in 4 replicates. Each replicate having 2 commercial standard varieties – Mana and Naidiri. The plot size was 4 rows by 6 meters. The summary of the trial data is provided in the table below followed by discussions.

Table 12. Performance of LF2015 test varieties with standards in plant crop at Labasa

Variety	%POCS	Cane (ton/ha)	Sugar (ton/ha)
	(P)	(P)	(P)
MANA	14.28	89	13
NAIDIRI	15.13	114	17
LF15 – 458	14.63	111	16
LF15 – 259	15.63	101	16
LF15 – 432	15.53	101	16
LF15 – 492	15.23	100	15
LF15 – 387	15.70	100	15
LF15 – 427	14.13	104	15
LF15 – 98	14.08	103	14
LF15 – 447	15.43	93	14

LF15 – 011	14.65	97	14
LF15 – 418	14.48	91	13
LF15 – 321	13.80	92	13
LF15 – 398	13.63	92	12
LF15 – 196	14.15	87	12
LF15 – 308	14.15	88	12
LF15 – 111	16.30	74	12
LF15 – 386	13.03	95	12
LF15 – 451	14.63	79	12
LF15 – 250	13.68	81	11

None of the varieties was found to be better than the best standard, however LF15-458, LF15-259 and LF15-4332 were found to be near to the best standard followed by LF15-492, LF15387 and LF15-427 (Table 12). These varieties will be monitored in the 1st ratoon and recommended for propagation for Farmer Feel Effect program if there is improvement or stability in performance.

LF2014 series: A total of 20 varieties with two other clones (LF11-233, LF09-1707) and 3 standards were planted at Drasa, Rarawai, Dobuilevu and Labasa (Table 13). The trial was planted in RCBD design with 4 replicates and standards. From this year agronomic parameters like tiller count, growth measurement and population count will be carried out for the selection of superior clones.

Table 13. Planting details of the trials in different locations

Name of the trial	LF2014 STAGE 4	LF2014 STAGE 4	LF2014 STAGE 4	LF2014 STAGE 4
Location	Rarawai Estate	Drasa Estate	Dobuilevu	Solove Sector, Dagau junction
Date Planted	08.07.21	17.06.21	23,06,21	14.05.21
No. of Varieties	20	20	20	20
Other clones	2 (LF11-233, LF09-1707)	2 (LF11-233, LF09-1707)	2 (LF11-233, LF09-1707)	2 (LF11-233, LF09-1707)
Standards	3 (MANA, NAIDIRI, KABA)	3 (MANA, NAIDIRI, KABA)	3 (MANA, NAIDIRI, KABA)	3 (QAMEA, NAIDIRI, KIUVA)
Trial design	RCBD	RCBD	RCBD	RCBD
No. of Replications	4	4	4	4
No. of plots	100	100	100	100
Plot Size	4 row x 6 m	4 row x 6 m	4 row x 6 m	4 row x 6 m
Headland	VIWA	VIWA	VIWA	VIWA, KIUVA

Topography	Flat	Flat	Slightly undulation	Flat
Soil Status	Rich soil	Medium	Poor- Medium (red) soil	Poor - Medium Soil

The bio-chemical analysis of these trials will be carried out next year.

2.1.5 Variety pre-release program

In 2020-2021, two varieties were in the pre-release program LF09-1707 and LF11-233 in Farmer Feel Effect being given to 2 prominent farmers and LF11-233 also planted for Large Mill Trial in 2021. Details on data for these varieties are provided under respective headings below.

Farmer Feel Effect (FFE): In 2020-2021, varieties from 2 x Stage 4 series have been provided to farmers (Table 14) for conducting FFE:

Table 14. Details on the Farmer Feel Effect trials conducted during 2021

Series	Variety	Location	Details
2009	LF09-1707	Rarawai Estate Drasa Estate	Planted as prop
2013	LF13-468, LF13-454, LF13-116, LF13-485, LF13-427	Arun Sharma farm – Nukuloa, Ba	Planted in strip trial, farmer feedback will be recorded in 2022.
2011	LF11-233	Nalin Maan's farm – Vitogo, Lautoka	Planted and harvested 0.9 acre, achieved approx. 100 tpha
2011	LF11-233	Arun Sharma farm – Nukuloa, Ba	Good feedback on growth in sloping land and height

LF2009 series: Variety LF09-1707 was identified from an FFE plot that was planted in Vatusui, Ba (Mota Sector) on farmer Vishwa Nathan's farm and propagated further in the Estate.

Table 15. Performance of LF09-1707 for cane yield and juice quality parameters in Farmer Feel Effect trials

Variety	%POCS		Cane (ton/ ha)		Sugar (ton/ha)	
	P	1R	P	1R	P	1R
MANA	15.47	9.74	125	128	19	9
KABA	13.76	7.90	133	118	18	6

NAIDIRI	15.69	7.72	92	102	14	6
LF09-1707	15.62	10.50	144	125	22	10

The data showed that this variety out-performed the standards and its growth and establishment at the estate farms were also found to be very good (Table 15). However, this variety has displayed profuse flowering as well as 'bunchy top' due to excessive side-shooting on the cane top hence cannot be promoted for release. However, it was found to be very good for cane yield and can be used in the crossing program.

LF2013 series: The LF2013 series Stage 4 was established in 2018 with 16 test varieties and 5 varieties were identified based on performance for cane yield and quality parameters in 3 crop cycles and mill areas (Table 16).

Table 16. Performance of LF2013 for cane yield and juice quality parameters in Farmer Feel Effect trials

Location	Variety	%POCS		Cane (ton/ha)		Sugar (ton/ha)	
		(P)	(1R)	(P)	(1R)	(P)	(1R)
RARAWAI	MANA	12.49	12.65	112	103	14	13
	NAIDIRI	13.93	14.24	121	98	17	14
	R570	12.23	12.31	130	77	16	9
	LF13-468	12.70	12.54	109	106	14	14
	LF13-468	11.44	12.78	119	107	14	13
	LF13-454	12.40	13.16	140	99	17	13
	LF13-116	12.50	13.95	98	108	12	15
PENANG	MANA	10.35	12.62	99	101	10	13
	NAIDIRI	11.22	15.39	87	91	10	11
	KABA	10.98	13.61	114	112	13	15
	LF13-468	9.62	12.49	131	109	13	13
	LF13-468	8.96	10.99	131	114	12	13
	LF13-116	9.37	11.27	104	119	10	13
	LF13-454	8.75	12.08	121	107	11	9
	LF13-427	11.67	12.44	98	101	12	12
	LF13-485	10.67	13.24	100	103	11	14
DRASA	MANA	11.69	12.83	71	73	8	9
	NAIDIRI	9.80	12.03	66	83	6	10

	LF13 – 468	10.18	10.39	95	75	10	8
	LF13 – 468	11.54	10.15	85	103	10	10
	LF13 – 454	11.56	13.33	74	74	8	10
	LF13 – 116	11.13	13.44	88	80	10	8
LABASA	NAIDIRI	13.85	13.20	67	83	9	11
	QAMEA	13.68	13.63	63	71	9	10
	RAGNAR	13.93	13.75	63	69	9	9
	LF13-452	13.03	13.33	61	75	8	10
	LF13-468	13.20	13.43	60	74	8	10
	LF13-405	13.98	13.85	58	70	8	10

Variety LF13-468 has been found to be better at all mill centers followed by LF12-454 being good at 3 mill centers (Table 16). These two varieties as well as LF13-116, LF13-427 and LF13-485 are being propagated for further assessment and Large Mill Trial.

LF2011 series: Variety LF11-233 had been planted in 2 farmers field – Naleen Maan in Lautoka and Arun Sharma in Ba for feedback. The following Table 17 shows the performance of the variety from the trials.

Table 17. Performance of LF11-233 for cane yield and juice quality parameters in Farmer Feel Effect trials LF11-233 trial data

Variety	%POCS		Cane (ton/ha)		Sugar (ton/ha)	
	P	1R	P	1R	P	1R
MANA	13.35	12.10	116	125	16	15
NAIDIRI	11.84	13.32	114	135	14	18
LF11-233	12.98	12.45	106	91	14	13

It was observed that the sugar yield per hectare which is a measure of POCS and cane yield falls within the range of the standard varieties (Table 17). The cane yield, although lower than standards in the Plant and First ratoon, was still higher indicating good ratooning ability.

The yield attained by farmer Naleen was close to 100 tpha under rainfed conditions and overall feedback has been impressive and willing to continue with this variety. Another farmer – Arun Sharma had planted it in undulating field (small plot) and has been impressed with its physical outlook – tall, slightly lodging even though planted on sloping field.

Large Mill Trial:

In 2020-2021, Large mill of variety LF11-233 was carried out despite two major challenges being:

- The LMT plots (LF11-233 and Raganar) got burnt in early season at Rarawai Estate.
- The standards plot (Naidiri) got burnt in Drasa Estate.

However, after discussions it was decided to send the cane from the plot of LF11-233 in Drasa Estate and compare the results with the mill data on the respective day. 7 loads of the new variety were harvested and brought to Rarawai mill for the large mill trial on 07.10.2021.

LF11-233 variety is a high yielding (close to 100 tpha in rainfed conditions), early to mid-maturing, sparsely flowering, long stalks, self-trashing, resilient to excessive lodging by wind. It has been developed from a cross between LF00-480 and Poly male group having LF02-1062, LF05-1160, LF05-973, LF00-540 and LF99-777.

Based on the analytical and mill data collected during large mill trial at FSC Rarawai Mill, following had been recommended:

- The fibre content for LF11-233 is at 12.30 which is within accepted milling range.
- Cell breakage is within par which the Engineering team are expecting
- Cane quality (POCS/Purity) in late season is showing very good results which indicates sugar content is more than expected.

The new variety LF11-233 has revealed through the large mill trial after all necessary data was collated that it has good milling capabilities and also contains high sucrose levels specially in late season (Table 18 to 21).

Table 18. Larger mill data of LF11-233 for quality traits

% Fibre	%POCS	Purity	Pol
12.3	14.79	87.2	15.96

Table 19. Comparative performance of LF 11-233 with the mill average data

Parameters	Mill Average	LF11-233
POCS	10.54	14.79
Cane Purity	79.9	87.2
Cane Brix	15.07	18.30
Cane Fibre	12.5	12.3
Pol in Cane	11.96	15.96

Cell Breakage	89	89
Expected TCTS @ 80% Recovery	10.4	7.8

Table 20. Comparative performance of the test clone LF11-233 and the standard Qamea (Based on small mill tested conducted at FSC Analytical lab at Rarawai)

Variety	**LF11-233**	**Qamea**
%Pol	20.3	19.5
Fibre	12.3	12.3
Pol in Cane	16.79	16.13
Bx in Cane	19.65	18.89
Small Mill POCS	15.36	14.75
Small Mill PTY	85.4	85.4
Large Mill POCS	13.86	13.25
Large Mill PTY	82.2	82.2
Ph	5	5.1

Table 21. Comparative performance of the test clone LF11-233 and the standard Qamea (Based on small mill tested conducted at SRIF Small mill)

Variety	**Fiber (%)**	**% POCS**
LF11-233	13.2	15.7
Qamea	11.9	15.8

Monthly maturity studies were conducted and it was found that LF11-233 maturity trend falls between Mana and Viwa (Figure 2) which is a mid to late maturing variety therefore LF11-233 shows to be more inclined towards late season maturity.

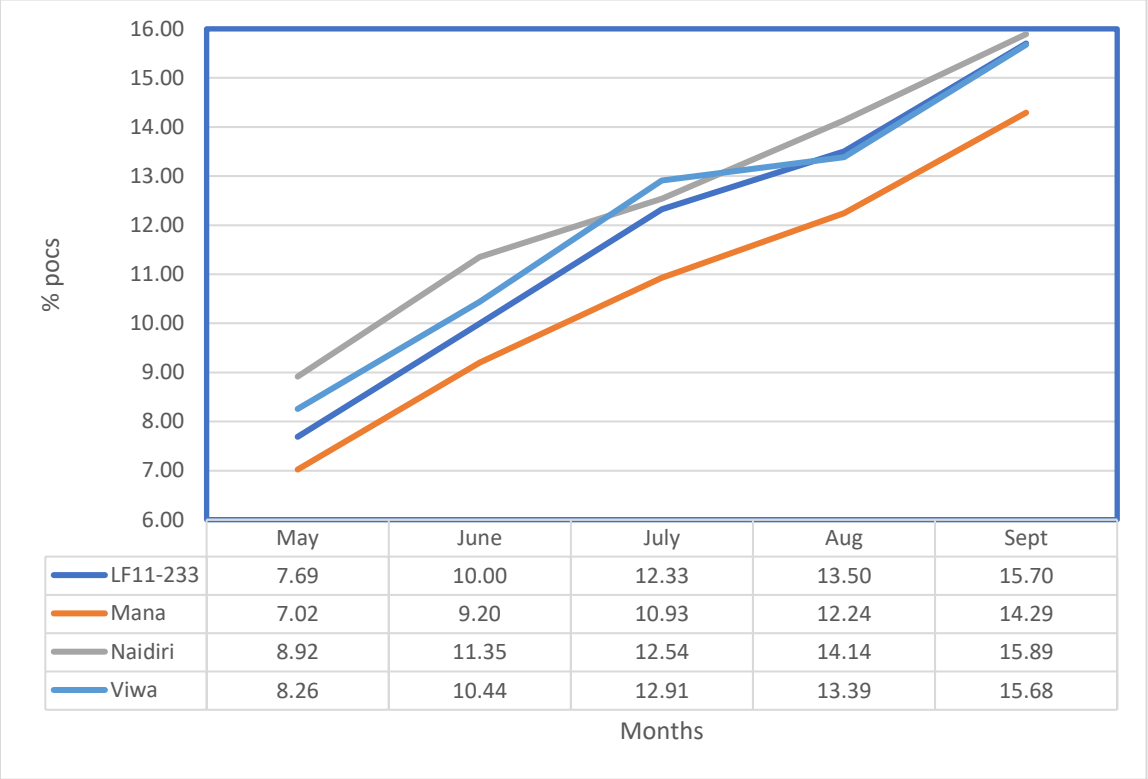


Fig 2. Monthly maturity trend (as expressed in % POCS) of LF11-233

Agronomical Traits

Variety LF11-233 was re-planted in LF2014 Stage 4 series to collect data on important agronomic characters viz., number of tillers, stalk height and stalk population. The data will be recorded in the 3rd, 5th and 7th month to ascertain the agronomic characteristics of LF11-233 in comparison with the standards (Kaba, Mana and Naidiri). Following table (Table 22) shows the data from the 3rd month after planting:

Table 22. LF11-233 agronomic traits against standards at different locations

Location	Variety	Average Tillers (per stool)	Average Height (m per stalk)	Average Population (per 1 x 6m row)
DRASA	Kaba	4	0.27	27
	Mana	4	0.51	37
	Naidiri	6	0.51	54
	LF11-233	4	0.60	36
DOBUILEVU	Kaba	3	0.46	53
	Mana	5	0.42	59
	Naidiri	4	0.41	75

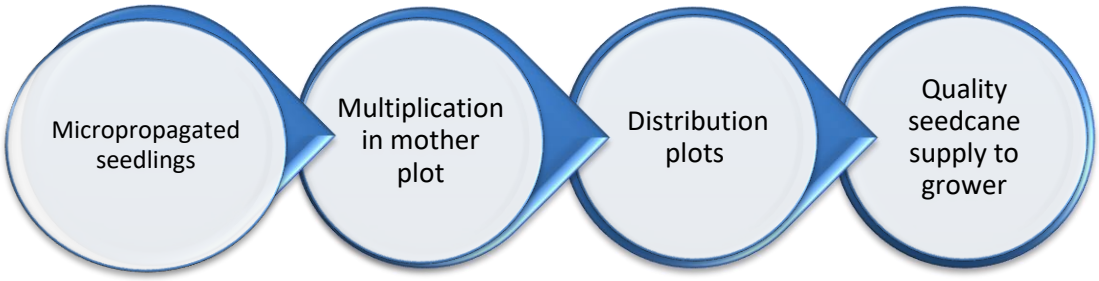
	LF11-233	3	0.47	36
RARAWAI	Kaba	3	0.80	37
	Mana	5	0.64	50
	Naidiri	5	0.72	36
	LF11-233	4	0.75	49

It could be seen that the data of LF11-233 is comparable to the standards especially the stalk height which is higher than the standards at Drasa and Rarawai and better than at least 2 standards in Rarawai. Performance of the test clone will be evaluated at harvest during the year 2023.

2.1.6. Seedling production using Tissue Culture

Objective

- To develop high-quality seed cane material that will be propagated in mother plots and distributed via micropropagation



Work done:

Plant tissue culture is a powerful *in vitro* technique used for creating new genetic variability, long term conservation of desirable germplasm, large scale and fast micropropagation of newly developed varieties and production of disease-free seedlings for quality seed production. The main advantage of tissue culture technology is the production of high quality and genetically uniform planting material that can be multiplied on a year-round basis. Dr. Krishnamurthi Tissue Culture Laboratory produces clean and true to type seed cane materials in a short period of time.

The lab has been successfully re-established and the procedures for production of clean seed material has been implemented. The lab is capable of producing clean seed material in a very

small scale. The procedures for producing seedlings in the lab has been standardized and adoption of seedlings for commercialization is in progress. The overall benefit for the farmers and mills is the production and distribution of quality, clean seedcane material.

During the year 2021, 8,691 cultures were produced in the existing and new batch of meristem culture (L11- 233, Ragnar, LF91-1925, Viwa, Aiwa, and Naidiri). A total of 3,250 Qamea tissue culture seedlings were planted in Waqadra Estate in mother plot, with 45 cm spacing between the seedlings, in 0.4ha. The 2nd batch of seedlings for this year was dispatched with two varieties, LF91-1925 (7,000 plants) and Qamea (2,001 plants) and is scheduled for field planting by late January 2022 under favorable weather conditions. In June, 7 months TC seed cane with an average yield of 37 tonnes/ha was harvested as quality seed cane and distributed to two farms.

The experiment planned for optimization of different potting mixture and comparing the efficiency of tissue cultured vs conventional and hot water treated seed cane was disrupted due to COVID pandemic and lockdowns.

Seedling Production in the lab: The production capacity of a laboratory depends on the size of the laboratory, skilled manpower and number of cycles of micropropagation. Upon culturing one explant, which multiples at several other stages, one glass jar has the capacity of producing 15-25 single plantlets. Year-round production target of 10,000 was drastically affected due to lockdowns and staff testing positive to COVID.

Table 23. Month-wise progressive seedling production and planting

Months	Progressive seedling production	Seedlings dispatched
January	16,003	
February	17,653	
March	17,120	
April	14,271	3,500 Qamea seedlings were transferred to greenhouse
May	10,700	
June	10,300	
July	10,500	
August	14,508	
September	13,540	2,700 Qamea seedlings and 7,410 LF91-1925 seedlings were transferred to greenhouse
October	8,146	
November	7,102	
December	8,691	

As micropropagation is a continuous cycle, in January the culture production was 16,007 plantlets of varieties like LF91-1925 and Qamea. With an increase in culture production during February and March, varieties Aiwa and Viwa were sub cultured. Towards the end of March, the sub

cultured varieties of LF91-1925, Aiwa, Viwa and Qamea were wilting and heavily affected by bacterial and fungal contamination. Due to this, the number of plantlets decreased from 17,120 in March to 14,271 in April 2021. The dispatch of 3,500 Qamea seedlings reduced culture production to 10,500 in May. From June to August, production output increased as Qamea and LF91-1925 was subjected to be dispatched as second batch of the year. From September to October, 2,700 Qamea seedlings and 7,410 LF91-1925 seedlings were transferred to greenhouse. After dispatch, culture production fell, but by November, with higher multiplication and timely subculturing, production had increased to 8,691 by the end of December (Table 23).

Varieties selected for seed cane production: Qamea, Viwa, Aiwa, LF91-1925 and Naidiri were the varieties selected for seed cane production through tissue culture. With Qamea and LF91-1925 dispatched in April, two new batch were introduced for seed production (Table 24).

- LF11-233 – as one of the promising pre-release clones
- Ragnar – Rejuvenation of variety through tissue culture

To shorten the timeframe and procedures, a combination media of Shooting and Rooting trial with Normal Stock at 50X strength and Rooting stock solution at 100X strength was experimented. With good performance in terms of root development, shoots (plant height and leaves size), normal stock solution was finalized in R&S combination media.

Under the variety exchange program between MSIRI and SRIF, extra hygienic protocols for the development of tissue culture seedlings of *Saccharum edule* (Duruka) was standardized and reached Multiplication Stage for the variety White- Duruka Vulavula.

Table 24. The seven varieties selected for seed cane production

Varieties	Stages of Culture	Number of glass jars in this stage	Estimated count of plants per glass jar	Estimated number of plantlets
Viwa	R&S Combination	486 glass jars	8	3,888
Aiwa	R&S Combination	438 glass jars	8	3,504
Naidiri	Multiplication	161 glass jars	7-8	1,281
LF 91-1925	Multiplication	3 glass jars	3	3
LF11 – 233	Initiation	7 glass jars	7	7
Ragnar	Initiation	5 glass jars	5	5
Duruka	Initiation	3 glass jars	3	3
Total		1,103 (glass jars)		8,691 Seedling Production

Once Proliferation of shoot starts it keeps on increasing the number of plants in a glass jar. During secondary proliferation stage, lateral shoots are developed from the base of newly initiated shoot. As a result, a dense mass of shoots (10-20) is developed in each culture jar known as Multiplication phase. In 14 -20 days the dense mass of shoots are further sub-divided in bunches containing 4-5 shoots and transferred into fresh medium and this process is known as sub

culturing. In this way shoot multiplication are maintained for several phase (M0 – M4) by regular transfer to fresh medium.

Acclimatization to Field Planting: A substantial number of micro propagated plants do not survive when transferred from *in vitro* conditions to greenhouse or field environment. The greenhouse and field have substantially lower relative humidity, higher light intensity and septic environment that are stressful to micro propagated plants compared to *in vitro* conditions (Table 25). The benefit of any micropropagation system can, however, only be fully realized by the successful transfer of plantlets from tissue-culture vessels to the ambient conditions that is referred to as *ex vitro.*

Method:

- The plants are exposed to greenhouse conditions or environment while still in glass jars within the liquid media for 2 nights so that the plants are exposed to *ex vitro* conditions with moderate relative humidity and light exposure.
- Potting mixture – Top soil and Mill mud (1:1) is sterilized for 1 hour to prevent soil microbes.
- The sterilized mixture is left for three days before commencing planting and filling in pro trays.
- Using the Plantlet dispatch procedures: cleaning (removal of wilted or dead single plants), separation (separating clumps of plantlets to single plants), trimming (trimming leaves and roots to medium length), dipping in Fungicide (protect from fungus and bacteria), drying (not allowing moisture to be captured) and planting in each pot tray cell. Tissue culture seedlings of the varieties Qamea and LF91-1925 were dispatched on April 2021.
- The potted plants are placed in a polytunnel covered with 70% sylon cloth for 2 months for Primary hardening to reduce stress and relative humidity. Timely irrigation and fertilizer application were ensured and the seedlings were monitored for Armyworm infestation (Figure 3).
- After 2 months, the sylon cloth are removed in the morning and the potted plantlets are exposed to direct sunlight as per requirement for Secondary hardening.
- As plants get ready, with its leaves and stem thickening, Secondary Hardening should commence with complete removal of sylon cloth and timely irrigation.
- To get better performance in field the longer the plants are hardened at Secondary stage the better it is for its survival when planted out in the field.

Table 25. Details on the varieties, seedlings produced and survival percent in greenhouse experiment

Variety	Batches	Transferred to greenhouse	Seedlings planted	Seedlings Survived	Survival Percentage	Field Transfer
Qamea	Batch 1	26/04/2021 27/04/2021	3,500	3,295	94	3,250- Planted in Waqadra Mother plot While 45 seedlings were maintained in the greenhouse for gap filling
LF91-1925	Batch 2	21/09/2021 till 27/10/2021	7,410	7,000	94	Yet to be planted in Field- Still in greenhouse Scheduled for 2022 planting
Qamea			2,700	2,001	74	
Total Seedlings Dispatched for 2021 (Field and Greenhouse)				12,251		

A total of 3,250 tissue culture raised seedlings (Variety- Qamea) were planted in Waqadra Estate, Nadi under mother plot in two days (13/09/21 and 14/09/21), with 1.8m between rows × 45 cm spacing between the seedlings, occupying 0.24ha of land. 45 seedlings were kept in the greenhouse for gap filling, and were utilized after 30 days of planting in field. Preliminary observations indicate that overall seedling established was very good with 95-98% establishment.

Fig 3. Seedlings in Greenhouse and Field at tillering phase

Seed cane Distribution

Tissue culture raised seedlings are first generation quality seed source used for Nucleus plot. Seed plots are harvested at 7- 9 months when sucrose cumulation are low so germination establishment can be easily met, upon harvesting the material it will be planted in Breeder plot followed up by Distribution plot. In June 2021, one of the Qamea plot was harvested at 7 months as quality seed cane from Field 8, Rarawai Estate. The harvested seed canes were planted on two farms and the cane yield will be recorded during 2022.:

- FSC Rarawai Farm # 1695 – 12.98 tonnes planted in 3.75 acre
- Ilisoni Vorelevu Farm # 20145 – est. 2 tonnes in 1.2 acre

Preliminary trial planning is in pipeline to evaluate tissue culture derived Sugarcane vs Conventional, HWT seed cane for germination, tillering, millable cane, cane height (cm), number of Internodes/canes, internode length, juice quality and cane yield. The year had a rough start to it with increasing cases of COVID 19 and the associated risks. However, we still managed to achieve few objectives of releasing 2 batches with 12,251 seedlings of Qamea and LF91-1925. With internal trials we have also come up with Modified MS Media for Rooting and Shooting bination media at increased strength to reduce timeframe and media cost.

2.2. DEPARTMENT OF CROP MANAGEMENT

2.2.1 Analytical Service

Analytical service is provided for advisory and research programs. This service is essential due to the rising cost of fertilizers and to maintain optimum production in the future. The analytical services provided at SRIF laboratory includes soil, foliar and cane analysis. Soil samples are collected from either fallow land or field that is undergoing preparation for cane planting. Soil and leaf samples are received from sugar cane growers in Penang, Rarawai, Lautoka and Labasa districts through the FSC Extension team. Fertilizer and lime recommendations are provided based on soil and leaf analysis. The Lautoka laboratory received a total of 1887 soil samples for analysis comprising of 1530 advisory samples for fertilizer recommendation and 357 research samples during 2021. The Labasa laboratory received a total of 894 soil samples comprising of 629 advisory samples and 265 research samples (Table 26).

Table 26. Number of soil samples received during 2021

Type of sample	Received	Results Dispatched	Pending
a). Lautoka			
Advisory	1530	1530	-
Research	357	357	-
Total	1887	1887	-
b). Labasa			
Advisory	629	629	0
Research	265	172	93
Total	894	801	93

A total of 2159 advisory fertilizer recommendation reports were sent to the FSC extension team within a timeframe of 2-6 weeks. The FSC extension team discusses the fertilizer recommendation given by SRIF with the growers in a timely manner so that fertilizers could be ordered on time for planting.

Plant testing is used to monitor the nutrient status of the plants and also it can help identify the nutrient deficiencies and imbalances if any. Plant testing helps the growers to adjust fertilizer programs so that nutritional problems and their costly consequences are prevented.
The analytical laboratory had received 708 leaf samples for analysis from the sectors within the sugarcane belt while 28 samples were received from the research section of the institute. The

samples were analyzed for N, P, K, Ca, Mg and Na. Data from the analysis will be used to create a new database for the lab and relook into the fertilizer recommendation calculations.

2.2.2 Evaluation of Effectiveness of Liming Materials

Sugarcane is grown under wide variety of soils in Fiji. The soils are highly diverse in their characteristics, which include, *Alluvium (Fluvents, Inceptisols and Mollisols), Nigrescent (Mollisols, Alfisols and Inceptisols), Humic Latosols (Inceptisols, Alfisols, Ultisols)*, *Ferruginous latosols (Oxisols, Ultisols, Inceptisols)*, *Red Yellow Podzolic (Ultisols, Inceptisols)*, *Gley (Aquents, Aquepts, Aquolls, Histosols)* and *Saline soils of marine marsh (Entisols, Inceptisols).* These soils are sandy or loamy or clay loam in texture and mostly acidic in nature, where the pHs range from 3.2 to 8.8, but mostly very acidic. The soil organic matter (SOM) was also found low (<10 g kg^{-1}) in these soils. The nutrient status of soils generally varied significantly and showed low in nitrogen and phosphorus, but high in potassium. Generally, fertilizer recommendation is made based on soil test results. Lime is recommended for ameliorating the soil acidity.

In this regard Fiji Sugar Corporation (FSC) has sent the following two samples and requested whether the sample can be used as an amendment for liming.

- ✓ (L1) Ag Lime (limestone) from South Pacific Fertilizer Ltd. (Powder form)
- ✓ (L2) Wailotua Lime (Standard concrete) lime from Basic Industries (Granular form)

Therefore, a laboratory study was carried out to examine the dissolution of these two liming materials and their impact on pH of water, mineral acid HCl and acid soils which was measured over a period of time.

Methodology

$CaCO_3$ content: The $CaCO_3$ content, pH and Electrical conductivity (EC) of the samples were measured. The analysis of limestone samples was carried out by following a standard procedure given by Smithson (2021). The samples were ground to pass through 2 mm sieve to get a powdered sample. A 0.5g of the sample was weighed into 5 different 250mL Erlenmeyer flasks. Using a volumetric pipette, 50mL of 0.25M HCl was added to the limestone sample. The solution was stirred vigorously using a stirring rod and heated on a hot plate for the limestone to dissolve with regular stirring. After the limestone had dissolved, it was cooled to near room temperature in an ice bath. Then 3 drops of phenolphthalein solution was added and titrated against 0.1 M NaOH to a faint permanent pink end point and the amount of $CaCO_3$ calculated.

Dissolution and impact on pHs: To examine dissolution of the liming materials in different matrices laboratory incubation experiments were conducted. Different rates (0, 0.5, 1.0, 2, 5 and 10 g) of liming materials were added to 100 ml of water or different molar (0, 0.05, 0.1, 0.2, 0.5

and 1.00 M) concentrations of HCl (100 ml). Each treatment had two replications. The changes in pHs and EC were measured after one hour and after 1, 3, 5, 7 and 14 days.

Soil: In another set of experiment the dissolution was measured in an acid soil collected from the SRIF Drasa Estate (pH 4.5). Different rates (0, 0.5, 1, 2, 5 and 10 g) of lime material was thoroughly mixed with 100 g (air dried) of soil at its field moisture condition and incubated at 25^0C under laboratory condition. Subsamples were removed after one hour and after 1, 3, 5, 7 and 14 days of incubation. The pH was measured in 1:2.5 soil: water solution.

Results

- The pH, EC and $CaCO_3$ of the two samples examined are given in the following Table 27.

Table 27. Some important characteristics of liming materials

Sample	pH (1:2.5 H_2O)	EC (mS/cm)	CaCO3 (%)
1. Ag Lime	8.11	0.30	89.0
2. Wailotua Lime	8.21	0.12	86.0

- The pH of Ag Lime was 8.11, whereas, it was 8.21 in Wailotua Lime. Marked difference was observed in EC of the two samples. While the $CaCO_3$ content was found to be 89% in Ag Lime, it was 86% in Wailotua Lime. Since both materials are originating from naturally occurring rocks no significant difference in $CaCO_3$ content, pH, and EC was observed.

- Though the two samples differed in their particle size, the samples were ground to pass through 2mm sieve and analyzed. This also might have contributed for the results obtained (Table 27).

- The dissolution of liming materials as measured by the changes in pH of water, HCl and acidic soil is depicted in Figures 4 to 6.

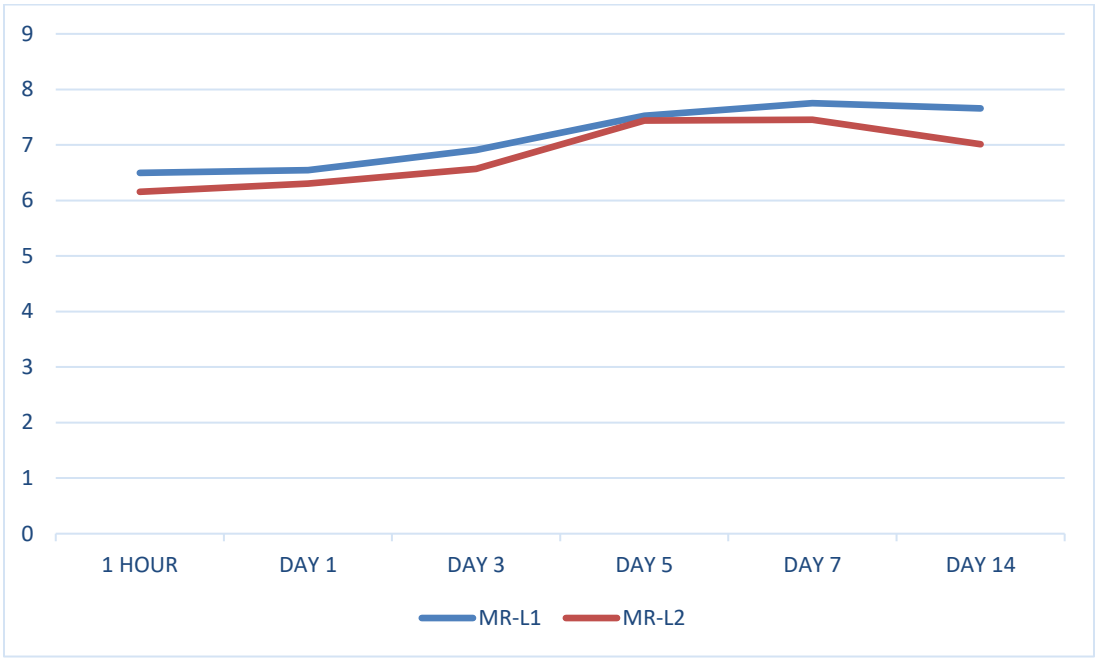


Fig 4. Changes in pH of water due to addition of liming materials

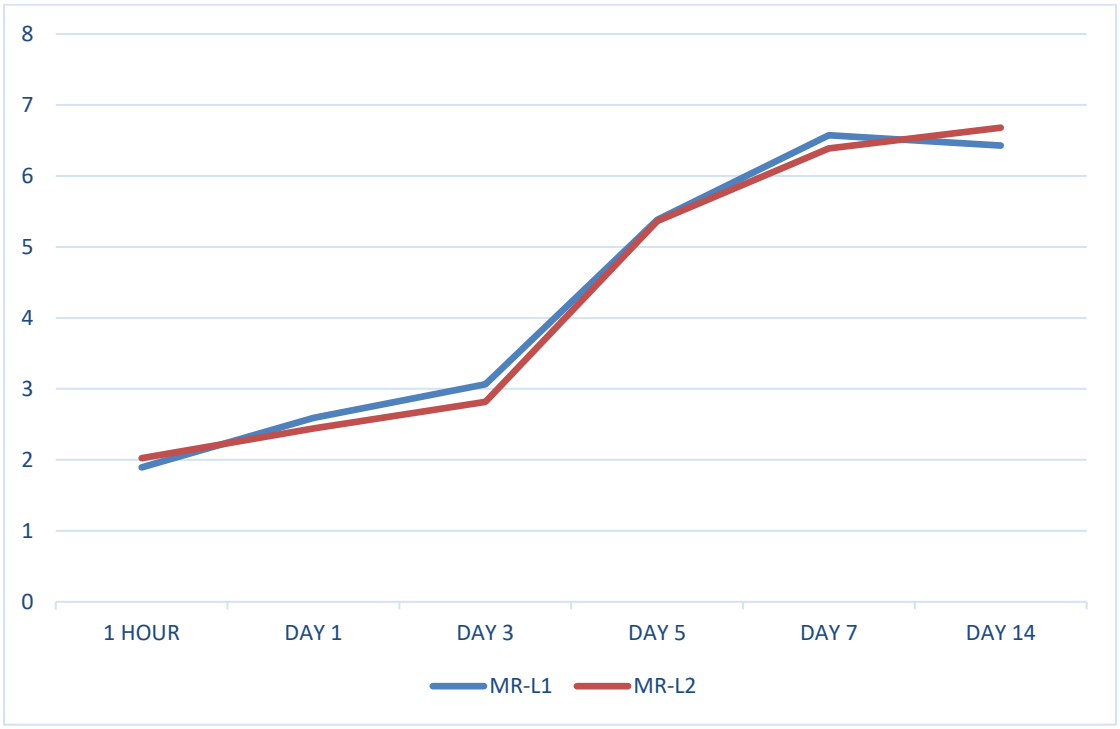


Fig 5. Changes in pH of HCl due to addition of liming materials

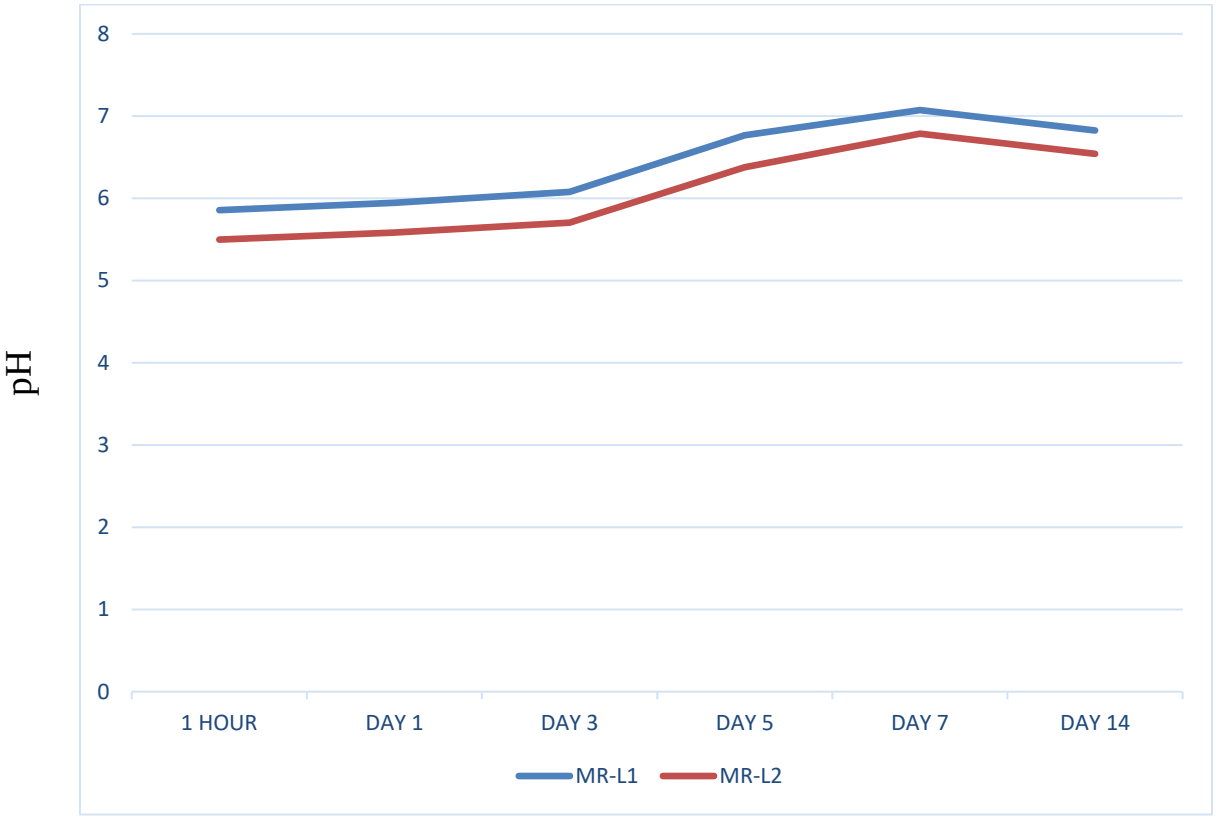


Fig 6. Changes in pH of soil due to addition of liming materials

Salient Findings

- Th $CaCO_3$ content of the Ag Lime and Wailotua lime differed only slightly.
- No significant difference in the dissolution of the Ag Lime and Wailotua Lime was observed in water, HCl and soil.
- In all matrices the pHs were consistently found increased up to 7 days which could be attributed to the dissolution of these liming materials and there after shown a declining trend.
- The Wailotua Lime was found equally effective in changing the pHs of water, HCl and soil.
- In view of the above observation the Wailotua Lime can also be recommended for liming the acid soils of Fiji.
- However, further detailed research, involving laboratory and field experiments, is needed for evaluating its effectiveness as a liming material.

2.2.3. Meteorology

Summary

- January: A moderate strength La Niña event continued in the Pacific Ocean, marking the month as the wettest of all. Tropical cyclone Ana was the major highlight of the month. It made a landfall near Rakiraki as a Category 2 system and then bisected through Viti Levu exiting near Navua. During this event, the rainfall was intense, in particular, over Vanua Levu and eastern half of Viti Levu. Consequently, gale to storm force winds, damaging and destructive, was recorded. Ana also brought very significant rainfall over the country, especially over the Northern and Central Divisions, and as well as north-western Viti Levu that resulted in severe flooding. Labasa recorded its worst flood since the flood associated with severe Tropical Cyclone Ami in 2003. All the major towns from Rakiraki to Nadi were inundated with flood waters.

- February: The La Niña event continued to persist in the tropical Pacific Ocean, marking the month as the 2nd wettest of all. A major highlight of the month was the passage of tropical depression 09F over the Northern and Eastern Divisions. This resulted in strong and gusty winds together with heavy rainfall. A number of heavy rainfall events were recorded during the month where two major flash flooding incidents were experienced, in particular in the Western and Northern Divisions. The first episode of flash flooding was around areas of Tavua. The 2nd episode of flash flooding occurred on the 27th, where localized heavy rainfall led to flooding at Ba and Tavua towns. A day later, many areas in the northern half of Vanua Levu registered flash floods.

- March: The La Niña that hovered over the Pacific had slightly weakened, with rainfall activity varying throughout Fiji. The start of the month saw heavy downpour in the western division, with flash flooding being registered at Nadi, Lautoka, Ba and Tavua.

- April: There was rainfall variation with some sectors such as Cuvu receiving above 300mm rain while sectors like Meigunyah and Yako registering only 25mm of rainfall.

- May: A typical La Niña like rainfall pattern was observed during the month, where active trough of low pressures affected Fiji.

- June: A typical dry season rainfall pattern was observed where periods of widespread rainfall were observed during the first and last week of the month. A trough of low pressures with occasional showers and isolated heavy falls affected the country.

- July: Generally suppressed rainfall continued to be experienced.

- August: The suppressed rainfall pattern during the past months continued into the month of August and dry conditions were recorded across Fiji. This was declared as the driest month across the sugarcane belt.

- September: Troughs of low-pressure system affected the northern parts of the country during the first week of the month, resulting in some significant rainfall events while suppressed rainfall was experienced in some parts of the Western Division.

- October: The month of October was dominated by dry spells with suppressed rainfall continuing in most parts of the western division.

- November: Typical wet season rainfall started to be experienced which meant a weak La Niña event was established. Signs of relief from dry conditions were observed at various stations across the sugarcane belt.

- December: A weak La Niña event was firmly established in the tropical Pacific thus most stations across the sugarcane belt experienced heavy rainfall.

The Meteorological Station at SRIF is equipped with a range of meteorological instruments and maintained with the help of the Fiji Meteorological Service (FMS) at its head office in Lautoka and three other daily Climatological recording Centres. Climatological station is manned by observers who records temperatures (dry bulb, wet bulb, maximum and minimum), earth temperatures situated at depths (of 5cm, 10cm and 50cm), 24 hours rainfall, amount of cloud, visibility, wind force and wind direction at 9am daily. At the end of each month, data is compiled in a designated F211 form and forwarded to The Regional Specialized Meteorological Centre Nadi. Similarly, rainfall figures from each sector from the eight districts are compiled and kept for our records. The climatic data is used to produce climate summary and predicting of weather forecast for the country. The Research Institute provides a summary statement towards the Fiji Sugar Cane Rainfall Outlook (FSCRO) which becomes an advice to farmers on possible farm activities such as land preparation, cultivation, fertilizer application, weedicide application and harvesting from sugarcane belt areas.

El Niño Southern Oscillation (ENSO): ENSO is an irregular cycle of persistent warming and cooling of Sea surface temperatures in the tropical Pacific Ocean. The warm extreme is known is El Niño and the cold extreme, La Niña. Scientists now refer to an El Niño event as sustained warming over a large part of central and eastern equatorial Pacific Ocean. This warming is usually accompanied by persistent negative values of Southern Oscillation Index (SOI), a decrease in the strength or reversal of the trade winds, increase in cloudiness in the Pacific and reductions in rainfall over most of Fiji which can, especially during moderate to strong events, lead to drought.
La Niña is a sustained cooling of the Pacific Ocean. The cooling is usually accompanied by persistent positive values of SOI, an increase in strength of the trade winds, decrease in

cloudiness and higher than average rainfall for most of Fiji with frequent and sometimes severe flooding, especially during the wet season (November to April).

Fiji enjoys a tropical maritime climate without extremes of heat or cold. The peak period for cyclones in the region is usually from November to April. The annual average rainfall is usually between the ranges 2000mm to 3000mm. From the Table 28 it can be seen that the total rainfall for all mills was either in the annual average rainfall range or above.

Table 28. Monthly rainfall data obtained for the four mill areas

2021	Lautoka Mill		Rarawai Mill		Labasa Mill		Penang Mill	
Month	Rainfall (mm)	Rainy Days	Rainfall (mm)	Rainy Days	Rainfall (mm)	Rainy Days	Rainfall (mm)	Rainy Days
January	653	23	905	20	1056	27	646	19
February	305	18	607	23	719	20	735	22
March	317	16	532	15	276	13	431	16
April	199	13	135	10	205	11	209	12
May	129	12	157	13	277	17	365	22
June	43	4	29	3	13	7	111	10
July	2	1	1	1	58	7	23	6
August	20	1	0	0	3	1	17	7
September	28	8	55	7	124	11	48	5
October	32	3	30	4	22	5	29	9
November	104	15	161	16	247	19	131	13
December	357	22	325	20	334	19	377	23
Total	2187	136	2937	132	3334	157	3120	164
Average	182	11	245	11	278	13	260	14

The peak rainy season is from January to March and in April rain starts to ease off but in 2021, good rainfall was received in April and May (Table 28). The rainfall during April and May favours cane growth and adversely affects maturing. The rainfall during these months is likely to contribute to low sugar content at start of crushing season.

Meteorological variables are the primary variables responsible for the productivity and quality of sugarcane. As growth rates decrease, a lower amount of sugar is used in new tissue formation, and a greater amount of sucrose is stored. During ripening, sucrose levels in stalks gradually increase as the percentage of glucose and fructose decreases. Therefore, in most of the humid tropical and subtropical regions, as the sugarcane crop approaches to the harvest, the dry season and the low temperatures slow down the sugarcane growth, forcing the conversion of reducing sugars into sucrose. Climatic variables have significant correlations with sugarcane ripening.

Lautoka Mill

There is a total of 12 sectors that fall under Lautoka mill. A rain gauge has been installed at each sector office to record rainfall within the 24-hour period. A full-fledged meteorological station has been setup within the Lautoka mill boundary, where, apart from rainfall, temperatures are also noted on a daily basis. The monthly rainfall received in Lautoka mill areas are presented in Figure 7.

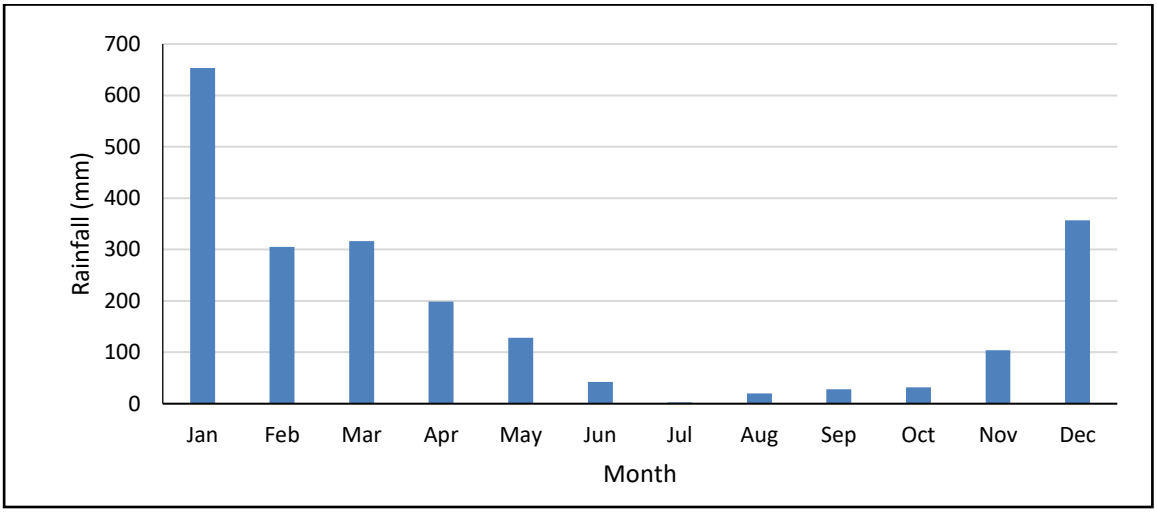


Fig 7. Monthly rainfall received in Lautoka mill areas

The graph represented above indicates that majority of the rainfall was received in the month of January while the least amount of rainfall was received in the month of July (Figure 7). The rainfalls consecutive from July to November indicates that the weather was advantageous both to the miller, for smooth mill operations and to the growers, for harvest and transport of green cane to the mill. The same pattern of rainfall can be seen in the sector table given below (Table 29).

Table 29. Total rainfall (mm) received in each sector of the Lautoka mill areas

Sectors/ Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
Drasa	853	384	468	151	73	52	1	35	45	17	184	346	2609
Lautoka	653	305	317	199	129	43	2	20	28	32	104	357	2187
Saweni	626	384	457	259	178	56	7	8	89	26	150	666	2907
Natova	461	337	304	85	132	45	11	2	49	45	130	301	1902
Legalega	524	486	349	43	152	70	5	19	102	44	192	433	2419
Meigunyah	506	366	335	25	133	48	2	5	108	40	278	304	2150
Yako	464	229	374	25	118	65	4	0	108	108	169	78	1740
Malolo	617	340	625	55	190	76	2	7	236	97	283	240	2765
Nawaicoba	653	399	392	93	143	68	13	4	141	94	443	372	2815

Lomawai	335	188	283	74	145	57	24	1	38	28	138	169	1480
Cuvu	950	540	594	379	453	345	181	46	209	224	288	653	4861
Olosara	287	185	213	99	177	123	55	35	83	45	188	340	1830

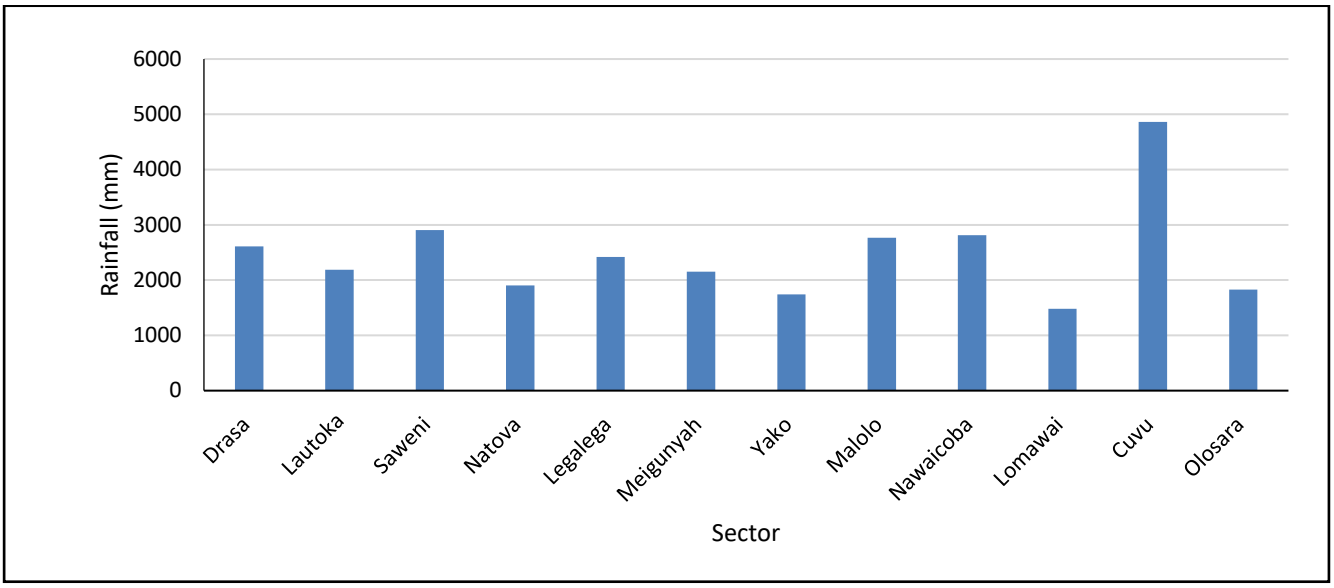


Fig 8. Total rainfall received in different sectors of the Lautoka mill area

From the graph presented above, it can be concluded that Cuvu sector received the most rainfall in 2021 while Lomawai received the least amount of rainfall. Both sectors are next to each other, thus indicating that localized rain was received (Figure 8).

Rarawai Mill

There is a total of 10 sectors that fall under Rarawai mill. A rain gauge has been installed at each sector office to record rainfall within the 24-hour period. A full-fledged meteorological station has been setup within the SRIF boundary, where, apart from rainfall, temperatures are also noted on a daily basis (Figure 9).

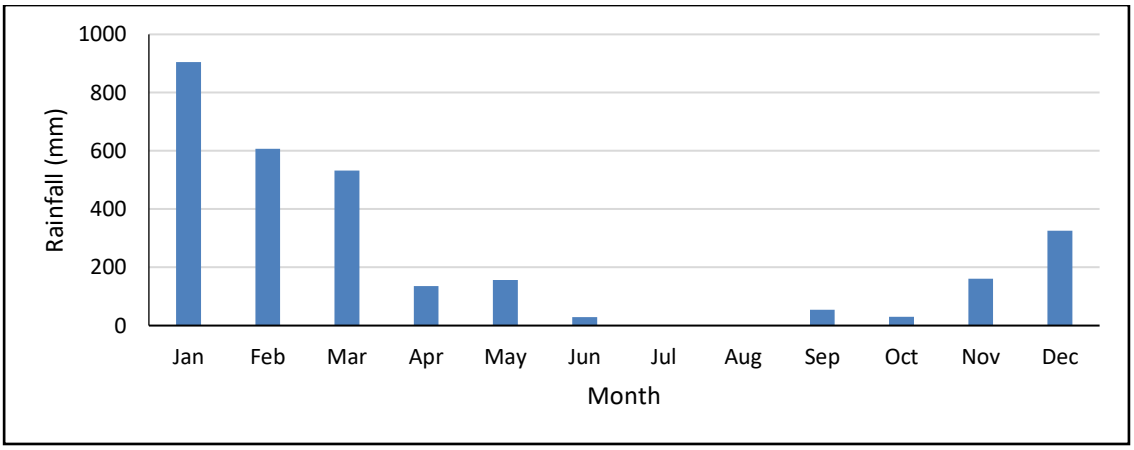


Fig 9. Monthly rainfall received in Rarawai mill areas

The graph represented above indicates that majority of the rainfall was received in the month of January while the least amount of rainfall was received in the month of July and August (Figure 9). The total rainfall received in Rarawai mill areas during 2021 is presented in Table 30 and Figure 10.

Table 30. Total rainfall (mm) received in each sector of the Rarawai mill areas

Sectors / Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
Varoko	951	520	451	56	179	33	3	2	40	24	156	428	2843
Mota	1043	728	662	154	237	48	15	20	82	62	315	403	3769
Koronubu	828	527	530	124	155	31	4	7	82	118	335	273	3014
Rarawai	905	607	532	135	157	29	1	0	55	30	161	325	2937
Veisaru	863	731	668	43	103	42	2	0	30	28	227	414	3151
Varavu	766	533	407	42	101	15	5	0	27	0	122	354	2372
Naloto	977	715	686	166	205	45	43	11	80	101	366	409	3804
Tagitagi	814	503	627	38	178	53	2	3	32	14	94	232	2590
Drumasi	837	454	521	66	169	37	2	4	23	21	180	380	2694
Yaladro	792	384	480	75	144	50	5	3	37	21	115	295	2401

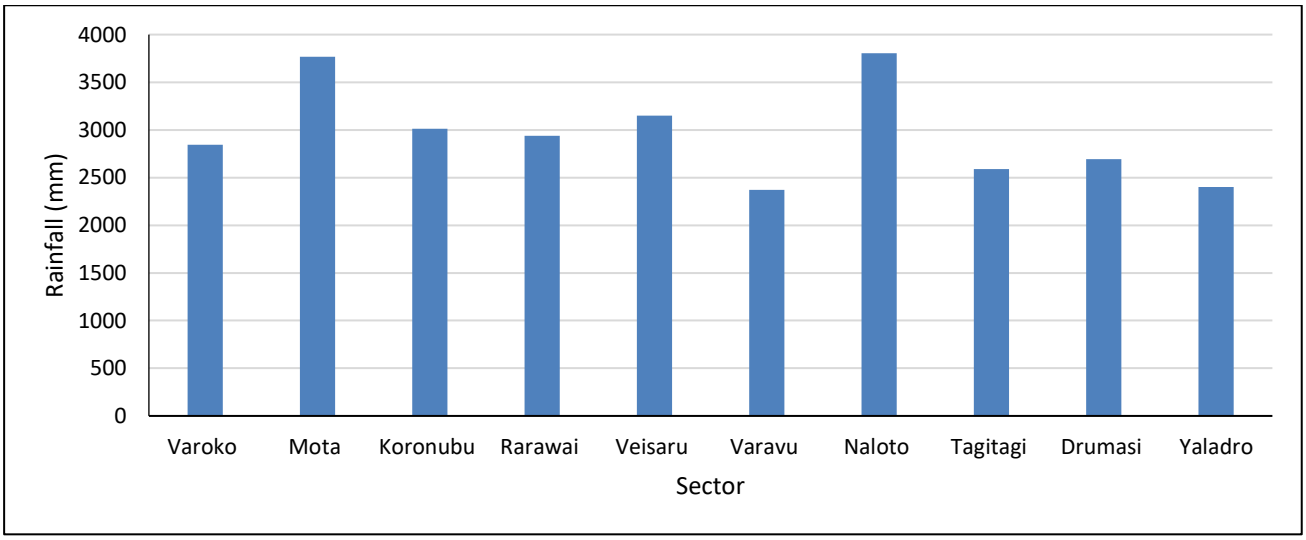


Fig 10. Total rainfall received in different sectors of the Rarawai mill area

From the graph presented above, it can be concluded that Mota and Naloto sectors received the most rainfall in 2021 while Varavu and Yaladro received the least amounts of rainfall.

1. Penang Mill

There are 4 sectors that fall under Penang mill. A rain gauge has been installed at each sector office to record rainfall within the 24-hour period. A full-fledged meteorological station has been setup

within the FSC boundary, where, apart from rainfall, temperatures and evaporation are also noted on a daily basis.

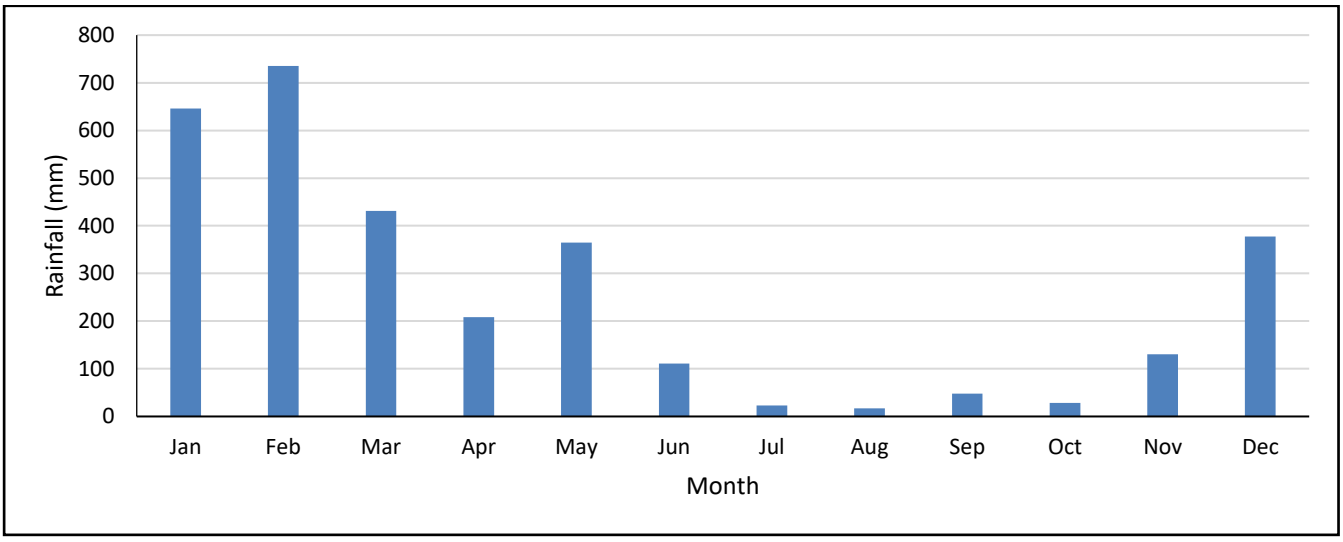


Fig 11. Monthly rainfall received in Penang mill areas

The graph (Figure 11) represented above indicates that majority of the rainfall was received in the months of January and February while the lesser amount of rainfall was received in consecutive months from July to October (Table 31).

Table 31. Total rainfall received in each sector of the Penang mill areas

Sectors / Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
Ellington 1	828	414	288	29	190	54	23	19	67	51	178	402	2543
Malau	646	735	431	209	365	111	23	17	48	29	131	377	3120
Nanuku	663	447	361	68	204	63	36	3	32	21	91	278	2267
Ellington 2	792	384	480	75	144	50	5	3	37	21	115	442	2548

From the graph presented above, it can be concluded that Malau sector received the most rainfall in 2021 while Nanuku sector received the least amount of rainfall. This indicates that localized rain was received as both sectors are located next to each other.

2. Labasa Mill

There is a total of 12 sectors that fall under Labasa mill but only 7 sectors have rain gauges installed to record rainfall within the 24-hour period (Figure 12). A full-fledged meteorological station has been setup at the SRIF Labasa sub-station, where, apart from rainfall, temperatures and evaporation are also noted on a daily basis.

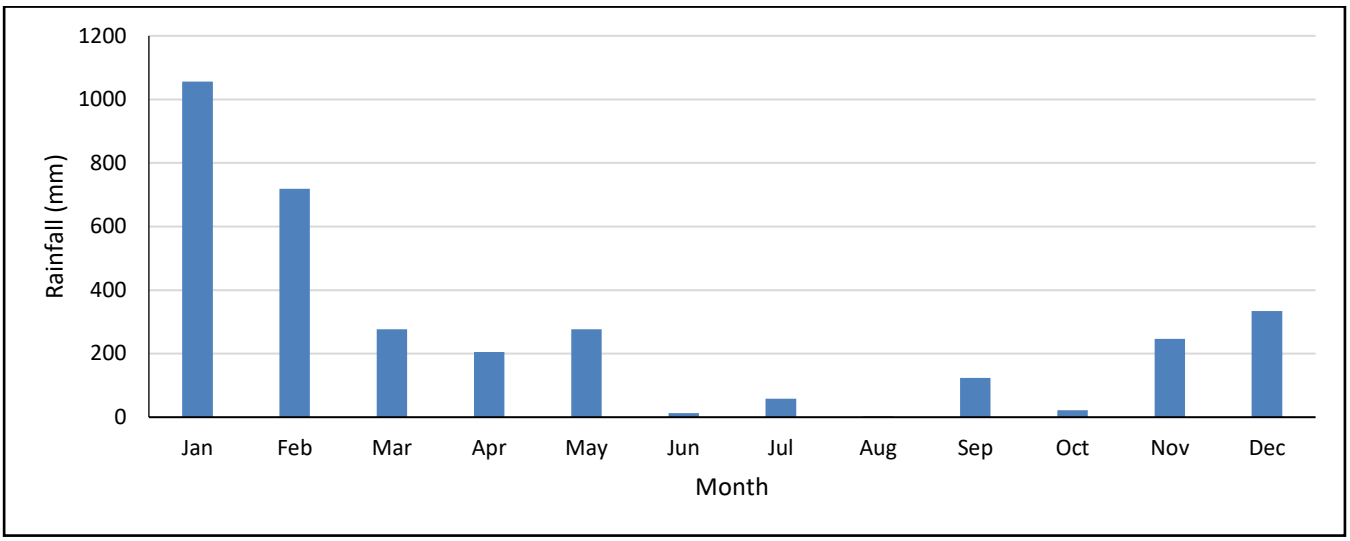


Fig 12. Monthly rainfall received in Labasa mill areas

The graph presented above indicates that majority of the rainfall was received in the months of January and February while the least amount of rainfall was received in the months of June and August.

The total rainfall received in different sectors of Labasa mill areas are presented in Table 32 and Figure 13.

Table 32. Total rainfall (mm) received in each sector of the Labasa mill areas

Sectors / Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
Waiqele	968	516	297	214	216	21	27	2	102	50	427	372	3211
Wailevu	924	533	204	153	231	23	15	2	100	50	342	391	2969
Vunimoli	1179	741	335	152	253	33	67	1	122	29	237	288	3437
Labasa	1056	719	276	205	277	13	58	3	124	22	247	334	3334
Bucaisau	602	605	318	175	272	25	39	0	159	43	444	400	3081
Wainikoro	821	664	175	77	395	38	43	2	115	29	277	346	2982
Seaqaqa	845	523	324	252	169	88	38	2	193	127	419	473	3452

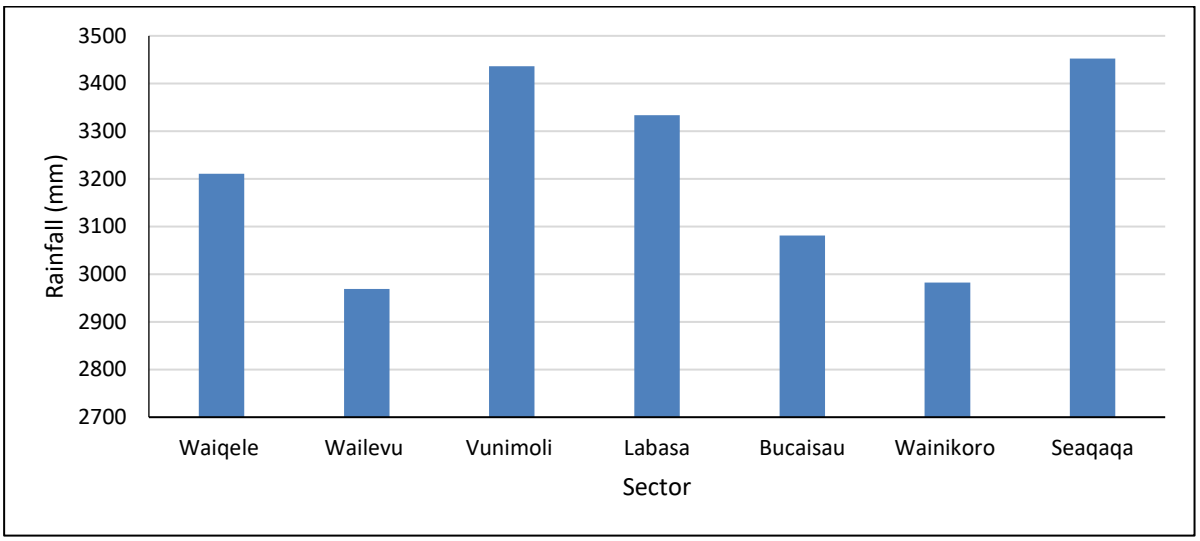


Fig 13. Total rainfall received in different sectors of the Labasa mill areas

From the graph presented above, it can be concluded that Vunimoli and Seaqaqa sectors received the most rainfall while Wailevu and Wainikoro sectors received the least amount of rainfall.

Rainfall Pattern for Past 26 Years

Wetter years, as can be seen during 2021, which caused flooding at major towns, farms and community, has effect on nitrogen fertilizer. The flooding may leach the nitrogen from the fields and farmer will be required to re-apply fertilizer. Water logging may reduce the oxygen availability for root system and inhibit the uptake of nutrients (Table 33 and Figure 14).

Table 33. Annual rainfall (mm) for the past 26 years for each mill areas

Year	Lautoka	Rarawai	Penang	Labasa
1996	2242	2704	2404	2716
1997	2319	2648	3174	2734
1998	1213	1266	1274	1585
1999	3457	3354	3848	3141
2000	3017	3464	3750	3655
2001	2041	2121	2114	2147
2002	1704	1741	1819	2418
2003	1459	2033	1886	1834
2004	1488	1955	1573	1568
2005	1580	1749	1517	1794
2006	1844	2194	1824	1429
2007	2337	2805	2616	2786
2008	2502	3052	3380	2612

Year	Lautoka	Rarawai	Penang	Labasa
2009	2870	3556	3041	2480
2010	1228	1686	1644	2321
2011	3028	3140	3239	2831
2012	3744	3265	3957	2894
2013	2501	2353	2343	2757
2014	1199	1318	2110	1654
2015	1043	1158	1310	1168
2016	2098	1883	2126	1773
2017	1739	2134	1802	2122
2018	2129	2228	2940	2971
2019	1354	2036	1990	2355
2020	1830	1850	2221	2601
2021	2187	2937	3120	3334

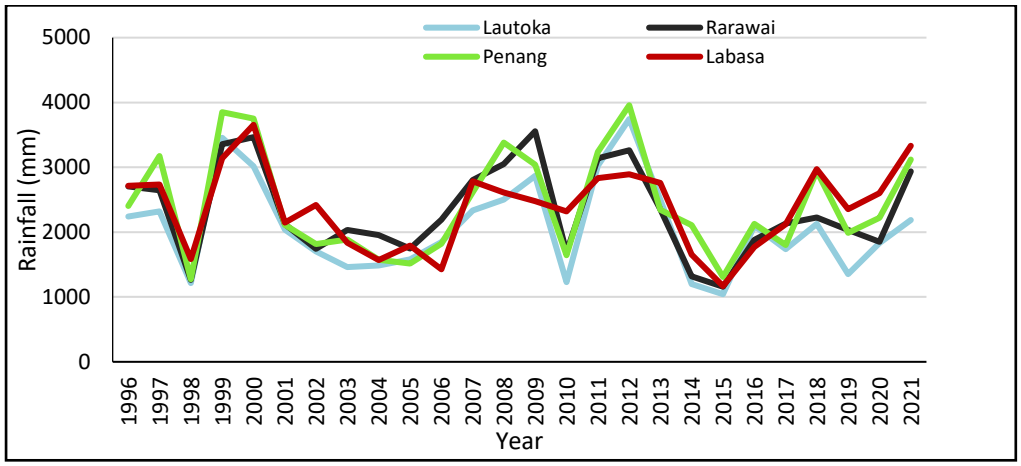


Fig 14. Annual rainfall pattern from 1996

Fiji's rainfall continues to display large year-to-year variability associated with the El Niño and La Niña events. Extreme rainfall events were recorded during the year, including rainfall associated with TC Ana, and due to lingering active troughs of low pressure in other months. Severe tropical cyclone Ana was the only TC that had a direct impact on Fiji during 2021, making landfall near Rakiraki as a Category 2 system. It made its way across Viti Levu and exited near Navua. Ana brought heavy rain, which resulted in severe flooding, especially in the Central and Northern Divisions. This caused Labasa to record its worst flood. TC Ana claimed one life while five people were reported missing in Fiji. (Ref 2021 annual climate summary, FMS). The meteorological data recorded at SRIF, Lautoka are presented in Table 34.

Table 34. Meteorological Data for Sugar Research Institute of Fiji, Lautoka

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Relative Humidity (%)	80	79	75	71	86	73	70	62	67	57	68	75	72
52 yrs avg	75	77	75	74	74	72	70	69	70	66	69	72	72
Air Temperature													
Mean Maximum	31	31	31	32	30	30	31	29	31	32	32	31	31
52 yrs avg	32	31	31	31	30	28	28	28	29	31	31	31	30
Mean minimum	23	23	22	22	22	19	21	19	21	22	22	22	21
52 yrs avg	24	24	24	24	22	20	20	20	21	26	23	23	23
Mean	27	27	26	27	26	25	26	24	26	27	27	27	26
Highest maximum	33	33	33	33	33	32	33	32	33	35	34	34	33
Lowest minimum	21	21	20	21	18	16	18	15	20	20	20	21	19
Evaporation													

Raised pan	141	113	196	151	92	123	128	155	146	198	160	128	144
Earth thermometers													
5cm	28	28	27	29	26	25	26	25	28	31	29	29	28
52 yrs avg	27	29	29	27	26	24	24	24	26	27	29	29	27
10cm	28	28	26	28	26	25	26	25	27	28	28	28	27
52 yrs avg	29	28	26	27	24	24	23	24	28	27	28	28	26
30cm	29	29	28	29	28	26	27	26	28	29	29	29	28
6 yrs avg	30	29	29	29	28	27	27	27	27	29	29	29	28

1. **Relative Humidity (%)**: Relative humidity is the amount of water vapor actually in the air, expressed as a percentage of the maximum amount of water vapor the air can hold at the same temperature. High humidity (80-85%) favors rapid cane elongation during grand growth period. The relative humidity calculated for SRIF-Drasa Estate is presented in Figure 15.

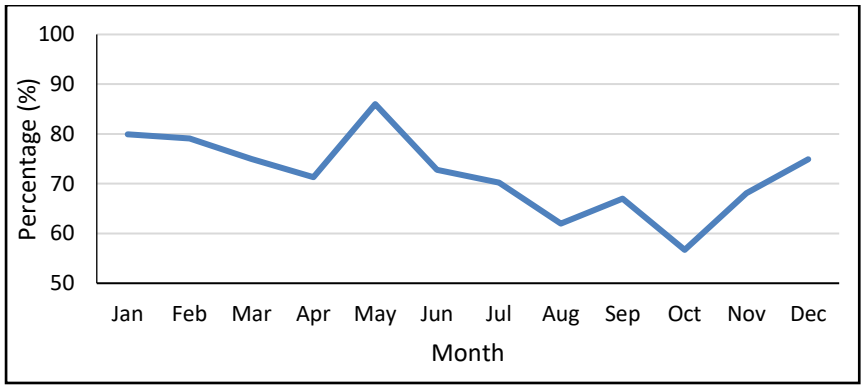


Fig 15. Relative humidity calculated for SRIF-Drasa Estate

2. **Temperatures:** Cane quality in terms of sucrose content is influenced by climatic factors like maximum and minimum temperatures. Desired night temperatures should be below 20°C, which, in the graph presented below, has mostly been above 20°C, except for June and August. In 2021, night temperatures during initial ripening stage was higher than 20°C, which has a negative effect on sucrose accumulation. The graph presented below shows that minimum temperatures were between 15 to 21°C and maximum as high as 35°C were reached (Figure 16).

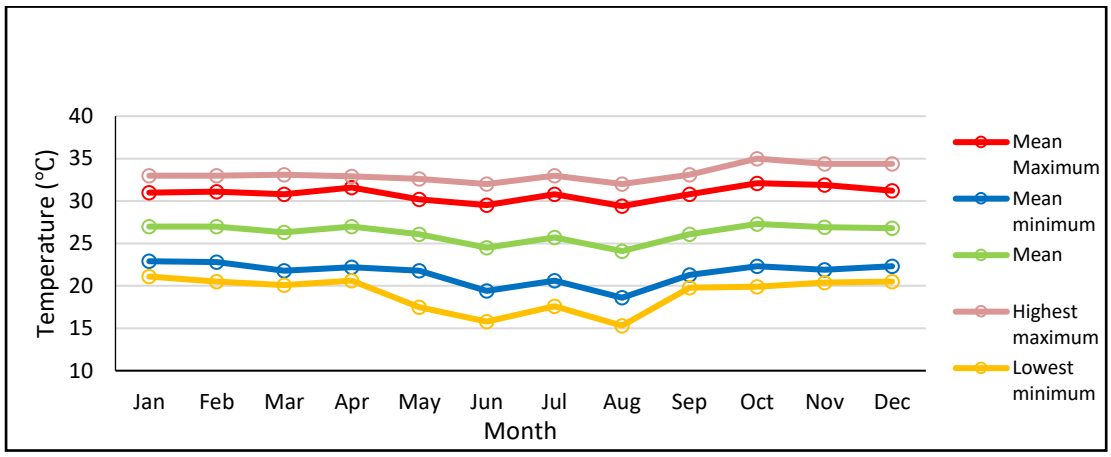


Fig 16. Mean maximum, mean minimum and mean with highest maximum and lowest minimum for SRIF-Drasa Estate

3. **Evaporation:** Looking at the monthly precipitation and the evaporation ratio, the months of January, February, March and December was good for plant growth since the soil had sufficient moisture needed for growth. The months of July, August and October received less rainfall but the evaporation rate was high, thus indicates that drought conditions prevailed (Table 35; Figure 16).

Table 35. Transeau Ratio (Precipitation/Evaporation: P: E) and moisture status of soil 2021

P. E	Moisture Status	Months
<0.25	Drought conditions	Jul, Aug, Oct
0.26-0.50	Very dry - limiting moisture. Slow growth	Sept
0.51-1.00	Dry - limiting moisture. Slow growth	Apr, May, Jun
1.10-2.00	Moderate - sufficient moisture for moderate growth	Nov
>2.00	Good - sufficient moisture for good growth	Jan, Feb, Mar, Dec

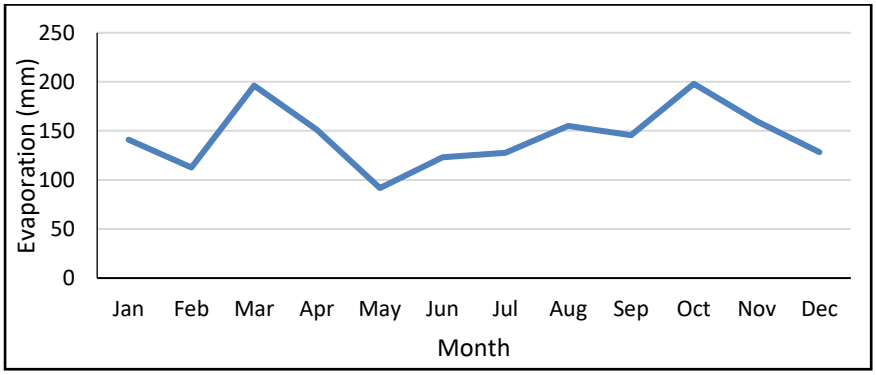


Fig 17. Monthly evaporation for SRIF-Drasa station

4. **Earth thermometers:** The earth thermometers at SRIF are at depths of 5cm, 10cm and 30cm. The 52 years average of thermometers at depths 5cm and 10cm were calculated to be 27°C and 26°C respectively. The 30cm thermometer was newly installed in 2016, thus, the 6 years average calculated was 28℃ (Figure 18).

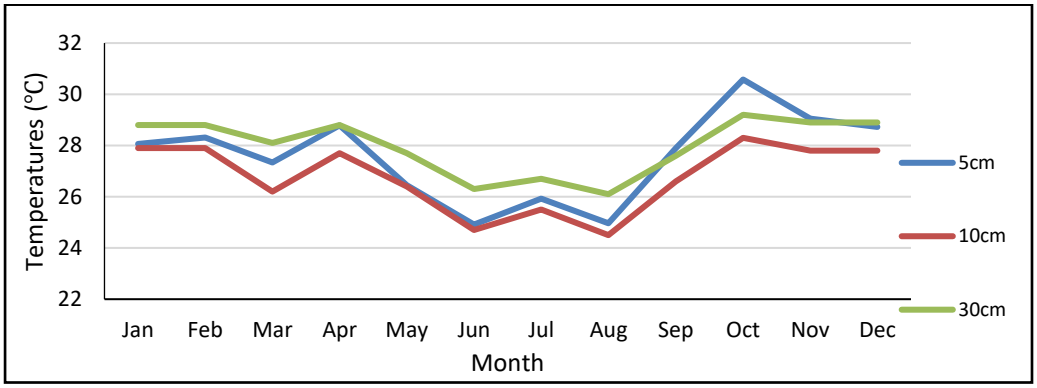


Fig 18. Earth temperatures calculated at depths (5cm, 10cm and 30cm) for SRIF-Drasa Estate

5. **Sunshine:** There is currently no sunshine recorder installed at the Drasa station (V77555) but a request has been made to FMS to have a recorder installed at the site.

2.3. DEPARTMENT OF CROP PROTECTION

2.3.1 Effect of green manure on nematodes

Objective:

- To evaluate the impact of green manure (urdi) on the population density of Plant Parasitic Nematodes (PPN).

Work done:

The soil samples were taken from the 15 farms before planting and after planting green manure. The collected samples were analyzed for PPN count. The nematodes were extracted by application of extracting tray techniques and the population count was done under the microscope using 50X magnification.

Salient findings:

- The cultivation of green manure has improved the soil moisture by 15%.
- Overall, there was a significant increase in the population of PPN after planting green manure. The species that built up were *Pratylenchus spp* and *Rotylenchulus spp*.
- There was a slow buildup of free-living nematodes after planting greening manure that can control PPN.

2.3.2 Fiji Leaf Gall Screening (FLG)

Objective:

- To test and identify sugarcane varieties that are resistant to Fiji Leaf Gall Disease LF 2016 and LF 2017 series screened from stage 3 of the breeding program.

Work done:

The insectary screening techniques were applied to screen the new varieties against FLG virus, where the vectors were collected from the commercial farms and cultured under a control condition for inoculation purpose. The nymph stage of this insects was used for spreading disease on healthy clones and screening for 100 days by physically observing the disease under the leave surface of individual clones. A total of 139 clones in stage III of the series LF2016, LF2017, and hybrids were screened for FLG from May to September 2021. Overall data have shown 88.5% of clones were resistant, 9.4% of clones were moderately resistant and 2.2% of clones were susceptible to FLG.

2.3.3 Inspection of commercial sugarcane farms (Roguing)

Objective:

- To reduce the initial inoculum of Fiji Leaf Gall Disease and maintain it to below 5% in commercial fields.

Work done:

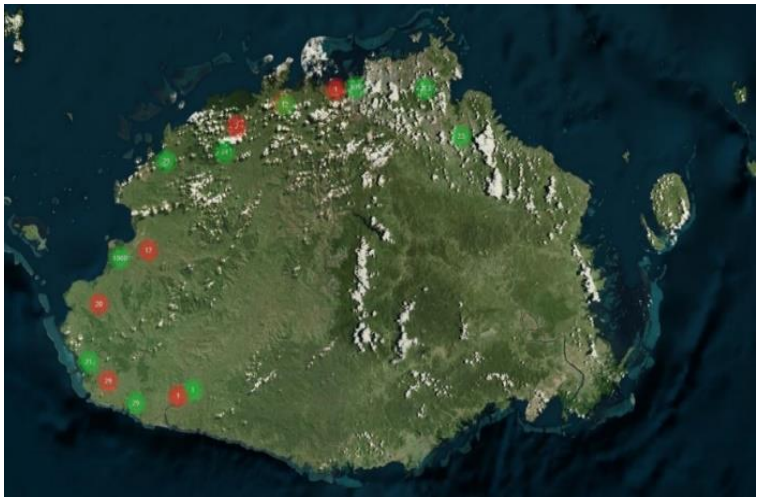
Inspection and roguing of FLG were carried out in Lautoka, Rarawai, and Penang mill zones in January 2021, in 2312 farms comprising 5750 ha with 1073 ha of plant crop and 4677 ha of ratoon crop, covering 22% of the growers. A total of 3547 disease stools were rogued out (Table 36). In Labasa, the roguing was undertaken in early April as the sugarcane leaves were badly damaged by the tropical cyclone Yasa and the crop recovery was observed in March. Upon inspection, the fields in Labasa were free of FLG.

Table 36. Roguing for Fiji Leaf Gall from January – December 2021

Mill District	No. of Farms Inspected	No. of farms with FLG	% farms infected with FLG	Area Rogued (ha)		No. of FLG stools Rogued	Total no. of Growers
				Plant	Ratoon		
Lautoka	300	3	1	138	628	192	1478
Nadi	755	56	7	329	1686	802	1166
Labasa	252	0	0	207	961	0	2596
Sigatoka	273	31	11	106	536	1996	587
Ba and Tavua	369	22	6	198	597	557	3899
Penang	363	0	0	94	269	0	728
Total	2312	112	5	1073	4677	3547	10454

Among the districts surveyed, FLG was predominantly found in the ratoon crops of the variety Mana in every sector in the three districts of Lautoka (Sigatoka, Nadi, and Lautoka) and the Rarawai sector in Ba district. Repetitive ratooning for more than five years was found to be the cause of increased susceptibility to FLG in the moderately resistant variety Mana.

Mapping of disease positive and negative fields: Through GPS technology, the fields surveyed for FLG were marked. A FLG map of the surveyed farms in Viti Levu (Figure 19) and Vanua Levu (Figure 20) were developed for monitoring the possible spread or containment of the disease over the years.



Red: FLG-affected

Green: FLG-free

Fig 19. FLG map of Viti Levu.

Fig 20. FLG map of Vanua Levu.

Monitoring of Minor Diseases:

Of the 2312 farms surveyed during January-December 2021, a total of 13 minor diseases were recorded (Figure 21). Data showed that the common minor diseases were Ring spot disease (69% farms), Leaf scorch (67%), and Pokkah Boeng (56%).

Continuous monitoring further revealed that a high incidence of ring spots (80-100%), Leaf scorch (60-100%), and Eye spot (65-95%) was observed during June -July, January-August, and September - December 2021.

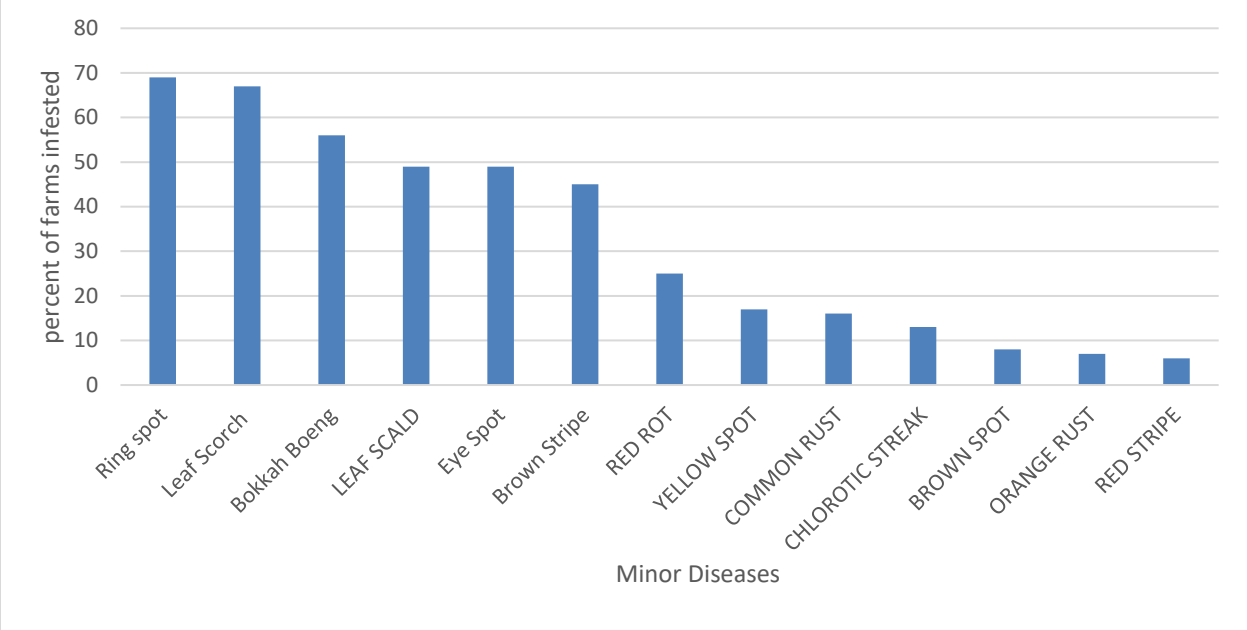


Fig 21. Percentage of farms that recorded various minor diseases between January to December 2021.

Disease-free certified setts: The seed cane certification is the third management strategy that SRIF adopts to manage Fiji disease and to ensure availability of approved and quality seed cane to the growers. Inspections have shown that the percentage of certified seed canes increased from 17% (2020) to 20.9 % of planting in 2021 (Table 37).

Table 37. Adoption of certified disease-free seed cane

Year	Plant or Ratoon	No. of farms certified	Plant cane certified (ha)	Tons of cane certified	% certified as seed cane
2019	Plant	278	240.50	9620	14%
2020	Plant	195	184.77	7391	17%
2021	Plant	212	124.69	6235	20%
	Ratoon	24	40.99	2050	0.9%

Salient findings:

- Through intensive roguing, release of resistant variety and seed cane certification the disease control unit have contained the Fiji disease below one percent on commercial farm for Fiji Sugar Industry.

- On the Mana variety, the Fiji Leaf Gall Disease was discovered in the fields throughout the year. Due to repeated ratooning, which made the variety sensitive to Fiji disease, this variety has a moderate level of resistance to the disease.

2.3.4. Management of Sett Rot

Objective:

- To assess two fungicides (Flutriafol) on sett rot diseases and provide recommendations to Agchem.

Work done:

A field experiment was undertaken at the Sugar Research Institute of Fiji (SRIF), Drasa, Lautoka to assess the impact of the fungicide Flutriafol in comparison to other chemicals in the management of pineapple sett rot of sugarcane caused by *Ceratosystis paradoxa* and corresponding sett germination (Var: Naidiri). The various treatments with the tested doses are given in Table 38.

In general, the percent germination was low ranging from 12.1-21.08%, the highest being in untreated plots. Since the results four weeks after planting showed no significant differences in germination or plant height, it could either be due to the absence of pineapple rot or the inefficiency of the treatments. However, the poor germination of the setts needs further investigation.

Table 38. Evaluation of fungicides for sett germination and control of sett rot

Fungicide product	Dipping concentration for sett rot	% Sett germination*	Plant height (cm) at different periods (Months)$			
			Three	Five	Seven	Nine
Control	Zero chemical	21.08	30.00	125.75	197.50	211.25
Copper oxychloride 84 WDG	1g/1L	12.83	30.50	127.50	173.00	189.00
Benomyl 50g/kg	0.40g/1L	12.10	26.50	104.50	171.75	179.00
Flutriafol 12.5% SC	0.12ml/1L	15.85	28.25	121.25	180.00	195.00
Flutriafol 50% SC	0.5mL/1L	19.35	21.50	88.50	145.75	138.00

*-Means are insignificantly different in a column (p=0.05), LSD

$- Means are insignificantly different in a column, LSD

2.3.5. Incidence of Cane Weevil Borer (*Rhabdoscelus obscurus*) on different varieties

Objective:

- To assess the impact of cane weevil borer on commercial sugarcane farms.

Work done:

A preliminary survey was carried out on 85 sugarcane farms constituting 0.81% of the total number of farms in the cane belt of Fiji, to evaluate borer damage from June to August 2021. The sample fields of Viti Levu had Mana variety while those in Vanua Levu had multiple varieties such as Ragnar, Naidiri, Qamea, Kiuva, Galoa, LF91-1925, Vatu, and Viwa (Table 39).

Table 39. Percent varieties damaged by *Rhabdoscelus obscurus*

Varieties	Damage parameters assessed			
	% infestation	% length damaged	% cane weight damaged	% Severity
Mana	8.39	0.91	7.98	4.85
Naidiri	12.19	0.82	12.79	6.94
Ragnar	11.20	0.64	10.72	5.68
Qamea	18.50	1.30	21.40	10.55
Kiuva	15.00	2.10	2.70	5.20
Galoa	6.00	0.20	6.30	3.00
LF91-1925	4.00	0.30	6.80	2.90
Vatu	14.00	1.10	15.00	7.30
Overall	9.92	0.82	9.30	5.16

A total of 8, 500 sugarcane stalks were sampled. The borer infestation was recorded in 95% of the farms examined. Overall, it could be observed that 9.92% of stalks were damaged, 0.82% of stalk portion with 1.26% of total internodes, and 9.3% of cane weight on a farm basis were damaged by this pest on sugarcane (Table 39). The severity of infestation was found to be the highest on Qamea (10.55%). Though Kiuva suffered 15.0% stalk damage the percent severity was lower (5.2%). A district-wise analysis of borer damage is indicated in Table 40.

Table 40. Different sectors analyzed for *Rhabdoscelus obscurus* damage

District	Sector	Damage parameters assessed			
		% Infestation	% cane length damaged	% cane weight damaged	% Severity
Lautoka	Lovu	8.80	1.02	8.65	5.91
	Drasa	15.00	1.26	19.39	10.15
	Lautoka	4.60	0.39	4.34	2.48
	Saweni	4.80	0.60	5.37	3.32
	Natova	7.40	0.85	6.20	4.16
	Legalega	6.60	0.54	5.16	3.20
Nadi	Yako	6.40	0.87	3.53	2.98
	Qeleloa	14.00	1.40	11.32	7.13
	Malolo	7.80	0.93	7.86	5.01
	Nawaicoba	5.40	0.46	6.20	3.23
Tavua	Drumasi	11.20	1.56	7.10	4.86
Penang	Ellington 2	7.00	0.92	6.82	4.20
Labasa	Vunimoli	19.20	1.74	19.74	10.16
	Wailevu	9.80	0.50	9.60	6.50
	Waiqele	14.00	1.12	16.72	8.26
	Bucaisau	11.60	0.40	10.68	5.40
	Natua	7.40	0.28	8.64	4.18

The impact of *R. obscurus* on the juice quality was assessed with the canes sampled from 46 farms in two districts (Lautoka and Nadi). Results indicated significant variations in brix, purity, Pol, and Pocs ($p \leq$-value 0.05) in the juice due to the borer infestation (Table 41) while the fiber percentage remained unaffected.

Table 41. Impact of *Rhabdoscelus obscurus* infestation on the quality of cane juice

Parameters	Brix	Fiber	Purity	Pol	POCS
Healthy	15.09 (a)	8.78 (a)	82.87 (a)	15.39 (a)	11.74 (a)
Infested	8.76 (b)	8.74 (a)	70.65 (b)	13.00 (b)	9.65 (b)
d.f	1.00	1.00	1.00	1.00	1.00
F=value	391.88	0.00	4.18	4.07	4.97
p=0.05	0.00	0.96	0.04	0.04	0.03

Salient Findings:

- The CWB damage significantly reduces the quality of the cane by affecting the brix, purity and pocs.
- Every farm is infested with CWB with an average of 10% infestation and a severity of 5.36% in all the sectors.

2.3.6. Effective management of sugarcane termites, *Coptotermes gestroi*

Objective:

- To monitor and control termite population and assess losses incurred to the grower and to the miller

Work done:

The institute has been monitoring termites in collaboration with the Biosecurity Authority of Fiji since 2014. Bait boxes were stationed in a total of 27 farms in December 2020 and were monitored periodically. All baits were removed in August 2021 during harvest and replaced in December 2021, post the harvest. Three to four baits were placed per farm and monitored periodically. The percent incidence was worked out through the percentage of bait boxes trapping the termites, sector-wise. It could be observed that Lautoka had the maximum trapping with 16.84% bait boxes showing termite incidence in the sampled farms (Table 42).

Table 42. Sector-wise termite- trapping in bait boxes (2020)

Mill Area	Sector	% boxes trapping termites
Lautoka	Drasa	8.46
	Lovu	4.88
	Lautoka	16.84

In the same fields, the levels of infestation and intensity were directly assessed through 25 random samples each of 50 stalks in the monitored farms:

$$\% \text{ incidence} = \frac{Number\ of\ stalks\ infested}{Total\ number\ stalks\ sampled} \times 100$$

$$\% \text{ intensity} = \frac{Number\ of\ infested\ nodes}{Total\ internodes\ sampled} \times 100$$

There was no termite incidence in the Drasa sector while it was 0.3% and 2% in Lovu and Lautoka sectors respectively, with the corresponding percent intensity of attack of 0.15% and 0.32% in the latter two sectors. Additionally, new infestations of termite *C. gestroi* were recorded in eight farms in Lautoka District in 2021. In yet another survey, though symptoms of past attack were observed in Bulileka in Labasa, termites could not be seen at the time of inspection during June 2021.

Application of Fipronil (active constituent: 26g/l) at the rate of 1ml per 1L once in 2020 in five farms (total 10.4ha) in Drasa and Lovu sector infested with *C. gestroi.* Post this application, no further occurrence of the termites was observed in 2020 as well as during the time of planting, gap filling, soon after harvesting, 3 months post-harvest and monthly monitoring done in 2021.

2.3.7. Study on Fall Armyworm *Spodoptera frugiperda*

Objective:

- To monitor the pest's entrance into the country and to have a holistic defensive approach (Contingency Plan) put in place before Fall Armyworm reaches Fiji

Work done:

Fall Armyworm (FAW) is polyphagous and with sugarcane being one of its hosts, is a potential threat to the Fijian sugar industry. There was a collaboration between SRIF, ACIAR, Ministry of Agriculture, SPC and BAF to study the impact of FAW that included surveillance, monitoring as well as trapping of the pest. Monthly monitoring with 72 pheromone traps placed throughout the country's sugarcane belt (Figure 22) this year showed absence of FAW. An information sheet has been prepared and circulated to the stakeholders.

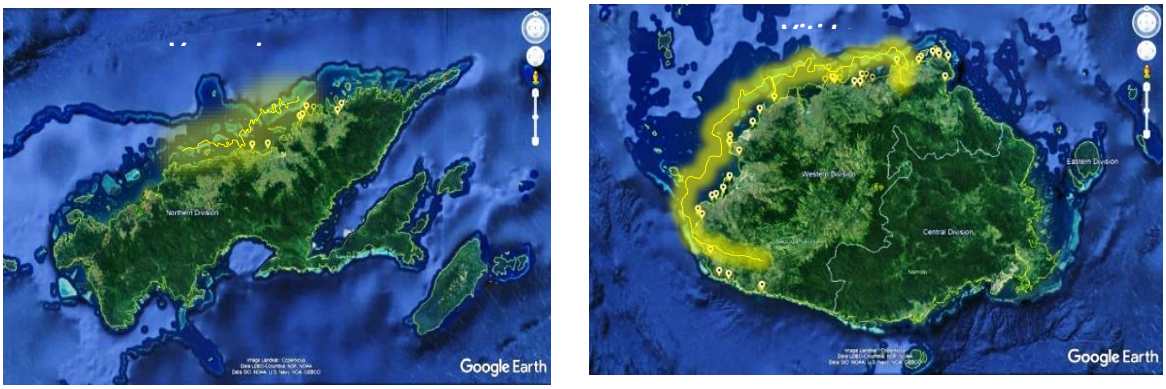


Fig 22. Locations of Fall Armyworm pheromone traps

Surveys during 2021 based on inputs received from disease control unit, 100% infestation of armyworm *Leucania* sp. was observed in a single farm in the following sectors - Cuvu ,Drumasi, Solove, Labasa, and Bucaisau (Table 43). Preliminary inspections revealed the presence of the parasitic tachinids on *Leucania* sp.

Table 43. Incidence of *Leucania* sp. In different sectors

Sector	Area Infested (ha)	Month of Infestation	Crop Age	Variety
Cuvu	0.5	October	Ratoon- 4 Weeks	Mana
Drumasi	0.6	March	Ratoon-3 Months	Mana
Solove	0.6	December	Ratoon- 3½ Months	Naidiri
Labasa	0.3	December	Ratoon- 3 Months	Naidiri
Bucaisau	0.3	December	Ratoon- 3 Months	Galoa

White grubs associated with sugarcane

Eight farms were found infested with the native white grubs, *Xenotrogus vestita* (Arrow), *Xenotrogus subnitida* (Arrow) and the introduced white grub *Adoretus versutus* Harold (as identified by SRA, Australia) during 2015-16, was revisited during Jan- March 2021 but no incidence of white grubs could be observed.

2.3.8. Isolation and inventory of potential soil microbes for nitrogen fixing at seedling stage in rhizosphere of sugarcane and other cash crops in Fiji

Objective:

- To isolate potential soil microbes that can fix nitrogen and other nutrients to the sugarcane plants in the rhizosphere stage and its significance in improving soil fertility.

Work done:

Two pot culture trials were carried out to assess the efficacy of the nitrogen fixing bacteria (NFB), *Rhizobium tropici* and *Azotobacter* sp. on the plant, black gram (*Vigna mungo*) through impact on plant height, number of leaves and nodules per plant (Figure 23).

Fig 23. Assessment of impact of nitrogen fixing bacteria on Vigna mungo.

Treatments in the first study included comparison of seeds soaked in bacterial suspension(T1), topical application of bacteria just after planting(T2), incorporation of bacteria in soil prior to planting(T3), seed drenching with bacteria(T4) and control (T5). There were no significant variations in any of the vegetative growth parameters tested at the time of harvest (Table 44).

Table 44. Assessment of growth parameters of *Vigna mungo* due to nitrogen fixing bacteria

	Treatments	Growth parameters (per plant basis)					
		Shoot length (cm)*	Shoot dry weight (g)	Number of Leaves**	Root Length (cm)***	Root Dry weigh (g)t***	Number of Nodules***
T1	Seeds soaked in bacterial suspension	23.96	5.88b	15.12	17.36	0.24	52.20
T2	Topical application of bacteria just after planting	47.86	18.36a	16.85	34.18	0.34	119.80
T3	Incorporation of bacteria in soil prior to planting	37.24	11.54ab	17.52	28.02	0.39	51.20
T4	Seed drenching with bacteria	34.62	11.14ab	12.38	23.76	0.24	8.00
T5	Control	46.24	13.80ab	26.62	25.62	0.88	83.60
	F- Value	1.01	1.58	0.95	0.68	1.41	1.18
	P- Value	0.43	0.22	0.45	0.61	0.27	0.35

*Means are insignificantly different in the column(p=0.05), LSD

It can be inferred that Black gram being a naturally nodulating legume, reinforcement with NFB inoculum may have been redundant which needs further confirmation. However, the biomass showed significant differences between the two treatments, *i.e.* T1 and T2. In the second pot culture study, the efficacy of diluted vinasse (1:10 with water; 200ml per pot) as a carrier for *Azotobacter* was applied at the differential doses of 5,10,15 and 20 ml per pot (27.5 x 24.5cm).

All treatments significantly increased the percent germination (Table 45) compared to untreated plants indicating suitability of vinasse as the carrier for *Azotobacter* and perhaps, the influence of the latter. Observations at weekly intervals from two weeks to seven weeks post application (Figure 24) showed significantly higher growth rate in all treatments compared to control. Among the treatments too, significant differences were observed. While incorporation of *Azotobacter* in soil prior to planting (T3) resulted in significantly higher plant height among all the treatments till 28 days post treatment, seed drenching (T4) resulted in the tallest plants at 35 days post inoculation and thereafter. Increased rate of *Azotobacter* did not yield corresponding increase in plant height nor improve gemination statistically.

Table 45. Impact of Vinasse and Azotobacter on germination of sugarcane

Treatments	% Germination at 4 weeks*
Vinasse(200ml) + *Azotobactor* (1x)	46.640^{bc}
Vinasse + *Azotobactor* (2x)	66.680^{ab}
Vinasse + *Azotobactor* (3x)	100.00^{a}
Vinasse + *Azotobactor* (4x)	93.320^{a}
Control	20.000^{c}
F- Value	5.15
P- Value	0.01

*- Means are significantly different in the treatment ($p<0.05$).

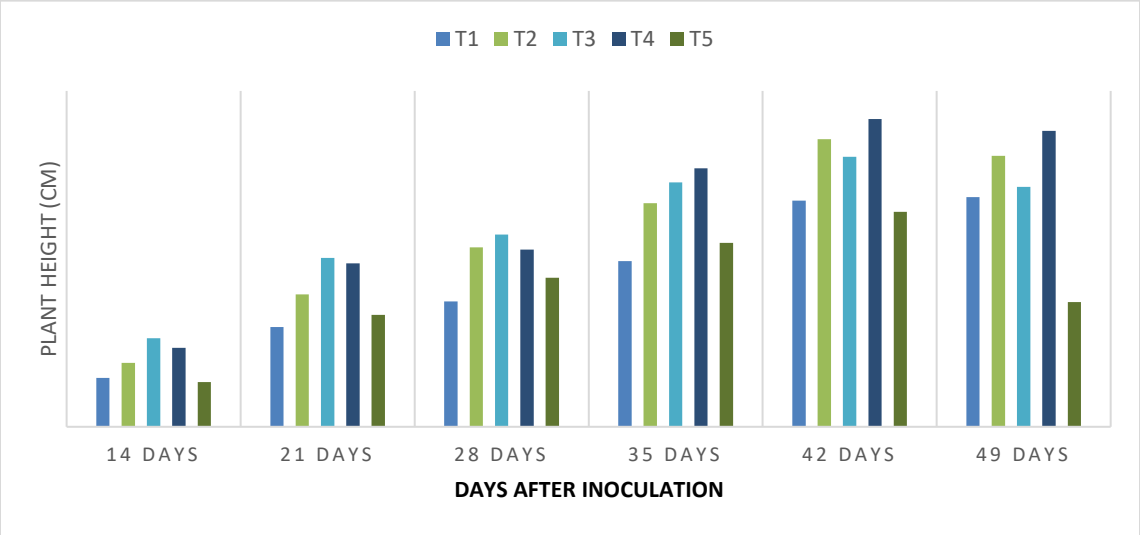


Fig 24. Impact of Vinasse and *Azotobacter* on plant height of sugarcane

The impact of pulse crop *Vigna mungo* (Urd) as a green manure crop on the population of the most common plant-parasitic nematodes of sugarcane indicated that neither the green manure crop nor the free-living nematodes (FLN) were able to control the population of the plant parasitic nematodes. In the 15 farms sampled, 49% increase in the population of plant parasitic nematodes was observed despite 26% increase in the population of free-living nematodes (Figure 25). Data on individual species showed among the nine species of the plant parasitic nematode populations of two species namely Lesion nematodes (*Pratylenchus* sp.) and Reniform nematodes (*Rotylenchulus* sp.) and free-living nematodes were found to increase from 2 to 8%. The green-manure crop could reduce the population of Root-knot (*Meloidogyne* sp.), Stunt

(*Tylenchorhynchus* sp.), Dagger (*Xiphinema* sp.), and Ring (*Criconemoides* sp.) by an average of 4%. The pre- and post-planting differences in the population densities of the nematodes did not significantly vary. The population density of Root-knot nematodes decreased by 9%, and there was an increase in the population of Lesion nematodes by 3%. However, the average soil moisture in the field was found to be improved by 15% due to the cultivation of green manure crops.

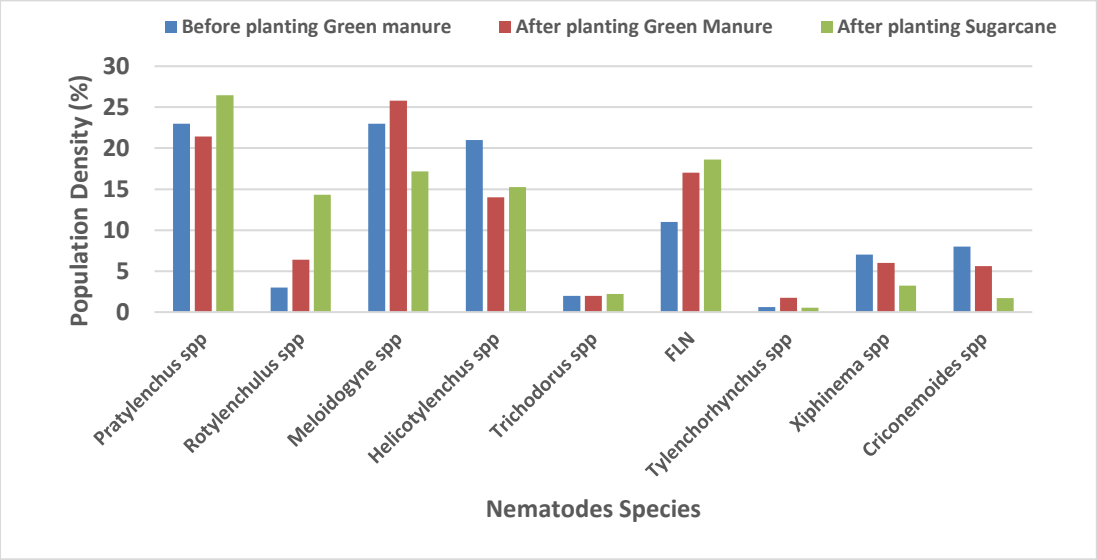


Fig 25. Effect of green manuring on relative frequency of Nematodes

In a preliminary study at SRIF met station Drasa, Lautoka on Urd, profuse root knots were observed (Figure 26), that indicates that Urd may not be inhibitory to root-knot nematodes and further studies are needed to confirm this observation.

Fig 26. Root knot nematodes in Urd roots a). Urd roots infected by root knot nematodes, b). Cross section of infested Urd roots stained and observed under microscope

2.4 DEPARTMENT OF TECHNOLOGY TRANSFER

The technology transfer initiatives of the Sugar Research Institute of Fiji include the following key activities:

- ✓ Provide Technical training to FSC extension personnel – Sector Farm Advisors
- ✓ Provide on the job training to FSC Sector Farm Advisors
- ✓ Training/courses for farmers on Best Management Practice of sugarcane farming
- ✓ Establishing farmer field schools in sectors
- ✓ Organizing Farmer field school days/information days
- ✓ Planting and Managing Hot water treated mother plots for seed cane
- ✓ Conduct Grower Demonstration Trials (GDT) to demonstrate Research Initiatives that can be adopted to increase productivity
- ✓ Developing training and advisory manuals
- ✓ Design factsheets on specific subjects
- ✓ Visibility through mainstream and social media platforms

These activities are performed/ implemented throughout the calendar year to enhance the capacity of FSC's Farm Advisors, empowering them with modern technologies based on best management practices related to sugar cane farming. This allows the FSC's Farm Advisors to provide the much-needed advisory service to farmers in the Fijian sugar industry, helping them to improve that farming business by adopting new technologies.

2.4.1. Labasa

The major focus of technology transfer in the year 2021 was improving soil health, thrash conservation, vetiver planting, contour farming, ratoon management, quality seed cane, liming, intercropping, trash conservation, and weed control. The major challenge in technology transfer is to convince the farmers to adopt to the ideas and machineries. Grower demonstration trial and field information days are most commonly used technique to demonstrate the new/improved technologies and share research findings with farmers (Table 46). The following topics have been covered in the grower demonstration trials and respective field information days;

- ➢ Importance of improving Soil Health through Green Manuring
- ➢ Importance of Liming
- ➢ Application of recommended rates of fertilizer
- ➢ Trash conservation
- ➢ Sugarcane Varieties & Quality Seed cane.
- ➢ Vetiver and contour planting
- ➢ Ratoon Management
- ➢ Benefits of intercropping

Table 46. Number of field days conducted in sectors

Sector	No. of Famers Attended	Title
Labasa	25	Intercropping, contour farming & Vetiver planting
Daku	31	Importance of Lime application
Wailevu	22	Importance of thrash blanketing
Waiqele	31	Varietal spread &New variety seedbed visit
Daku	18	Importance of varieties towards industry
Daku	20	Importance of trash conservation
Solove	25	Importance of ratoon management, thrash conservation & Vetiver planting
Waiqele	22	Importance of quality seed cane
Wailevu	25	Importance of green manuring towards soil health

2.4.2. Liming

Most of the farms in Vanua Levu are becoming more acidic due to continuous mono cropping and usage of chemical fertilizer. The sugar cane is a heavy feeder of nutrients therefore the soil needs amendments such as lime to rectify the pH value so that the nutrient is available for the plants to uptake. Liming is recommended based on soil test. Lime was broadcasted in the fields and incorporated in soil (Table 47).

Effects of Lime on pH of soil in Farm No. 22261,3104, 9126 and 8580.

The sugar cane crop was planted in the field after the lime was spread, which occurred two weeks prior. In order to examine the impact of the lime on the chemical properties of the soil, soil samples were collected from the field every 2 months to track any changes in soil pH. The graphs (Figure 27 to 30) presented below illustrate the outcomes of the study:

Table 47. Lime application on selected farms

Farm	Initial pH	Lime added (ton/ha)	pH after Liming	
22261	4.01	2.51	5.4	
3104	3.99	2.92	5.34	
8580	3.99	1.80	5.14	
9126	4.02	1.71	5.18	

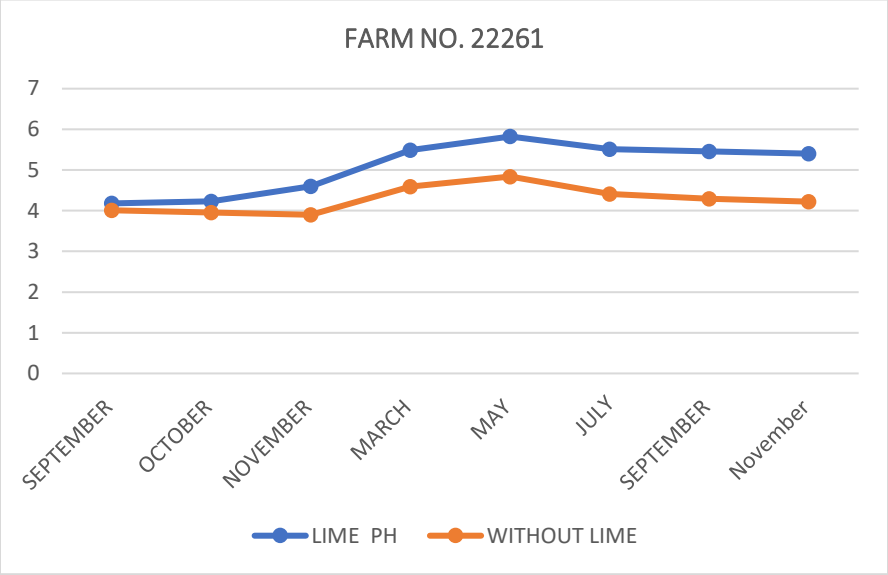


Fig 27. Effect of liming on pH of soil in Bucaisau sector

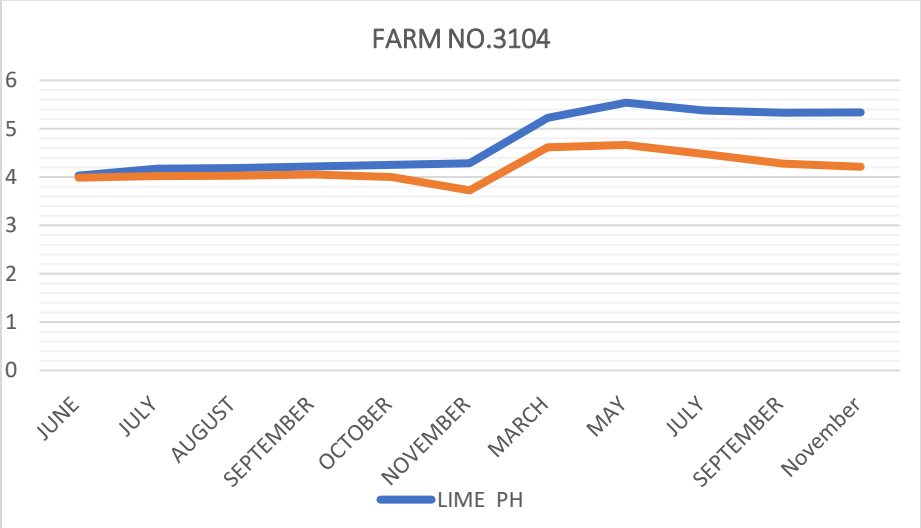


Fig 28. Effect of liming on pH of soil in Waiqele sector

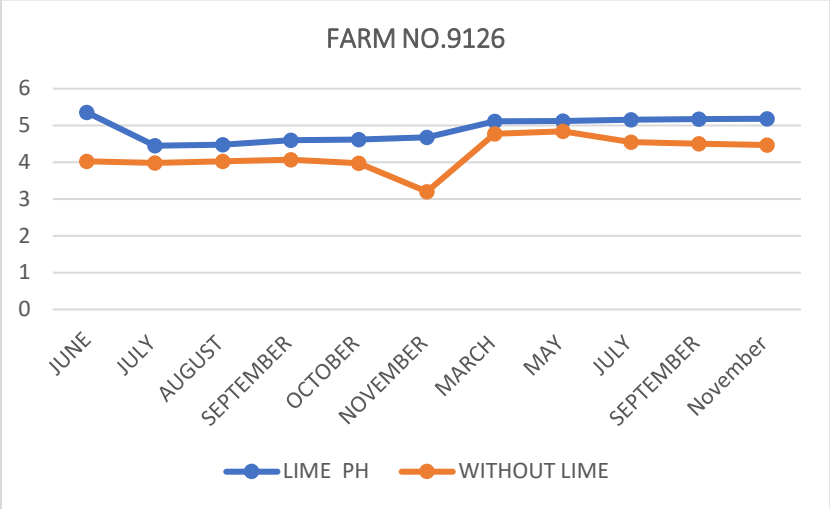


Fig 29. Effect of liming on pH of soil in Waiqele sector

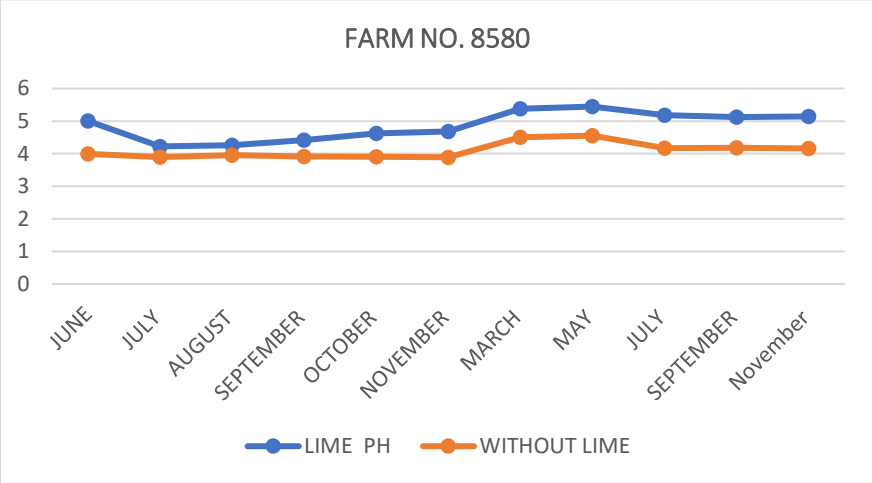


Fig 30. Effect of liming on pH of soil in Bulivou sector.

2.4.3. Heat treated sugar cane: Quality seed cane

The major disease that threatens the quality of seed cane and can lead to yield loss is ratoon stunting disease (*Leifonia xyli* subsp. *Xyli*) which is prevalent in Fiji (Johnson et al, 2006) and can cause loss up to 27% annually (Johnson and Tyagi, 2010). Treating seed cane kills the bacteria and avoids its spreading from one farm to the other as this is one of the modes of transmission. Also, farmers should use clean sterilized knives to harvest the seed cane before taking it for planting in their field. The seed bed established during 2020 was damaged by the cyclone where by a new mother plot and the recovered distribution plot were established in 2022 planting window. The mother plot will be used for establishing the distribution plot whereas the distribution plot which has been cultivated for first ratoon will be given to the farmers. The table below shows the seed beds planned for 2022 planting window (Table 48).

Table 48. Seedbeds for 2022 planting season

Sector	Variety	Plant/Ratoon	Area	Availability
Estate	Naidiri	Mother Plot/Plant plot	5.0ha	March – April
Waiqele	Viwa	1st Ratoon / distribution plot	2.0ha	March – April
	Qamea	1st Ratoon/ DP	0.4ha	March – April
Daku	Qamea	1st Ratoon/DP	0.4ha	March – April
	Ragnar	1st Ratoon/DP	0.4ha	March – April
	Naidiri	1st Ratoon/DP	0.4ha	March – April
	Viwa	1st Ratoon/DP	0.4ha	March – April
Wailevu	Naidiri	Plant/ Mother plot	0.6ha	March – April
Wainikoro	Qamea	1st Ratoon/DP	0.4ha	March – April
	Viwa	1st Ratoon/DP	0.4ha	March – April
Total			**10.4ha**	

Fig 31. Technology Transfer Officer demonstrates how to identify weeds to FSC field staff.

2.4.4. Lautoka

A total of twenty-two (22) Farmer Field School (FFS) plots were managed across the sectors in the Lautoka mill area in the year 2021. Twelve of these FFS plots were on plant cane establishment and these plots were planted in the year 2020. Eleven FFS plots were established on ratoon cane management in sectors across the Lautoka mill area. Additionally, three FFS plots were planted in the year 2021 on plant cane establishment based on best management practices of sugarcane farming. Further planting of FFS plots was affected by the outbreak of Covid-19 in Fiji in April 2021. Thus, due to various protocols implemented by the Fijian Government to minimize Covid 19 infection in communities; technology transfer staffs of Sugar Research of Institute of Fiji were not able to move in sectors to facilitate the establishment of FFS plots.

Despite the challenges associated with the Covid-19 outbreak, the Technology Transfer team in Lautoka was able to organize 6 FFS days to educate farmers on best management practices for sugarcane to improve productivity, profitability, and sustainability of the Fijian sugar industry. A total of 151 farmers and industry stakeholders attended these FFS days.

4.2-hectare seed cane nursery was planted with Naidiri and Qamea varieties in FSC Waqadra Estate. The seed cane from this nursery will be available for the 2022 main planting season (March to May) for farmers in Nadi and Sigatoka districts. Furthermore, about 19 hectares of seedcane nurseries were planted in Lautoka, Nadi, and Sigatoka districts. Most of these 19 hectares were planted with early to mid-maturing varieties such as Naidiri, Qamea, Viwa, and Kaba. The seed cane was sourced from Hot water-treated seed cane nurseries that were planted in 2020 by SRIF in collaboration with FSC and Farmers. Planting of 4.6 hectares of Hot water treated mother plot in SRIF Drasa estate was affected due to high incidences of cane fire during harvesting season which resulted in burning of seedcane that was reserved for planting this mother plot.

The main activity under technology transfer for the year 2021 was a 3-day Farm Advisors workshop that was organized by SRIF for 35 FSC sector Farm Advisors and SRIF Technology Transfer Officers. The objective of the workshop was to enhance the Farm Advisors' knowledge on best management practices for sugarcane farming. In addition, 3 on-job field trainings were also organized in collaboration with the FSC training department for FSC sector Farm Advisors in the Lautoka mill area on best management practices for plant cane establishment and ratoon management.

2.4.4.1. Training/Workshop for FSC Sector Farmer Advisors

A 3-day Farm Advisors' workshop was organized by SRIF from 25th to 27th October 2021 at SRIF, headquarters in Drasa, Lautoka. A total of 35 FSC Sector Farm Advisors together with 5 SRIF Technology Transfer Officers attended the workshop. The main purpose of this training was to provide empowerment and capacity-building to the Farm Advisors to assist farmers to help them identify and analyze their production problems and become aware of the opportunities for improvement (Figure 31), in addition to the dissemination of useful and practical information relating to agriculture, including quality seedcane, fertilizers, implements, pesticides, improved cultural practices, etc. The training was also envisioned to improve the performance of field staff in their day-to-day interactions with farmers through a greater understanding of the problems facing farmers in an ever-increasingly competitive environment and to place much greater emphasis on practical, field-based crop production advisory activities and grower support.

The workshop included the following sessions on Best Management Practices related to sugarcane farming;

- ✓ Identifying farm-related problems and discussing possible practical solutions

- ✓ Best Management Practices of Plant Cane establishment and Management
- ✓ Best Management Practices for Ratoon Cane Management
- ✓ Soil health and Conservation
- ✓ Sugarcane Nutrition and fertilizer requirement
- ✓ Integrated weed management and
- ✓ Field trip and demonstration on new technologies and practices implemented in SRIF and FSC estate farms in Drasa.

2.4.4.2 Establishment of Farmer Field Schools (FFS)/Demonstration plots

The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem-solving and discovery-based learning. FFS aims to build farmers' capacity to analyze their production systems, identify problems, test possible solutions, and eventually encourage the participants to adopt the practices most suitable to their farming systems (FAO, 2003 c). FFS can also provide an opportunity for farmers to practice and test/evaluate sustainable land-use technologies and introduce new technologies through comparing their conventional technologies developed with their tradition and culture.

A Farmer Field School (FFS) consists of a group of farmers and a farm to demonstrate, practice, and learn new farming technologies. A FFS is led by a Leader Farmer who has been trained in 'best practices' in sugarcane cropping as well as in subjects such as leadership, communication, and farming-as-a business. The FFS runs for two years during which best practices in fallow management, plant and ratoon cane management are covered. The Leader Farmer is supported by the Farm Advisory Services (FAS), notably FSC Sector Farm Advisors within the Fiji Sugar Corporation (FSC), with SRIF Technology Transfer Officers (TTO's) providing technical support and guidance as and when required (Figure 32 to 34)..

The true potential of the FFS concept is yet to be fully realized due to a lack of appreciation by the Farm advisory service institutions to roll out this concept after ceasing the pilot project back in the year 2018. However, with the appointment of full-time sector Farm Advisors by FSC, it is assumed that this concept will be enhanced and scaled up to encourage more farmer participation to educate them on best management practices related to sugarcane farming. Results from the FFS plots that were harvested in the 2021 season (Table 49).

Table 49. Results from the FFS plots on plant cane establishment that were planted in the year 2020

Sector	Farm #	Grower Name	Varieties Planted	Area Planted (ha)	Tonnes harvested	Tpha
Cuvu	5237	Sashinendra Kumar (alias Vinod)	NAIDIRI	0.4	39.48	99
Olosara	7673	Est of Akuila Kunavuni (Mailefihi Tukuaha)	VIWA	0.4	40.5	101
Lomawai	11644	Tevita Draunimasi	NAIDIRI	0.4	56	140
			VIWA	0.5	58	116
Lomawai	11521	Gopal Goundar	NAIDIRI	0.2	25	125
Lomawai	5007	Est of Ram Prasad (Chandar Bhan)	NAIDIRI	0.7	92	131
			VIWA	0.5	50	100
Natova	866	Kanda Sami Goundar	QAMEA	0.6	82.52	138
Saweni	606	Satya Prakash	NAIDIRI/QAMEA	0.4	36	90
Lautoka	1269	Suren	NAIDIRI/MANA	0.4	42	105
Lovu	18145	Priya Shadhana	VIWA/QAMEA	0.4	38.9	97
Lovu	1222	Janardhan Pillay	VIWA/NAIDIRI	0.4	55.4	137
Drasa	14154	Ravin Lal (Indr Rohit)	NAIDIRI	0.4	61.81	124
Meigunyah	2115	Mohammed Aneez	Naidiri	2.0	289	145

Results from Ratoon Cane FFS plots are presented in Table 50.

Table 50. Results from Ratoon FFS plots that were harvested in the year 2021

Sector	Farm #	Area (ha)	Variety	Crop	Tonnes harvested	Tpha
Drasa	8087	0.6	Viwa/Mana	2nd Ratoon	57.31	96
Olosara	5695	0.7	Viwa/Naidiri	2nd Ratoon	63.16	90
Lovu	18162	1.0	Naidiri	2nd Ratoon	97.37	97
Lovu	135	0.4	Naidiri	1st Ratoon	38.81	97
Natova	866	1	Mana	2nd Ratoon	84.37	84
Malolo	29111	1.7	Naidiri	1st Ratoon	184.26	108
Meigunyah	2270	1.1	Naidiri	1st Ratoon	134.49	122

The above results show that higher yield in ratoon cane can be achieved by following best management practices in ratoon cane as advocated by SRIF (Table 50). 6 FFS plots for ratoon cane

were abandoned due to lack of cooperation from selected farmers, as these farmers were selected from the list of Nil producers in the year 2019.

Farmer field school/field information days organized in the year 2021

Farmer Field Schools (FFS) is a group-based adult learning approach that teaches farmers how to experiment and solve problems independently. Sometimes called "schools without walls", in FFS, groups of farmers meet regularly with a facilitator, observe, talk, ask questions, and learn together (Table 51). The objectives of this Farmers' Field school Days are as follows:

- ✓ to exhibit new agricultural technologies to farmers and farm advisory personnel's,
- ✓ to allow farmers and extension workers to share their experiences in the industry and
- ✓ to bring farmers, input suppliers, research institutions, millers, support organizations, and Government bodies together to increase farmers' access to modern agricultural inputs and services that are available with various stakeholders, that can help farmers to improve their farming business.

Table 51. Details of FFS organized during 2021

S.No.	Date	Venue	Number of participants	Theme/take home message for farmers
1	31.3.21	Farm # 5278 Cuvu Sector	18 – farmers 5 – field personnel	✓ Improving soil through green manuring ✓ Farm planning ✓ Varietal propagation – benefits of planting early to mid-maturing varieties ✓ Timeliness of operations (planting, weed control, and fertilizer application)
2	15.04.21	Farm # 2115 Meigunyah Sector	25 – farmers 15 – industry personnel	✓ Importance of fallow management with cover crops ✓ Importance of using high-quality seedcane ✓ Varietal spread- benefits of planting early maturing varieties ✓ Farm mechanization – changing farm layout to suit mechanical harvesting
3	22.10.21	Farm # 10163 Nawaicoba Sector	31 – farmers 20 – industry personnel	✓ Adopting best management practices for plant cane establishment

				✓ Importance of farm planning and budgeting ✓ Use of high-quality seedcane for planting ✓ Timeliness of operations: planting, weed control, and fertilizer application. ✓ Varietal spread: benefits of planting early to mid-maturing varieties. ✓ Importance of improving soil health to improve and sustain sugar cane production in Fiji.
4	22.11.21	Farm # 8087 Drasa Sector	40 – farmers 10- industry personnel	✓ Adopting best management practices for plant cane establishment ✓ Importance of farm planning and budgeting ✓ Use of high-quality seedcane for planting ✓ Timeliness of operations: planting, weed control, and fertilizer application. ✓ Varietal spread: benefits of planting early to mid-maturing varieties. ✓ Importance of improving soil health to improve and sustain sugar cane production in Fiji.
5	24.11.21	Farm # 866 Natova Sector	33 – farmers 12 – industry personal	✓ Adopting best management practices for plant cane establishment ✓ Importance of farm planning and budgeting ✓ Use of high-quality seedcane for planting ✓ Timeliness of operations: planting, weed control, and fertilizer application. ✓ Varietal spread: benefits of planting early to mid-maturing varieties. ✓ Importance of improving soil health to improve and sustain sugar cane production in Fiji.

6	25.11.21	Farm # 7673 Olosara Sector	11 – farmers 8 – industry personal	✓ Adopting best management practices for plant cane establishment ✓ Importance of farm planning and budgeting ✓ Use of high-quality seedcane for planting ✓ Timeliness of operations: planting, weed control, and fertilizer application. ✓ Varietal spread: benefits of planting early to mid-maturing varieties. ✓ Importance of improving soil health to improve and sustain sugar cane production in Fiji.
7	26.11.21	Farm # 5007 Lomawai Sector	26 – farmers 16 – industry personnel	✓ Adopting best management practices for plant cane establishment ✓ Importance of farm planning and budgeting ✓ Use of high-quality seedcane for planting ✓ Timeliness of operations: planting, weed control, and fertilizer application. ✓ Varietal spread: benefits of planting early to mid-maturing varieties. ✓ Importance of improving soil health to improve and sustain sugar cane production in Fiji.

Establishment of seed cane nurseries

Good quality seed material is an important factor for yield improvement in plant and multi-ratoon cropping of sugarcane. The potential cane yield that should be obtained will not be achieved if seed cane of poor quality is planted. Seed cane quality is determined by freedom from diseases and pests, varietal purity, and germination capacity. The Fijian sugar industry has been fortunate in terms of being affected by very few diseases that are kept under control by an active pest and disease control program. 3.7-hectare seed cane nursery was planted in FSC Waqadra estate, for Naidiri and Qamea variety. The seed cane from this nursery will be available for planting in March to May planting season in the year 2022.

Planting of 4.6-hectare hot water treated mother plot was affected in SRIF Drasa estate, as the reserved seed cane for planting the plot was burned during harvesting season. However additional 16.2 ha of seed cane distribution plots were planted across the sectors in the Lautoka Mill area. Table 52 shows the summary of distribution plots planted in the year 2021.

Table 52. Summary of seed cane nurseries planted in the year 2021 in various sectors in Lautoka Mill area

Sector	Farm #	Variety	Seed Cane Source (Sector/Grower)	Area (Ha)	Date Planted	Seedcane Available (Months)
111	18076	Naidiri	111/18076	0.4	29.04.21	Nov - Jan
111	1	Naidiri	111/1	0.2	08.06.21	Jan - Mar
111	18086	Naidiri	111/18086	0.8	05.06.21	Jan - Mar
112	18184	Mana	112/18184	0.4	19.05.21	Dec -Feb
112	135	Naidiri	112/135	0.6	27.05.21	Dec - Feb
112	1222	Naidiri	112/1222	0.6	27.05.21	Dec - Feb
112	19046	Mana	112/22068	0.5	07.06.21	Jan - Mar
112	22057	Mana	112-18182	0.4	07.06.21	Jan - Mar
112	299	Mana	112-22068	0.4	09.06.21	Jan - Mar
112	172	Mana	119/11902	0.3	25.06.21	Jan - Mar
112	290	Naidiri	112-290/22068	0.5	14.08.21	Mar - May
112	19022	Naidiri	112-19022	0.8	22.08.21	Mar - May
112	299	Naidiri	112/22068	0.4	11.09.21	Apr - Jun
112	140	Mana	112/140	0.4	14.09.21	Apr - Jun
112	143	Mana	112/140	0.4	05.10.21	Apr - Jun
112	22118	Mana	112/140	0.4	09.10.21	Apr - Jun
115	115/00866	Naidiri	114/00606	1	15.09.21	Apr - Jun
115	115/00856	Viwa	119/11902	0.8	16.09.21	Apr - Jun
115	115/00856	Qamea	119/11902	0.2	16.09.21	Apr - Jun
115	115/00856	Naidiri	114/00606	0.8	16.09.21	Apr - Jun
115	115/14620	Naidiri	131/11663	0.4	02.10.21	May - Jul
115	115/14620	Qamea	131/11663	0.2	02.10.21	May - Jul
121	18524	Naidiri	123/02115	0.3	28.05.21	Dec - Feb
123	2119	Naidiri	123/02115	0.8	28.04.21	Nov - Jan
124	18695	Naidiri	123/02115	0.4	25.05.21	Dec - Feb
127	127/10163	Naidiri	114/00601	0.4	08.09.21	Apr - Jun
127	127/10163	Qamea	114/00601	0.4	08.09.21	Apr - Jun
129	12902	Naidiri	119/11902	0.2	09.07.21	Feb - Apr
129	12902	Naidiri	119/11902	0.2	29.07.21	Mar - May

129	12902	Naidiri	119/11902	0.2	11.08.21	Mar - May
129	12902	Naidiri	119/11902	0.2	12.08.21	Mar - May
129	12902	Naidiri	119/11902	0.4	13.08.21	Mar - May
129	12902	Naidiri	119/11902	1.1	24.08.21	Mar - May
129	12902	Qamea	114/00606	0.6	28.08.21	Apr - Jun
129	12902	Qamea	114/00606	0.6	29.08.21	Apr - Jun
129	12902	Qamea	119/11902	0.2	14.09.21	Apr - Jun
131	11488	Naidiri	131/11644	0.4	30.05.2	Jan - Mar 2022
131	5008	Kaba	111/18839	0.6	30.06.21	Mar - May 2022
132	132/5278	Viwa	131/11644	0.4	24.04.21	Nov - Jan
133	133/7673	Viwa	133/5695	0.4	01.05.21	Dec - Feb
133	133/7675	Qamea	133/7673	0.4	13.07.21	Feb - Apr
133	133/5420	Qamea	131/11663	0.4	10.09.21	Apr - Jun
133	133/5420	Naidiri	131/11663	0.4	10.09.21	Apr - Jun

Fig 32. Farmers and FSC personnel attending FFS day in Cuvu sector on Farm # 5278 in March 2021

Fig 33. CEO addressing the Farmers at Meigunyah sector, highlighting the importance of soil health

Fig 34. Improved farming system such as trash conservation and wider row spacing adopted in SRIF Drasa Estate

3. ESTATE FARMS

3.1 Drasa Estate

A total of 1752 tonnes of sugarcane was harvested in the SRIF Drasa estate in the year 2021 (Table 53). 56% i.e. 987.47 tonnes was harvested as burnt cane due to indiscriminate burning which happened in the harvesting season. This burning incident affected many trial data which we were collecting on soil health through trash conservation. 824.90 tonnes were transported using cage bins and 927.72 tonnes were transported using lorries.

Table 53. Sugarcane production data for SRIF Drasa Estate (2021)

Field	Plot	Date harvest	Area (ha)	Tonnes	Tpha
11	1	06/08/2021	1.51	120	79
8	1	13/08/2021	3.5	256.44	73
25	1	07/10/2021	0.99	88.73	90
	2	25/20/2021	0.5	24	48
	3	09/10/2021	1	75.25	75
24	1	27/09/2021	3.5	190.63	54
	2	05/10/2021	3.2	242.63	76
	3	09/10/2021	7.8	380.65	49
	4	06/10/2021	5.3	374.29	71
Total			**27.3**	**1752.62**	**64**

Overall yield (tonnes/hectare) declined by almost 20 tonnes compared to the 2020 harvesting season due to the early onset of high rainfall in the 2020/2021 rainy season which affected fields that were harvested late in the 2020 season. Due to heavy rainfall the cultivation works in respective fields were affected.

3.2. Rarawai Estate

SRIF continues to cultivate a portion of FSC Rarawai Estate which was provided under a MoA after becoming independent in 2006. Total registered area available is 20.3 ha which is exclusively used for research trials and seed cane plots. In 2020-2021, a total of 19.4 ha was under cane (18.5 ha harvested and sent to mill, 0.9 ha used for seed cane) while 0.9 ha was under fallow. The total cane production during 2021 was 1219.4 (1167.36 was harvested and sent to the mill and approximately 28.9 tonnes were used as seed cane). The total cane yield achieved was 60.1 t/ha (63.1 t/ha for cane harvested and delivered). The research cane occupied 12.9 ha producing 738.0 tonnes of cane giving yield of 57.2 t/ha whereas commercial cane was in 5.6 ha producing 429.2 tonnes of cane giving yield 76.7 t/ha (Table 54).

Table 54. Cane delivered - Rarawai Estate 2021

Type	Plant			1R			2R			OR			All Cane		
	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph
Research	3.5	197.5	56.4	2.6	164.9	63.4	0.5	35.0	69.9	6.3	339.7	53.9	12.9	737.1	57.1
Commercial	1.0	96.0	96.0	0.7	59.1	84.5	0.6	62.0	103.4	3.3	212.3	64.3	5.6	429.4	76.7
Total	4.5	293.5	65.2	3.3	224.0	67.9	1.1	97.0	88.2	9.6	552.0	57.5	18.5	1166.5	63.1

The following table (Table 55) shows production records from last 3 years.

Table 55. Three-year production history – SRIF Rarawai Estate 2021

Land Use	Research			SCN			Total		
Year	2019	2020	2021	2019	2020	2021	2019	2020	2021
Total registered area	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3
Total area available	20.3	20.3	20.2	20.3	20.3	20.3	20.3	20.3	20.3
Total Area under cane (AUC)	11.2	12.6	12.9	5.6	5.2	5.6	16.8	17.8	18.5
Production (tonnes)	641	832	738	363	367	429.4	1004	1199	1167.4
Yield (t/ ha)	57	66	57.2	65	70	76.7	60	67	63.1

The harvesting started on 28 July, 2021 and was completed on 15 September 2021. Some research plots and commercial cane were harvested manually (0.5 ha = 30 tonnes) whereas remaining were harvested mechanically (18.0 ha = 1133.51 tonnes). About 97% of plots were harvested burnt due to arson acts.

The cultivation works in terms of weeding, fertilizing, spraying and mechanical cultivation were done progressively as and when required. The fertilizer and weedicides were applied at the recommended rates. Some fields had high incidence of itch grass and Johnson grass attributed to new seeds coming from the adjacent fields with run-off water as well as flood. The 2021 season overall was good with slightly less production from 2020 (2.63% less than crop harvested from 2020) possibly attributed to ratoon damage and poor harvesting which was evident in 2021 The varietal composition for 2020-2021 season is presented in Table 56.

Table 56. Varietal composition for 2020-2021 season

Varieties	Plant			1R			2R			OR			All Cane		
	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph	Ha	Tonnes	Tph
Ragnar	0.7	69.7	99.6	0.2	16.4	82.0							0.9	86.1	95.7
Mana				0.3	28.6	95.3	0.6	62.0	103.4	0.1	6.9	68.9	1.0	97.5	97.5
Kaba										1.2	75.0	62.5	1.2	75.0	62.5
Naidiri										0.4	26.4	66.0	0.4	26.4	66.0
LF91-1925	0.2	13.6	68.1							0.4	25.7	64.1	0.6	39.3	65.4
QAMEA	0.1	12.7	126.6	0.2	14.2	70.8				0.8	54.5	68.1	1.1	81.3	73.9
VIWA										0.4	23.9	59.7	0.4	23.9	59.7
O/Var	3.5	197.5	56.4	2.6	164.9	63.4	0.5	35.0	69.9	6.3	339.7	53.9	12.9	737.1	57.1
Total	4.5	293.5	65.2	3.3	224.0	67.9	1.1	97.0	88.2	9.6	552.02	57.5	18.5	1166.49	63.1

Seed cane Production: SRIF Rarawai Estate has got a Hot Water treatment facility to routinely treat seed cane and plant mother plots to supply clean seed cane material for distribution plots as well as to farmers. In 2020-2021, SRIF Rarawai had 1.3 ha of HWT single eye-sets plots planted namely Qamea – 0.1ha, LF11-233 – 0.2 ha, and TC Qamea – 0.4 ha. Apart from HWT seedlings, tissue culture seedlings were also received from Drasa and planted in Field 8 in an area of 0.4 ha. However, this seedcane was harvested and planted in FSC Field 17 and has shown to be thriving well in terms of growth and tillering. The Table 57 summarizes total number of seedlings produced from single eye-setts.

Table 57. Seedling production of different varieties

Varieties		# trays	# Seedlings
Naidiri		54	1728
Qamea		50	1600
Mana		40	1280
Kaba		48	1536
Waya		3	96
Viwa		57	1824
Pindar		3	96
Total		255	8160

Some Mana seedlings were bought by a nearby farmer for gap filling and some were planted as standards in trial plots. Other seedlings i.e. Kaba, Naidiri, Waya, Pindar and Viwa were planted in trial plots and remaining are still in greenhouse awaiting to be planted under favorable rainfed conditions. Approximately 25 tonnes of HWT treated seedcane of Mana, Qamea, Viwa and Kaba (whole stalks) were taken by farmers and remaining (mostly from ratoons) were harvested and sent to the mill.

2.4. Labasa Estate

Labasa estate suffered loss in yield due to cyclones Yasa and Ana. Also, after the cyclone the crop got affected by flood. Total of 180 tonnes of cane were harvested from the estate and sent to the mill whereas 45 tonnes were used as seed cane (Table 58). Around 8ha was ploughed out for which 5ha have been used to plant mother plot. The remaining 3ha were left fallow for green manuring and distribution plot planting in early 2022 planting window. Around 48% of cane was harvested as green and 52% was harvested as burnt crop. Total crop had decreased by 76% compared to 2020 season. Unfavorable weather conditions, (cyclones Yasa and Ana) had contributed to this decrease in production.

Table 58. Seed production in Labasa Estate during 2021

Field	Plot	Area (ha)	Tonnes	Tph	Variety
1	1,2,3,4	5.0	90	22	Naidiri
2	5,6	2.0	35	17.5	Naidiri, Viwa, Mali, Kuiva
3	7,8	0.8	15	18.75	Qamea, Ragnar
4	9,10,11,12	3.0	40	13	Stage 04, Ragnar, Qamea, Kuiva
5					Fallow, green manure
Total		10.8	180	17	

4. OUTREACH PROGRAMME

4.1. Training Organized by the SRIF

The following trainings were organized by the SRIF

1. Training on the Weed Management for farm advisors on 23 February 2021 (Venue; SRIF Rarawai). There were 11 participants.
2. Training on Pests and Diseases of Sugarcane for Disease Control Unit (Roguers) from 1 – 5 March 2021 (Venue: SRIF Lautoka). There were 30 participants.
3. Training on Weed Management for growers in Malau and Nanuku sector on 10 March 2021 (Venue: Grower's residents). There were 90 participants.
4. Training on OHS Fire Warden for self-protection at the workplace on 12 March 2021 (Venue: SRIF Lautoka). There were 28 staff's participants.
5. Training on the Weed Management for growers in Varavu sector on 17 March 2021 (Venue: Grower's residents). There were 5 participants.
6. Training on the Best Management Practices related to sugarcane farming for farm advisors from 16 – 18 August 2021 (Venue: FSC Training Centre). There were 35 participants.
7. Training on the Best Management Practices for improving sugarcane production for farm advisors from 25 – 27 October 2021 (venue: SRIF Lautoka). There were 35 participants.

4.2. Training attended by SRIF Staff

1. Mr. Shazil Hasan attended Farmer Advisory Training on the best management practices conducted by the Sugar Research Institute of Fiji from 25 – 27 October 2021 at SRIF Lautoka.
2. Mr. Shazil Hasan attended a training on Multi Timescale conducted by the Fiji Meteorological Service on 15 September 2021 at SRIF Lautoka.
3. Mr. Shazil Hasan attended a training on OHS Fire Warden Training conducted by the National Fire Authority on 12 March 2021 at the SRIF Lautoka.
4. Ms. Kaashvi Goundar attended a training on OHS Fire Warden Training conducted by the National Fire Authority on 12 March 2021 at the SRIF Lautoka.
5. Ms. Binita Padayachi attended a training on OHS Fire Warden Training conducted by the National Fire Authority on 12 March 2021 at the SRIF Lautoka.
6. Ms. Nikhilta Goundar attended a training on Multi Timescale conducted by the Fiji Meteorological Service on 15 September 2021 at SRIF Lautoka.
7. Ms. Nikhilta Goundar attended Farmer Advisory Training on the best management practices conducted by the Sugar Research Institute of Fiji from 25 – 27 October 2021 at SRIF Lautoka.
8. Ms. Doreen Pillay provided training to Farm Advisors on Soil Sampling conducted by the Sugar Research Institute of Fiji from 25 – 27 October 2021 at SRIF Lautoka.

9. Ms. Doreen Pillay participated in the “3rd Pacific Nation Laboratories” meeting and made a presentation on the work being done at SRIF analytical lab, conducted by ASPAC on 22 November 2021 through virtual mode at SRIF Lautoka.

4.3. Work Shops, Conferences and Seminars attended by SRIF Staff

1. International Conference on Sugarcane Research: Sugarcane for Sugar and Beyond (CaneCon 2021) held through virtual mode at ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India from 9 - 22 June 2021 attended by Abinesh Chand, Amit Singh, Binita Padayachi, Doreen Pillay, Ilisoni Vorelevu, Kaashvi Goundar, Nalini Prasad, Nazeea Bano, Nikhilta Goundar, Pedro Rounds, Rusila Baleidroma, Santiago Mahimairaja, and Shazil Hasan.
2. Workshop on World Soils Day “Halt Soil Salinization, Boost Soil Productivity” on 8 December 2021 attended by Abinesh Chand, Amit Singh, Anishika Mala, Ashna Devi, Ashneel Kumar, Binita Padayachi, Doreen Pillay, Faizal Ali, Ilisoni Vorelevu, Kaashvi Goundar, Kalivati Valetini, Nalini Prasad, Nazeea Bano, Nikhilta Goundar, Nikita Natasha, Pedro Rounds, Prema Naidu, Renil Kumar, Ronal Kumar, Ronika Ranjeshni, Rusila Baleidroma, Sanmogam Goundar, Santiago Mahimairaja, Sharon Chand and Shazil Hasan.

4.4. Field Information Day Conducted

1. Field Information Day on the importance of contour farming & vetiver planting on 9 November 2021 (Venue: Anuveh) Labasa sector. There were 20 participants.
2. Field Information Day on Plant Cane Establishment on 22 October 2021 (Venue: Osea Naiqamu) Nawaicoba sector. There were 45 participants.
3. Field Information Day on Maximize Unit Productivity on 15 April 2021 (Venue: Hasmat) Meigunyah sector. There were 40 participants.
4. Field Information Day on Improving Soil Health to Maximize Unit Production on 31 March 2021 (Venue: Mrs. Khan) Cuvu sector. There were 25 participants.
5. Field Information Day on Importance of adding lime on 10 November 2021 (Venue: Madan Sen) Daku sector. There were 20 participants.
6. Field Information Day on Adopting Best Management Practices for Sugarcane Farming on 22 November 2021 (Venue: Padmanavan Pillay) Drasa sector. There were 42 participants.
7. Field Information Day on Adopting Best Management Practices for Sugarcane Farming on 24 November 2021 (Venue: Kanda Sami Goundar) Natova sector. There were 44 participants.
8. Field Information Day on Adopting Best Management Practices for Sugarcane Farming on 25 November 2021 (Venue: Mailefihi) Olosara sector. There were 18 participants.
9. Field Information Day on Adopting Best Management Practices for Sugarcane Farming on 26 November 2021 (Venue: Chandar Bhan) Lomawai sector. There were 30 participants.

10. Field Information Day on the Importance of Trash Conservation in sugarcane farming on 18 November 2021 (Venue: Jitendra Goundar) Wailevu sector. There were 14 participants.
11. Field Information Day on Varietal Spread & New Variety Seedbed on 18 November 2021 (Venue: Abdul Hamid) Labasa sector. There were 21 participants.
12. Field Information Day on Intercropping, Contour farming and vetiver planting on 2 November 2021 (Venue: Aman Chand) Labasa sector. There were 25 participants.
13. Field Information Day on Varietal spread & New Variety Seedbed visit on 24 November 2021 (Venue: Dharmendra Jit) Waiqele sector. There were 31 participants.
14. Field Information Day on Importance of Varieties towards Industry on 30 November 2021 (Venue: Kamal Deo) Daku sector. There were 18 participants.
15. Field Information Day on the Importance of Trash Conservation on 30 November 2021 (Venue: Dhiren Chand) Daku sector. There were 20 participants.
16. Field Information Day on Importance of Ratoon Management, Trash Conservation & Vetiver Planting on 1 December (Venue: Surna Devi) Solove sector. There were 25 participants.
17. Field Information Day on the Importance of Quality Seedcane on 15 December 2021 (Venue: Chandar Deo) Waiqele sector. There were 22 participants.
18. Field Information Day on the Importance of Green Manuring Towards Soil Health on 16 December 2021 (Venue: Babu Singh) Wailevu sector. There were 25 participants.

5. PUBLICATIONS

5.1. Conference Paper

1. Padayachi B.V., Prasad N.S and Rounds P. N. B. 2021, Status of Asian Subterranean Termites in the sugarcane belt of Fiji. Proceedings of the Australian Society of Sugarcane Technologists, volume 42.

2. Padayachi B.V., Rounds P. N.B. 2021, Sugarcane grubs in the Lautoka and Rarawai Mill area, Fiji. Proceedings of the Australian Society of Sugarcane Technologists, volume 42.

3. Mahimairaja, S**.,** Nazeea, B., Abinesh, C., Naidu P and Amit, S. (2021). Sugarcane farming in Fiji: Current problems and future prospects. Invited Lead paper presented during the International Conference on Sugarcane Research: Sugarcane for Sugar and Beyond, CaneCon 2021, held at Sugarcane Breeding Institute, Coimbatore, India from 19-22, June 2021.

5.2. Newspaper Articles

1. Prasad Nalini. (2021), 'The Fiji Sun' Management of Pests in the Sugar Fields an Economic Gain, 04 September. https://www.pressreader.com/fiji/fijisun/20210904/282634625724690

2. Mahimairaja Santiago. (2021), 'The Fiji Times' Burning cane has 'detrimental effects', 21 October. https://www.fijitimes.com/burning-cane-has-detrimental-effects/

3. Mahimairaja Santiago. (2021), 'The Fiji Sun' Sugar Industry Has A Future: Santiago, 17 April. https://www.pressreader.com/fiji/fiji-sun/20210417/282587380806026

4. Hassan Shazil. (2021), 'The Fiji Sun' Despite the Pandemic the Sugar Research Institute Presses to Grow the Yield, 25 May. https://fijisun.com.fj/2021/05/25/despite-the-pandemic-the-sugar-research-institute-presses-to-grow-the-yield/

5. Mahimairaja Santiago. (2021), 'The Fiji Times' Ratoon crop reduces output, 20 October. https://www.fijitimes.com/ratoon-crop-reduces-output/

6. Naidu Prem. (2021), 'The Fiji Sun' New Variety of Cane in The Nest Season, Says Research Institute, 23 November. https://fijisun.com.fj/2021/11/23/new-variety-of-cane-in-the-next-season-says-research-institute/

7. Mahimairaja Santiago. (2021), 'The Fiji Times' Farmers learn new crop techniques, 13 December. https://www.fijitimes.com.fj/farmers-learn-new-crop-techniques/

8. Mahimairaja Santiago. (2021), 'The Fiji Times' Research links soil health to yield, 13 October. https://www.pressreader.com/fiji/the-fiji-times/20211013/281608128615673

9. SRIF. (2021), 'The Fiji Sun' New CEO at Sugar Research, 12 March. https://www.pressreader.com/fiji/fiji-sun/20210312/281749862105324

10. SRIF. (2021), 'The Fiji Time' New CEO for the sugar research institute. 13 March. https://www.pressreader.com/fiji/the-fiji-times/20210313/282432761907440

5.3. Radio Talk/ Interviews

1. Mr. Prem Naidu has given two radio interviews on Radio Fiji 2.

2. Prof. S. Mahimairaja has given two radio interviews on Radio Fiji 2.

5.4. TV Program (News/ Stories)

1. Prem Naidu. (2021), 'FBC NEWS' New cane variety shows good results, 26 October. https://www.fbcnews.com.fj/news/new-cane-variety-shows-good-results/

2. Abinesh Chand. (2021), 'FBC NEWS' Field Advisers undergo needed training, 26 October.https://www.fbcnews.com.fj/news/fsc-field-advisers-undergo-needed-training/

5.5. Facebook Posting

1. **FBE NEWS coverage on farmer field school day at Raviravi, 22 November 2021.** https://www.facebook.com/SRIFFJ/videos/fbc-news-coverage-on-farmer-field-school-day-at-raviravi-22112021/976113876310451/

2. News Coverage by FIJI ONE on Trash Incorporation, 3 October 2021. https://www.facebook.com/SRIFFJ/videos/news-coverage-by-fiji-one-on-trash-incorporation-03102021srifsugarindustryminist/1437449363306762/

3. News Coverage by FIJI ONE on Professor Mahimairaja appointed as the CEO of Sugar Research Institute of Fiji, 18 March 2021. https://www.facebook.com/SRIFFJ/videos/professor-mahimairaja-santiago-appointed-as-the-ceo-of-sugar-research-institute-/294552268951005/

6. ANNEXURES

Annexure -1

Varieties recommended to growers based on soil type & maturity. The growers have a choice of at least three varieties to plant on their farms as per the Master Award

Mill/Sectors	Soil types	Varieties recommended on maturity trends	
		Early – mid maturing	Mid – late maturing
Lautoka/Olosara	Rich alluvial soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Cuvu	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Viwa
Lautoka/Lomawai	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Lautoka/Yako	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Lautoka/Nawaicoba	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Lautoka/Malolo	Flat Fertile soil	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Qeleloa	Rich alluvial soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa

Lautoka/Meigunyah	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Legalega	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Natova	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Lautoka/Lautoka	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Saweni	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Lautoka/Lovu	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
Lautoka/Lovu	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Drasa	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa
Rarawai/Varoko	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Mota	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa

	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Naloto	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Koronubu	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Veisaru	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
Rarawai/Veisaru	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Rarawai	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Varavu	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Tagitagi	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Mana, Kaba, Vatu, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Saline areas	Naidiri, LF91-1925	Kaba, Mana, Galoa
Rarawai/Yaladro	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Rarawai/Drumasi	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Mana, Kaba, Vatu, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Saline areas	Naidiri, LF91-1925	Kaba, Mana, Galoa
Labasa/Waiqele	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa

	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
Labasa/Wailevu	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu
Labasa/Vunimoli	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
Labasa/Vunimoli	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
Labasa/Labasa	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Bucaisau	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Wainikoro	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Daku	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
Labasa/Natua	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Labasa/Solove	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Labasa/Bulivou	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Penang/Nanuku	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa

	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Salt affected areas	Naidiri, LF91-1925	Galoa
	Viti Vanua area	Naidiri, LF91-1925, Qamea	Mana, Kaba, Kiuva, Mali, Viwa
Penang/Malau	Rich alluvial soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Mali, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Salt affected areas	Naidiri, LF91-1925	Galoa
Penang/Ellington	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Mali, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Salt affected areas	Naidiri, LF91-1925	Galoa

Annexure – 2

Main features of 2021 season compared to 2020

FACP

Mill →	Lautoka		Rarawai		Labasa		Penang		All mills	
Year →	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Total registrations (Numbers)	5494	5511	7161	7191	4179	4194	N/A	N/A	16834	16896
Total farm basic allotments (tonnes)	962195	965318	1250312	1258647	947586	949679	N/A	N/A	3160093	3176344
Total registered area (hectares)	23166	23194	30386	31751	49788	20439	N/A	N/A	103340	75383
Total area cultivated (hectares)	9443	9168	14505	12865	14522	11777	N/A	N/A	38470	33810
Total area harvested (hectares)	8957	8860	13950	12859	13826	11786	N/A	N/A	36734	33504
Total farm harvest quotas (tonnes)	Open									
Sugar makes actual (tonnes)	42353	50532	46291	48318	64473	34359	N/A	N/A	153117	133209
Tonnes 94 N.T sugar	42353	52651	47669	50101	66591	35574	N/A	N/A	156613	138326
Yield tonnes 94 N.T. sugar per hectare	5	6	3	4	5	3	N/A	N/A	4	4
Tonnes cane per tonnes sugar 94 N.T.	12	9	12	10	10	10	N/A	N/A	11	10
%POCS	9	10	10	10	10	10	N/A	N/A	10	10
Cane purity average for season	77	79	77	79	82	81	N/A	N/A	80	80
Tonnes cane harvested	418149	442811	639816	612220	671316	362236	N/A	N/A	1729280	1417267
Tonnes cane crushed	505652	532020	552314	523011	671316	362236	N/A	N/A	1729281	1417267

Annexure -3
Monthly Rainfall (mm) for 2021 compared with long term average

Mills	No. of years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lautoka	2021 actual	653	305	317	199	129	43	2	20	28	32	104	357	2187
	112 yrs. avg. to 2021	307	325	324	186	97	65	51	67	72	90	125	190	1897
Rarawai	2021 actual	905	607	532	135	157	29	1	0	55	30	161	325	2937
	135 yrs. avg. to 2021	360	360	360	284	80	39	29	91	100	142	216	238	2298
Labasa	2021 actual	1056	719	276	205	277	13	58	3	124	22	247	334	3334
	132 yrs. avg. to 2021	365	363	363	359	358	356	357	356	357	357	358	362	4312
Penang	2021 actual	646	735	431	209	365	111	23	17	48	29	131	377	3120
	123 yrs. avg. to 2021	431	359	401	374	124	72	52	92	85	143	153	248	2533

Annexure -4
Crop Production Details

	Lautoka		Rarawai		Labasa		Penang		All mills	
	2020	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**
Areas harvested (hectares)										
Plant	504	522	1133	832	1109	915	N/A	N/A	2745	2270
First ratoon	787	520	1702	1553	1806	1671	N/A	N/A	4294	3744
2nd ratoon	773	706	1902	2291	1908	1705	N/A	N/A	4583	4701
Other ratoons	6893	7112	9214	8183	9004	7495	N/A	N/A	25111	22789
Total	8957	8860	13950	12859	13826	11786	N/A	N/A	36733	33504
Cane harvested (tonnes)										
Plant	29812	32627	61219	50436	61014	36117	N/A	N/A	152044	119181
First ratoon	41340	29045	88045	77895	97857	56653	N/A	N/A	227243	163593
2nd ratoon	40702	35900	90152	107327	95279	52876	N/A	N/A	226133	196103
Other ratoons	306295	345239	400401	376562	417165	216590	N/A	N/A	1123861	938391
Total	418149	442811	639816	612220	671316	362236	N/A	N/A	1729281	1417267
Yield tonnes cane per hectare (tch)										
Plant	59	63	54	61	55	40	N/A	N/A	55	53
First ratoon	53	56	52	50	54	34	N/A	N/A	53	44
2nd ratoon	53	51	47	47	50	31	N/A	N/A	49	42
Other ratoons	44	49	43	46	46	29	N/A	N/A	45	41
Avg. yield/ha	47	50	46	48	49	31	N/A	N/A	47	42
Varieties crushed (% of total cane harvested)										
Ragnar	0.3	0.3	0.1	0.1	18.9	17.4	N/A	N/A	7.5	4.6
Aiwa	0.6	0.5	0.1	0.1	0.2	0.0	N/A	N/A	0.2	0.2
Beqa	0.1	0.0	0.0	0.0	0.0	0.0	N/A	N/A	0.0	0.0
Galoa	0.1	0.3	0.0	0.0	4.3	3.0	N/A	N/A	1.7	0.8
Kaba	1.6	1.4	2.5	2.1	0.2	0.2	N/A	N/A	1.6	1.7
Mali	0.0	0.0	0.0	0.0	6.4	4.6	N/A	N/A	2.5	1.2
Mana	92.7	93.6	95.0	95.5	0.0	0.0	N/A	N/A	57.3	70.3
Naidiri	3.2	2.6	1.3	1.2	53.9	60.6	N/A	N/A	21.7	16.8
Vatu	0.0	0.0	0.0	0.0	7.1	6.1	N/A	N/A	3.3	1.6
Waya	0.0	0.0	0.3	0.3	2.9	3.1	N/A	N/A	1.2	0.9
LF91-1925	0.7	0.7	0.2	0.3	3.4	3.5	N/A	N/A	1.5	1.1
Kiuva	0.3	0.2	0.1	0.1	0.7	0.7	N/A	N/A	0.4	0.4
Qamea	0.2	0.3	0.0	0.1	0.0	0.3	N/A	N/A	0.1	0.2
Viwa	0.2	0.1	0.0	0.0	0.1	0.3	N/A	N/A	0.1	0.1
Expt./Others	0.2	0.2	0.3	0.2	1.9	0.0	N/A	N/A	0.9	0.3
Total	100	100	100	100	100	100	N/A	N/A	100	100

Appendix 4: Hectares harvested											
Mills	**Crop**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Lautoka	P	279	566	681	1006	515	637	756	777	504	522
	R	11925	10403	10337	9876	8105	9476	8376	8506	8453	8338
	Total	12204	10969	11018	10882	10122	10113	9132	9283	8957	8860
Rarawai	P	665	833	803	1095	403	1309	1799	1309	1133	832
	R	12206	11415	11170	10754	9610	8968	8426	9586	12817	12027
	Total	12871	12248	11973	11849	10013	10277	10225	10895	13950	12859
Labasa	P	559	1598	1035	1756	1027	2008	1673	1812	1109	915
	R	12799	10054	11044	11216	12423	12238	12800	12402	12717	10871
	Total	13358	11652	12079	12972	13450	14246	14473	14214	13826	11786
Penang	P	158	318	260	580	302	226	452	428	N/A	N/A
	R	3367	2973	3098	3008	2907	3178	2823	2823	N/A	N/A
	Total	3525	3291	3358	3588	3209	3404	3275	3251	N/A	N/A
All mills	P	1661	3315	2780	4437	2247	4180	4680	4326	2746	2270
	R	40298	34845	35647	34854	35292	33860	32425	33317	33987	31234
	Total	41959	38160	38427	39291	36794	38040	37105	37643	36733	33504

Annexure -5
Tonnes of Cane harvested

Mills	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lautoka	481483	405652	520264	521065	372288	429570	457480	474914	418149	442811
Rarawai	508638	498881	596350	490765	269800	407861	479625	523920	639816	612220
Labasa	413285	546156	544353	662600	653353	675731	620328	661919	671316	362236
Penang	143568	159720	171214	170129	91806	118231	139937	N/A	N/A	N/A
All mills	1546974	1610409	1832181	1844559	1387247	1631393	1697370	1530997	1729281	1417267

Annexure -6
Tonnes of Cane per hectare harvested

Mills	**Crop**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Lautoka	P	53.9	51.2	59.8	55.5	48.9	54.6	58.8	58.8	59.1	62.5
	R	39.1	36.2	46.4	47.1	35.0	46.2	41.7	55.0	49.9	51.8
	Total	39.5	37.0	47.2	47.9	36.8	42.5	42.5	51.0	46.7	50.0
Rarawai	P	53.1	56.6	61.6	49.6	49.6	47.8	58.8	52.0	54.1	60.6
	R	38.8	39.6	49.0	40.6	26.6	43.0	54.0	49.0	47.5	47.7
	Total	39.5	40.7	49.8	41.4	26.9	39.7	56.4	48.0	45.9	47.6
Labasa	P	43.9	59.4	58.3	58.9	55.1	48.3	47.9	49.0	55.0	39.5
	R	30.4	44.8	43.8	49.9	46.1	47.5	44.8	49.3	50.2	31.3
	Total	30.9	46.9	45.1	51.1	48.6	47.4	46.4	47.0	48.6	30.7
Penang	P	46.4	40.8	60.4	52.2	32.2	37.2	35.7	52.0	N/A	N/A
	R	40.5	49.3	50.2	46.5	28.9	33.1	52.6	46.9	N/A	N/A
	Total	40.7	48.5	51.0	47.4	28.6	34.7	44.2	45.0	N/A	N/A
All	P	49.5	55.5	59.8	54.9	46.5	47.0	50.3	51.9	55.0	52.5
Mills	R	36.3	40.9	46.7	45.9	37.1	42.5	48.3	50.0	49.0	42.2
	Total	36.9	42.2	47.7	46.9	35.2	41.1	49.3	48.0	47.0	42.3

Annexure -7
Plant cane harvested as percentage of total cane harvested

Mills	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lautoka	3.1	7.1	7.8	10.7	6.8	8.1	9.7	10.0	7.1	7.4
Rarawai	6.9	9.4	8.3	11.1	5.3	15.3	20.1	12.9	9.6	8.2
Labasa	5.9	17.4	11.1	15.6	8.7	14.4	12.9	13.4	9.1	10.1
Penang	5.1	8.1	9.2	17.8	10.6	7.1	11.5	15.2	N/A	N/A
All mills	5.3	10.5	9.1	13.2	6.1	11.2	13.6	12.4	8.8	8.4

Annexure -8
Plant, ratoon yields and percentage of total area harvested

Mills	Plant			First ratoon			Other ratoons			All cane	
	tch	Area Ha	% of Area	tch	Area ha	% of Area	tch	Area ha	% of Area	tch	Area ha
Lautoka	62.5	522.2	5.9	55.8	520.1	5.9	48.8	7817.2	88.2	50.0	8859.5
Rarawai	60.6	832.0	6.5	50.1	1553.3	12.1	46.2	10473.8	81.5	47.6	12859.1
Labasa	39.5	915.4	7.8	33.9	1670.7	14.2	29.3	9199.4	78.1	30.7	11785.5
Penang	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
All Mills	52.5	2269.6	6.8	43.7	3744.1	11.2	41.3	27490.4	82.1	42.3	33504.1

Annexure -9
Seasonal %POCS in cane

Mills	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lautoka	10.7	11.6	12.9	12.4	10.7	11.8	10.6	9.9	9.3	10.2
Rarawai	10.7	11.5	12.0	12.6	9.7	11.4	10.0	10.4	9.8	10.1
Labasa	11.6	11.2	12.3	12.1	11.7	11.1	11.5	10.8	10.2	9.9
Penang	11.5	10.6	11.9	11.9	N/A	N/A	N/A	N/A	N/A	N/A
All Mill Avg.	11.1	11.3	12.3	12.3	10.6	11.6	10.6	10.4	9.8	10.1

Annexure -10
Weekly POCS in cane 2021 season

Week	Lautoka	Rarawai	Labasa	Weekly average
1	9.4	9.7	7.7	8.9
2	10.0	9.9	8.8	9.6
3	9.2	10.0	9.1	9.4
4	9.8	10.0	9.6	9.8
5	9.9	10.1	9.6	9.9
6	10.1	10.1	9.7	10.0
7	10.3	10.3	9.8	10.1
8	10.4	10.6	9.8	10.3
9	10.7	10.6	10.0	10.4
10	10.6	10.5	10.3	10.5
11	10.5	10.6	10.4	10.5
12	10.2	10.6	10.1	10.3
13	10.5	10.4	10.1	10.3
14	10.3	10.1	10.1	10.2
15	10.2	10.5	10.0	10.2
16	10.1	9.6	10.0	9.9
17	10.2	9.3	9.8	9.8
18	9.9	9.0	-	9.5
19	9.9	9.2	-	9.5
20	9.5	9.2	-	9.3
Average	10.1	10.0	9.7	9.9

Annexure -11
Sugar product (tonnes 94 N.T. equivalent)

Mills	Tonnes sugar 94 N.T equivalent									
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Lautoka	48129	41874	76456	63784	40595	52021	60256	60825	42353	52651
Rarawai	45732	60039	68277	61083	25979	57167	42708	46594	47669	50101
Labasa	45398	63423	69647	82744	76466	67010	64332	68007	66591	35574
Penang	19908	19258	21684	18731	N/A	N/A	N/A	N/A	N/A	N/A
All mills	159166	184594	236065	226342	143040	176198	167296	175431	156613	138326

Annexure -12
Sugar tonnes 94 N.T equivalent per hectare (tsh

Mill	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lautoka	3.8	3.8	6.9	5.9	4.0	5.1	6.6	6.6	4.6	5.9
Rarawai	3.8	4.7	5.6	5.2	2.6	5.6	4.2	4.4	3.3	3.9
Labasa	3.4	5.3	5.6	6.4	5.7	4.8	4.6	4.8	4.8	2.9
Penang	5.6	5.9	6.5	5.2	N/A	N/A	N/A	N/A	N/A	N/A
Average	4.2	4.9	6.1	5.8	3.9	5.1	5.1	5.3	4.1	4.0

- Please note the figures entered from 2017 till 2020 had error thus has been verified and changed in this

Annexure -13
Varieties percent of hectares harvested

	Lautoka		Rarawai		Labasa		Penang		All Mills	
Varieties	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Ragnar	0.3	0.3	0.1	0.1	18.9	17.4	N/A	N/A	7.5	4.6
Waya	0.0	0.0	0.3	0.3	2.9	3.1	N/A	N/A	1.2	0.9
Mali	0.0	0.0	0.0	0.0	6.4	4.6	N/A	N/A	2.5	1.2
Galoa	0.1	0.1	0.0	0.0	4.3	3.0	N/A	N/A	1.7	0.8
Aiwa	0.6	0.5	0.1	0.1	0.2	0.1	N/A	N/A	0.2	0.2
Mana	92.7	93.6	95.0	95.5	0.0	0.0	N/A	N/A	57.3	70.3
LF91-1925	0.7	0.7	0.2	0.3	3.4	3.5	N/A	N/A	1.5	1.1
Kaba	1.6	1.4	2.5	2.1	0.2	0.2	N/A	N/A	1.6	1.7
Vatu	0.0	0.0	0.0	0.0	7.1	6.1	N/A	N/A	3.3	1.6
Beqa	0.1	0.0	0.0	0.0	0.0	0.0	N/A	N/A	0.0	0.0
Naidiri	3.2	2.3	1.3	1.2	53.9	60.6	N/A	N/A	21.7	16.8
Kiuva	0.3	0.2	0.1	0.1	0.7	0.7	N/A	N/A	0.4	0.4
Qamea	0.2	0.3	0.0	0.1	0.0	0.3	N/A	N/A	0.0	0.0
Viwa	0.2	0.1	0.0	0.0	0.1	0.3	N/A	N/A	0.1	0.1
Exp.	0.0	0.0	0.0	0.0	0.1	0.0	N/A	N/A	0.0	0.1
Others	0.2	0.2	0.3	0.2	1.8	0.0	N/A	N/A	0.9	0.3

Appendix 14: Area planted in hectares as % of registered and cultivated areas

Mills	Hectares planted			Hectares planted as % of registered area			Hectares planted as % of cultivated area		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Lautoka	560.8	545.4	556.5	2.4	2.4	2.4	6.0	6.1	6.1
Rarawai	921.8	916.0	903.5	4.1	3.0	2.8	8.3	6.3	7.0
Labasa	1186.4	1099.2	1673.2	6.0	2.2	8.2	8.3	7.6	14.2
Penang	386.9	N/A	N/A	4.8	N/A	N/A	11.3	N/A	N/A
Total	3055.9	2568.6	3147.0	4.2	2.5	4.2	7.6	6.7	9.3

Appendix 15: Percentage of total area planted by different varieties over three years

		Lautoka		Rarawai		Labasa		Penang		All mills	
Year	Varieties	%	Area ha	%	Area ha	%	Area ha	%	Area ha	%	Area ha
2019	Ragnar	-	-	0.0	0.4	10.1	119.4	-	-	3.9	119.8
2020		0.2	0.9	-	-	9.3	101.7	-	-	4.0	102.6
2021		-	-	-	-	5.3	88.5			2.8	88.5
2019	Waya	-	-	0.3	2.9	1.5	17.9	-	-	-	-
2020		-	-	0.1	0.5	-	-	-	-	0.0	0.5
2021		-	-	0.1	1.2	-	-	-	-	0.2	5.2
2019	Mana	93.3	523.3	97.4	898.1	-	-	99.6	385.2	58.7	1806.6
2020		93.5	509.9	98.1	898.7	-	-	-	-	54.8	1408.6
2021		93.6	521.0	97.0	876.7	-	-	-	-	44.4	1397.7
2019	Galoa	-	-	0.0	0.4	6.2	73.5	-	-	2.4	73.9
2020		0.1	0.5	0.1	0.8	4.3	47.4	-	-	1.9	48.7
2021		0.0	0.2	-	-	6.0	100.3	-	-	3.2	100.5
2019	Vatu	-	-	-	-	3.0	36.0	-	-	1.2	36.0
2020		-	-	-	-	3.0	33.2	-	-	1.3	33.2
2021		-	-	0.6	5.7	4.1	68.7	-	-	2.4	74.4
2019	Mali	-	-	-	-	2.2	25.7	-	-	0.8	25.7
2020		-	-	-	-	3.3	36.3	-	-	1.4	36.3
2021		-	-	-	-	3.2	53.1	-	-	1.7	53.1
2019	Aiwa	0.2	0.9	0.2	1.9	0.1	0.8	-	-	0.1	3.6
2020		0.1	0.7	0.1	0.9	0.1	0.8	-	-	0.1	2.4
2021		0.3	1.5	0.3	3.0	0.1	1.5	-	-	0.2	6.0
2019	Beqa	-	-	-	-	-	-	-	-	-	-
2020		-	-	-	-	-	-	-	-	-	-
2021		-	-	-	-	-	-	-	-	-	-
2019	Kaba	1.0	5.8	1.0	8.9	0.1	1.3	-	-	0.5	16
2020		0.3	1.7	0.3	2.9	0.1	1.1	-	-	0.2	5.7
2021		0.6	3.2	0.6	5.1	0.3	4.3	-	-	0.4	12.6
2019	Naidiri	4.3	23.9	0.3	3.1	70.3	833.7	0.3	1.3	28.0	862.0
2020		3.0	16.2	0.7	6.8	66.4	730.1	-	-	29.3	753.1
2021		3.5	19.4	0.3	2.6	64.4	1077.4	-	-	34.9	1099.4
2019	Kiuva	-	-	-	-	0.6	7.2	-	-	0.2	7.2
2020		-	-	-	-	0.1	0.8	-	-	0.0	0.8
2021		-	-	0.3	3.0	0.3	5.7	-	-	0.3	8.7
2019	LF91-1925	-	-	0.9	2.9	4.0	47.4	-	-	1.6	50.3
2020		0.6	3.3	0.2	1.8	9.5	104.3	-	-	4.3	109.4
2021		0.4	2.4	-	-	10.8	181.4	-	-	5.8	183.8
2019	Qamea	0.2	1.4	0.3	2.5	1.7	19.6	0.1	0.4	0.8	23.9
2020		1.7	9.0	0.3	2.9	0.9	9.4	-	-	0.5	12.3
2021		1.2	6.5	-	-	0.3	4.2	-	-	0.1	4.2
2019	Experiment	-	-	-	-	-	-	-	-	1.4	43.4
2020		-	-	-	-	-	-	-	-	-	-
2021		-	-	0.2	1.7	-	-	-		0.1	1.7
2019	Others	-	-	-	-	-	-	-	-	-	-
2020		-	-	-	-	1.1	11.5	-	-	1.1	27.8
2021		0.0	0.6	-	-	-	-	-	-	0.6	19.4
Total											

Appendix 16: Percentage burnt cane of total tonnes crushed

Year	Lautoka		Rarawai		Labasa		Penang		Average	
	%	Total	%	Total	%	Total	%	Total	%	Total
1982	23.2	1507831	24.8	1100133	13.6	1140552	13.2	326348	18.7	4074864
1983	18.3	639823	18.4	561774	18.0	761454	12.0	239482	16.7	2202533
1984	25.1	1731580	8.2	1146140	12.9	1136737	10.0	382030	14.1	4396487
1985	28.6	947593	25.2	864264	22.4	934166	16.2	296418	23.1	3042441
1986	29.5	1526648	15.1	1204661	15.1	1017372	11.3	360284	17.8	4108965
1987	23.8	1090111	34.2	685994	20.9	877652	19.0	306706	24.5	2960463
1988	37.7	1116916	15.2	742128	16.0	1034788	19.2	291440	22.0	3185272
1989	20.6	1537337	13.6	1250977	12.7	974201	10.0	336418	14.2	4098933
1990	24.3	1347531	30.4	1148070	13.7	1171817	14.6	348110	20.8	4015528
1991	42.5	1112957	46.4	961961	32.0	1029223	27.6	276261	37.1	3380402
1992	52.5	1109778	52.1	962936	44.4	1162108	41.1	297818	47.5	3532640
1993	35.6	1341537	33.4	1013627	29.2	1124357	19.4	224383	29.4	3703904
1994	39.0	1337977	36.0	1104246	27.0	1298285	19.8	323743	30.5	4064251
1995	43.4	1515880	42.5	1044098	37.6	1216290	28.7	333790	38.1	4110058
1996	54.8	1561446	48.1	1229978	39.9	1238443	33.2	349348	44.0	4379215
1997	50.7	1160879	49.1	906495	33.5	910137	34.8	302095	42.0	3279606
1998	67.0	625763	67.7	406811	54.5	832622	44.6	232825	58.5	2098021
1999	41.6	1433143	39.8	992968	17.0	1192735	26.3	339292	32.4	3958138
2000	56.1	1301752	54.6	1251282	37.8	911370	49.0	322475	50.6	3786879
2001	56.7	906743	50.3	844411	18.9	845444	49.5	208183	42.9	2804781
2002	46.8	1137123	41.8	1071579	21.4	938450	33.9	275431	37.1	3422583
2003	40.1	890499	32.8	836728	29.3	638851	22.0	243602	33.4	2609680
2004	42.7	1032127	39.5	878121	18.3	848533	35.5	242408	34.3	3001189
2005	44.4	890779	38.4	761704	25.0	910663	34.9	225594	35.7	2788740
2006	60.5	1051097	58.5	1039474	34.4	871031	46.5	264498	51.7	3226100
2007	39.0	741231	40.5	738478	39.1	769138	53.5	229844	40.8	2478691
2008	50.9	770569	53.6	732165	49.1	604314	48.5	214572	51.1	2321620
2009	43.5	726046	33.3	659351	18.6	679584	28.8	181650	31.8	2246631
2010	30.4	527663	33.6	522114	18.6	554575	16.3	175701	25.0	1780053
2011	28.5	652333	28.2	663774	17.9	570468	26.6	208860	25.3	2095435
2012	43.8	481483	44.7	508638	18.7	413285	28.3	143568	35.9	1546974
2013	77.8	726046	31.9	347417	14.2	546156	27.0	159720	37.7	1779339
2014	50.7	520264	49.9	596350	22.0	544353	28.0	171214	39.9	1832181
2015	47.0	244680	48.5	238167	27.7	183840	31.0	52688	39.0	719375
2016	75.7	281824	89.7	242008	81.6	220034	50.2	85336	74.3	829202
2017	24.9	214336	20.9	170472	30.5	206433	34.3	40552	34.3	40552
2018	64.2	293513	57.8	365936	28.9	274535	60.9	85262	55.6	943378
2019	58.0	274535	61.0	319637	34.0	223388	47.0	67498	49.0	885058
2020	61.6	257527	60.0	383959	35.1	235816	N/A	N/A	50.7	877301
2021	53.3	237191	64.6	395527	46.5	168355	N/A	N/A	56.5	801073

7. FINANCIAL REPORT

Sugar Research Institute of Fiji
Financial Statements
For the Year Ended 31 December 2021

Building a better working world

SUGAR RESEARCH INSTITUTE OF FIJI

FINANCIAL STATEMENTS
FOR THE YEAR ENDED 31 DECEMBER 2021

Contents

SUGAR RESEARCH INSTITUTE OF FIJI
DIRECTOR'S REPORT
FOR THE YEAR ENDED 31 DECEMBER 2021

In accordance with a resolution of the Board of Directors, the Directors herewith submit the statement of financial position of Sugar Research Institute of Fiji ("the Institute") as at 31 December 2021, the related statement of activities and statement of cash flows for the year ended on that date and report as follows:

Board Directors

The Board Directors in office during the year end at the date of this report are:

- Mr. Prakash Chand
- Mr. Graham Clark – (Expired – February 2021)
- Mr. Vimal Dutt
- Ms. Reshmi Kumari
- Professor Ravendra Naidu
- Mr. Ashween Nischal Ram
- Mr. Raj Sharma – (Expired – June 2021)
- Mr. Bhan Pratap Singh – (Effective – March 2021)

State of affairs

In the opinion of the Board the accompanying statement of financial position gives a true and fair view of the state of affairs of the Institute as at 31 December 2021 and the accompanying statement of activities and other comprehensive income and the statement of cash flows give a true and fair view of the results, and cashflows of the Institute for the year then ended.

Principal activity

The functions of the Institute are outlined under the Sugar Research Institute of Fiji Act No 14 of 2005, which includes promoting by means of research and investigation, the technical advancement, efficiency and productivity of the sugar industry, and to provide its functions, powers, administration and finance and for related matters.

Current assets

The Directors took reasonable steps before the Institute's financial statements were made out to ascertain that the current assets of the Institute were shown in the accounting records at a value equal to or below the value that would be expected to be realised in the ordinary course of business.

As at the date of this report, the Director are not aware of any circumstances, which would render the values attributed to current assets in the Institute's financial statements misleading.

Receivables

The Directors took reasonable steps before the Institute's financials statements were made out to ascertain that all known bad debts were written off and adequate allowance was made for impairment loss.

At the date of this report, the Directors are not aware of any circumstances which would render the above assessment inadequate extent.

Related party transactions

All related party transactions have been adequately recorded in the financial statements.

Unusual transactions

Apart from these matters and other matters specifically referred to in the financial statements, in the opinion of the Director, the results of the operations of the Institute during the financial year were not substantially affected by any item, transaction or event of a material unusual nature, nor has there arisen between the end of the financial year and the date of this report any item, transaction or event of a material unusual nature likely, in the opinion of the Directors, to affect substantially the results of the operations of the Institute in the current financial year, other than those reflected in the financial statements.

Going concern

The Institute's ability to continue to operate on a going concern basis is dependent on it receiving ongoing financial support from Government of Fiji, Stakeholders in the Sugar Industry and other Donor Agencies. The Board Members consider the application of the going concern principle to be appropriate in the preparation of these financial statements as the Institute will continue to receive ongoing support from the Government and the Stakeholders in the Sugar Industry, which will enable the Institute to meet its funding requirements for operations and to meet its obligations as and when they fall due. The Institute receives funds from the Government, Fiji Sugar Corporation, and Growers through Fiji Sugar Corporation.

Further, the Institute incurred positive cash flows from operations of $496,708 during the year ended 31 December 2021 and positive working capital of $1,063,865 after reclassification of certain related party receivables to non-current assets.

Accordingly, these financial statements have been prepared on going concern basis and do not include any adjustments relating to the recoverability and classification of recorded asset amounts or to the amounts and classification of labilities that may be necessary should the necessary should the Institute be unable to continue as a going concern.

Events subsequent to balance date

No matters or circumstances have arise since the end of the financial year which significantly affected or may significantly affect the operations of the Company, the results of those operations, or the state of affairs of the Company in future financial years.

Impact of COVID-19 pandemic on the Institute

The coronavirus disease (COVID-19) outbreak has developed rapidly, bringing a significant health impact globally. Measures taken to contain the virus are already having a significant impact on global markets and economic activity. Fiji is also feeling the impact with business disruption and levels of activity already reducing in several market sectors.

The Institution has remained operational since this declaration and continues to engage in its principal activities. We have not seen a significant impact on our business to date. Directors and management are carefully considering the impact of the COVID-19 outbreak on the Institution and assessing future operational options. The future financial impacts, however, cannot be reasonably estimated at this time, as they will be largely the product of matters the Company cannot control.

Directors and management believe the Institution have sufficient financial resources together with arrangements with their customers and suppliers at this time to be able to successfully manage their business risks despite the current uncertain economic outlook due to the COVID-19 outbreak.

For and on behalf of the Board of Directors in accordance with a resolution of the Directors this 4th day of April 2022.

21 Enamanu Road
Nadi Fiji
PO Box 10812 Nadi Airport Fiji

Tel: +679 666 2433
Fax: +679 666 7282
ey.com

Building a better working world

Independent Auditor's Report

To the Board Members of Sugar Research Institute of Fiji

Report on the Audit of the Financial Statements

Opinion

We have audited the financial statements of Sugar Research Institute of Fiji ("the Institute"), which comprise the statement of financial position as at 31 December 2021, the statement of activities and the statement of cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, the accompanying financial statements give a true and fair view of the financial position of the Institute as at 31 December 2021, and of its financial performance and its cash flows for the year then ended in accordance with International Financial Reporting Standard for Small and Medium-sized Entities ("IFRS for SMEs").

Basis for Opinion

We conducted our audit in accordance with International Standards on Auditing (ISA). Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Institute in accordance with the International Ethics Standards Board for Accountant's Code of Ethics for Professional Accountants (IESBA Code) together with the ethical requirements that are relevant to our audit of the financial statements in Fiji and we have fulfilled our other ethical responsibilities in accordance with these requirements and the IESBA Code. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other information

The Directors are responsible for the other information. The other information comprises the Directors' report but does not include the financial statements and the auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information identified above and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained during the audit, or otherwise appears to be materially misstated. If, based upon the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of Management and those charged with Governance for the Financial Statements

The Management and Directors are responsible for the preparation and fair presentation of the financial statements in accordance with International Financial Reporting Standards for Small and Medium Enterprises, and for such internal control as the management and Directors determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management and the Directors are responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management and the Directors either intend to liquidate the Institute or to cease operations, or have no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Institute's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISA will always detect a material misstatement when it exists. Misstatements can arise from fraud and error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with ISA, we exercise professional judgement and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of the management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Institute's ability to continue as a going concern. If we conclude that material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures, are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Institute to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

Report on Other Legal and Regulatory Requirements

We have obtained all the information and explanations which, to the best of our knowledge and belief, were necessary for the purpose of the audit.

Building a better working world

Independent Auditor's Report (continued)

Report on Other Legal and Regulatory Requirements (continued)

In our opinion:

i) proper books of account have been kept by the Institute, sufficient to enable financial statements to be prepared, so far as it appears from our examination of those books; and

ii) to the best of our information and according to the information and explanations given to us the financial statements give the information required by the Sugar Research Institute of Fiji Act 2005, in the manner so required.

Ernst & Young
Chartered Accountants

Shaneel Nandan
Partner
Nadi, Fiji
4th April 2022

SUGAR RESEARCH INSTITUTE OF FIJI
STATEMENT OF ACTIVITIES
FOR THE YEAR ENDED 31 DECEMBER 2021

	Notes	2021	2020
		$	$
Contributions and grants	2.1	2,142,245	2,682,198
Estate income		283,249	183,551
Other income	2.2	458,636	55,088
Total income		2,884,130	2,920,837
Cost of operations	2.3	(2,073,286)	(1,638,407)
Administrative expenses	2.4	(825,073)	(1,286,780)
Surplus from operations		(14,229)	(4,350)
Finance income	2.6	14,451	4,735
Finance expense		(222)	(385)
Surplus before tax		-	-
Income tax expense		-	-
Balance at the beginning of the year		-	-
Surplus for the year		-	-

The accompanying notes form an integral part of the statement of activities.

SUGAR RESEARCH INSTITUTE OF FIJI
STATEMENT OF FINANCIAL POSITION
AS AT 31 DECEMBER 2021

	Notes	2021	2020
Assets		$	$
Current assets			
Cash and cash equivalents	3	1,090,664	764,453
Receivables and prepayments	4	66,375	35,473
Receivables from related parties	10(b)	1,195,699	1,400,688
		2,352,738	2,200,614
Non-current assets			
Property, plant and equipment	5	5,597,847	5,936,684
Intangible assets	6	18,048	18,437
Receivables from related parties	10(b)	7,851,728	6,225,255
		13,467,623	12,180,376
Total assets		15,820,361	14,380,990
Current liabilities			
Trade and other payables	7	129,746	326,709
Deferred income	8	1,090,664	764,453
Employee benefits	9	68,463	31,896
		1,288,873	1,123,058
Non-current liabilities			
Deferred income	8	12,265,803	10,992,247
Payable to related parties	10(c)	2,265,685	2,265,685
		14,531,488	13,257,932
Total liabilities		15,820,361	14,380,990
Net assets		-	-
Funds employed			
Funds employed		-	-
Total funds employed		-	-

Signed on behalf of the Board.

The accompanying notes form an integral part of the statement of financial position.

SUGAR RESEARCH INSTITUTE OF FIJI
STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED 31 DECEMBER 2021

	Note	2021	2020
		$	$
Operating Activities			
Receipts from stakeholders and donors		3,062,413	1,909,887
Payments to suppliers and employees		(2,579,934)	(2,084,206)
Interest and bank charges paid		(222)	(385)
Interest received		14,451	4,735
Net cash from/(used in) operating activities		496,708	(169,969)
Investing Activities			
Acquisition of property, plant and equipment		(170,497)	(429,000)
Proceeds from disposal of property, plant and equipment		-	41,881
Net cash flows (used in) investing activities		(170,497)	(387,119)
Financing Activities			
Proceeds from related party		-	900,000
Net cash flows provided by financing activities		-	900,000
Net increase in cash and cash equivalents		326,211	342,912
Cash and cash equivalents at 1 January		764,453	421,541
Cash and cash equivalent at 31 December	3	1,090,664	764,453

The accompanying notes form an integral part of the statement of cash flows.

1. Reporting entity

The financial statements of Sugar Research Institute of Fiji for the year ended 31 December 2021 were authorised for issue in accordance with a resolution of the Directors on 4th April 2022. Sugar Research Institute of Fiji ("the Institute") is a body corporate domiciled in Fiji, established under the Sugar Research Institute of Fiji Act 2005. The address of the Institute's registered office is Drasa, Lautoka.

The principal activity of the Institute is described in Note 15.

1.2 Basis of preparation of financial statements

(a) The financial statements of the Institute have been prepared in accordance with International Financial Reporting Standard for Small and Medium-sized Entities (IFRS for SMEs) issued by the International Accounting Standards Board. The financial statements have been prepared on a historical cost basis except where stated.

(b) Going concern

The Institute's ability to continue to operate on a going concern basis is dependent on it receiving ongoing financial support from Government of Fiji, Stakeholders in the Sugar Industry and other Donor Agencies. The Board Members consider the application of the going concern principle to be appropriate in the preparation of these financial statements as the Institute will continue to receive ongoing support from the Government and the Stakeholders in the Sugar Industry, which will enable the Institute to meet its funding requirements for operations and to meet its obligations as and when they fall due. The Institute receives funds from the Government, Fiji Sugar Corporation, and Growers through Fiji Sugar Corporation.

Further, the Institute incurred positive cash flows from operations of $496,708 during the year ended 31 December 2021 and positive working capital of $1,063,865 after reclassification of certain related party receivables to non-current assets.

Accordingly, these financial statements have been prepared on going concern basis and do not include any adjustments relating to the recoverability and classification of recorded asset amounts or to the amounts and classification of labilities that may be necessary should the necessary should the Institute be unable to continue as a going concern.

1.3 Summary of significant accounting policies

(a) Foreign currency translation

The Institute's financial statements are presented in Fijian dollar, which is also the Institute's functional currency.

Transactions in foreign currencies are initially recorded by the Institute at the functional currency rates prevailing the date of transaction.

Monetary assets and liabilities denominated in foreign currencies are retranslated at the functional currency of exchange ruling at the reporting date.

Non-monetary items that are measured in terms of historical cost in a foreign currency are translated using the currency rates as at the dates of the initial transactions. Non-monetary items measured at fair value in a foreign currency are translated using the exchange rates at the date when the fair value is measured.

(b) Revenue recognition

Revenue is recognized to the extend that it is probable that the economic benefit will flow to the entity and the revenue can be reliably measured in accordance with realisation principle, regardless of when the payment is being made. Revenue is measured at the fair value of the consideration received, excluding discounts, rebates, and consumption tax. The following specific criteria must also be met before revenue is recognised:

Contributions and grants

Grants are recognised in the statement of financial position initially as deferred income when there is reasonable assurance that it will be received and that the Institute will comply with the conditions associated with the grant.

1.3 Summary of significant accounting policies (continued)

(b) Revenue recognition (continued)

It is the recognised in the profit or loss as grant income on a systematic basis as the Institute recognises expenses be achieving the relevant conditions of the grant. Grants that relate to the acquisition of an asset are recognised in profit or loss as the asset is depreciated or amortised. The Institute chooses to present grant income on a gross method that is, recognising entire grant income and than offsetting against expense.

Other income

Outsource income and other revenue from operating activities are recognised in profit or loss on an accrual basis.

(c) Income tax

The Institute is exempt from income tax by virtue of Part 7(2) of the Income Tax (Exempt Income) Regulations 2016.

(d) Financing income

Finance income comprises interest received on the term deposits held. Interest income is recognised as it accrues in profit or loss.

(e) Property, plant and equipment

(i) Recognition and measurement

Items of property, plant and equipment is stated at cost, net of accumulated depreciation and/or accumulated impairment losses, if any.

Cost includes expenditure that is directly attributable to the acquisition of the asset. When parts of an item of property, plant and equipment have different useful lives, they are accounted for as separate items (major components) of property, plant and equipment.

Any gain or loss on disposal of an item of property, plant and equipment is determined by comparing the proceeds from disposal with carrying amount of the property, plant and equipment, and is recognised net within other income/ other operating expenses in profit or loss.

(ii) Subsequent costs

The cost of replacing part of an item of property, plant and equipment is recognised in the carrying amount of the item if it is probable that the future economic benefit embodied within the part will flow to the Institute an its cost can be measured reliably. The cost of the day-to-day servicing of property, plant and equipment are recognised in profit or loss as incurred.

(iii) Depreciation

Depreciation is calculated to write off the costs of the items of property, plant and equipment less their estimated residual values using the straight-line method over their estimated useful lives, and is recognised in profit and loss. The estimated useful lives of property, plant and equipment for current and comparative periods as follows:

The depreciation rates for the current and comparative year is as follows:

Asset	Rate
• Fixtures and fittings	10 years
• Plant and equipment	6.67-10 years
• Motor vehicles	6.67 years
• Land and building	80 years
• Computers	5 years

Depreciation methods, useful lives and residual values are reassessed at reporting date and adjusted if appropriate.

1.3 Summary of significant accounting policies (continued)

(f) Intangible assets

(i) Recognition and measurement

Intangible assets that are acquired by the Institute have a finite useful life and are measured at cost less accumulated amortisation and impairment losses.

(ii) Amortisation

Intangible assets are amortised on a straight-line basis in profit or loss over their estimated useful lives, from the date that they are available for use.

The estimated useful life for the current and comparative years is as follows:

- Software 4 years

(g) Financial instruments

(i) Non- derivative financial asset

The Institute generally recognises loans and receivable on the date that they are originated. All other financial assets (including assets designed as at fair value through profit or loss) are recognised initially on the trade date, which is the date that the Institute becomes a third party to the contractual provisions of the instrument.

The Institute derecognises a financial asset when the contractual rights to the cash flows from the asset expire, or it transfers the rights to receive the contractual cash flows on the financial asset in a transaction in which substantially all the risks and rewards of the ownership of the financial asset are transferred. Any interest in the transferred financial asset that is created or retained by the Institute is recognised as a separate asset or liability.

Financial assets and liabilities are offset and the net amount presented in the statement of financial position when and only when the Institute has a legal right to offset the amounts and intends either to offset the amounts and settle on a net basis or to realise the asset and settle the liability simultaneously.

The Institute classifies non- derivative financial assets into the following categories: financial assets at fair value through profit or loss, held to maturity financial assets and loans receivable.

Receivables

Receivables are stated at cost less allowances for doubtful debts. The collectability of debt is assessed at balance date and specific allowance is made for any impairment. Bad debts are written off in the period they are identified. Receivables comprise receivables from related party, staff advances and deposits.

Cash and cash equivalents

Cash and short-term deposits in the statement of financial position comprise cash at bank and cash on hand. For the purpose of statement of cash flows, cash and cash equivalents consist of cash and short-term deposits as defined above, net of outstanding bank overdrafts.

(ii) Non- derivative financial liability

Financial liabilities are recognised initially on the trade date at which the Institute becomes a party to the contractual provisions of the instrument.

The Institute derecognises a financial liability when its contractual obligations are discharged or cancelled or expire.

The Institute classifies non-derivative financial liabilities into the other financial liabilities category. Such financial liabilities are recognised initially at fair value plus any directly attributable transaction costs. Subsequent to initial recognition, these financial liabilities are measured at amortised cost using the effective interest method.

Other financial liabilities comprise of payable and other accruals.

1.3 Summary of significant accounting policies (continued)

(h) Impairment

The carrying amount of assets are renewed at each balance date , to determine whether there is an indication of impairment. If any such indication exists, the assets recoverable amounts are estimated at each balance date. An impairment loss is recognised when ever the carrying amount of an asset or its cash generating amount exceeds its recoverable amount. All impairment losses are recognised in profit or loss.

An impairment loss is reversed if more has been charged in the estimates used to determine the recoverable amount and is reversed only to the extent that the asset's carrying amount that would have been determined, net of depreciation or amortisation, if no impairment loss has been recognised.

(i) Employee benefits

(i) Superannuation

Obligations for contributions to a defined contribution plan are recognised as an expense in profit or loss when they are due.

(ii) Employee entitlements

Liability for annual leave is recognised and measured as the amount unpaid at reporting date at current pay rates in respect of employee services up to that date.

(ii) Short-term benefits

Short-term employee benefit obligations are measured on an undiscounted basis and are expensed in profit or loss as the related service provided.

A liability is recognised for the amount to be paid under short-term benefit if the Institute has a present or constructive obligation to pay this amount as a result of past services provided by the employee and the obligations can be measured reliably.

(j) Receivable from related parties

The amounts receivable from related parties are recognised when there is a contractual receivable or a right to receive.

(k) Employee benefits

Liabilities for wages and salaries expected to be settled within 12 months of the reporting date are recognised in other payables on the statement of financial position.

(l) Deferred income

The Institute's deferred income comprises of cash received or receivable from the stakeholders and donor agencies. Each grant received or receivable has its specific conditions that the Institute needs to comply with. The related grant being credited to deferred income as the liability and released to profit or loss over the expected useful economic life.

(m) Unexpended project funds

Unutilised donor monies at year end used for cash grant which is received for utilization in more than one financial period is treated as unexpended project funds.

(n) Leases

Leases are classified as operating leases. Rental payable under operating leases are charged to the income statement on a straight-line basis over the term of the relevant lease.

(o) Value Added Tax (VAT)

The Institute complies with VAT under the Second Schedule of the VAT Decree 1991.

(p) Comparative figures

When necessary, comparative figures have been adjusted to conform to changes in current presentation year.

	2021	2020
2. Revenue and expenses	$	$
2.1 Contributions and grants		
Contribution from the Fiji Government	679,323	698,965
European Union	104,276	585,303
Fiji Sugar Corporation (FSC)	679,323	698,965
Sugar Cane Growers	679,323	698,965
	2,142,245	2,682,198
2.2 Other income	$	$
Gain on sale of motor vehicles	-	41,881
Outsource income	31,837	13,207
EU Income	426,799	-
	458,636	55,088
2.3 Cost of operations	$	$
Advertising	3,085	2,876
Amortisation	6,187	4,609
Bank charges	3,822	2,251
Consultancy fees	8,810	7,073
Depreciation	465,009	450,485
Electricity	50,049	52,580
EU cost	-	211,223
Communication expenses	36,812	34,289
Material costs	122,312	98,904
Motor vehicle running expenses	83,796	129,524
Repairs and maintenances	51,984	20,289
Subcontract expenses	173,423	162,778
Wages and salaries	1,067,998	461,526
	2,073,286	1,638,407
2.4 Administrative expenses	$	$
Audit fees	9,000	9,000
Audit fees - EU Project	-	1,231
Audit Fees - Internal	4,594	-
Audit fees - Deferred reconciliation	2,550	-
Accommodation and meals	23,051	1,772
Annual leave expense	36,567	-
Board allowance	-	35,807
Cleaning and landscaping	7,415	8,018
Office security	115,660	116,682
Office supplies	9,181	7,091
Director's fees	47,976	52,090
Doubtful debts	14,051	-
Fiji National Provident Fund contributions	68,020	79,300
Freight	18,576	9,911
Fringe benefit tax	9,382	9,562
General expenses	51,889	44,513
ICT consumables	10,427	7,733

2. Revenue and expenses (continued)	2021	2020
2.4 Administrative expenses (continued)	$	$
Insurance	34,192	66,755
Legal fees	13,479	2,125
Land rent	8,809	8,160
Loss on disposal	4,215	-
Medical expense	5,209	5,969
Media and publication	-	13,605
Office rent	8,400	8,400
Repair and maintenance	200	10,365
Rent expense	24,712	20,250
Staff expenses	14,119	24,122
Stationery	10,710	5,882
Training and Productivity Authority of Fiji	13,681	26,379
Travel	6,887	9,651
Utilities	14,995	10,119
Wages and salaries	237,126	692,288
	825,073	1,286,780

2.5 Personnel expenses	$	$
Fiji National Provident Fund (FNPF) contributions	68,020	79,300
Training and Productivity Authority of Fiji	13,681	26,379
Key management compensation - short term benefit	244,838	98,980
Wages and salaries	1,060,286	1,054,834
	1,386,825	1,259,493

2.6 Finance income	$	$
Interest received	14,451	4,735

3. Cash and cash equivalents	$	$
Cash at bank	1,090,164	763,953
Cash on hand	500	500
Cash and cash equivalents in the cash flow statements	1,090,664	764,453

Cash and cash equivalents consist of cash on hand and balances with banks. Cash and cash equivalents included in the statement of cash flows comprise of the following statement of financial positions amounts:

	$	$
Cash at bank and on hand	1,090,664	764,453
	1,090,664	764,453

4. Receivables	$	$
Trade receivable	8,139	21,504
Deposits	6,434	5,884
Prepayments	51,802	8,085
	66,375	35,473

5. Property, plant and equipment

Cost	Land and Buildings	Fixtures and Fittings	Plant and Equipment	Motor Vehicles	Computers	Work in progress	Total
As at 1 January 2020	4,244,576	180,778	2,951,486	1,717,660	447,044	-	9,541,544
Additions	-	14,261	2,429	334,404	9,517	68,389	429,000
Disposals	-	(5,227)	(74,385)	(189,066)	(192,418)	-	(461,096)
At 31 December 2020	4,244,576	189,812	2,879,530	1,862,998	264,143	68,389	9,509,448
Additions	-	5,068	30,435	112,661	16,535	-	164,699
Transfers	-	-	39,017	-	29,372	(68,389)	-
Disposals	-	-	-	(68,807)	-	-	(68,807)
At 31 December 2021	4,244,576	194,880	2,948,982	1,906,852	310,050	-	9,605,340
Accumulated depreciation							
As at 1 January 2020	260,213	81,318	1,693,212	1,177,088	371,631	-	3,583,462
Depreciation charge for the year	49,220	15,280	238,605	121,011	26,282	-	450,398
Disposals	-	(5,227)	(74,385)	(189,066)	(192,418)	-	(461,096)
At 31 December 2020	309,433	91,371	1,857,432	1,109,033	205,495	-	3,572,764
Depreciation charge for the year	49,220	15,394	224,234	145,981	30,180	-	465,009
Disposals	-	-	-	(30,280)	-	-	(30,280)
At 31 December 2021	358,653	106,765	2,081,666	1,224,734	235,675	-	4,007,493
Net book value							
At 31 December 2021	3,885,923	88,115	867,316	682,118	74,375	-	5,597,847
At 31 December 2020	3,935,143	98,441	1,022,098	753,965	58,648	68,389	5,936,684

6. Intangible assets

	Software	Total
Cost	$	$
At 31 December 2020	28,841	28,841
Additions	5,798	5,798
At 31 December 2021	34,639	34,639
Accumulated depreciation		
As at 1 January 2020	5,795	5,795
Amortisation	4,609	4,609
At 31 December 2020	10,404	10,404
Amortisation	6,187	6,187
At 31 December 2021	16,591	16,591
Net book value		
At 31 December 2021	18,048	18,048
At 31 December 2020	18,437	18,437

	2021	2020
7. Trade and other payables	$	$
Trade creditors	23,646	22,770
Payables and accruals	89,852	289,547
VAT payable	16,248	14,392
	129,746	326,709

8. Deferred income

The Institute's deferred income comprises cash received or receivable from the stakeholders and donor agencies. Each grant income received or receivable has its specific conditions that the Institute needs to comply with. The movement in deferred income is as follows:

	$	$
Balance at the beginning of the year	11,756,700	12,120,683
Funds received or receivable during the year	4,498,474	2,561,590
Utilised during the year	(2,898,707)	(2,925,573)
Balance at 31 December	13,356,467	11,756,700
This is comprised as follows:	$	$
Fiji Government	116,923	101,243
Fiji Sugar Corporation (FSC)	6,951,728	6,725,943
Sugar Cane Growers	3,895,700	2,700,000
European Union grant	1,969,411	1,829,359
Estate income	174,481	199,212
Other income	248,225	200,943
Total	13,356,467	11,756,700

8. Deferred income (continued)

	2021	2020
Disclosed as:	$	$
Current	1,090,664	764,453
Non-current	12,265,803	10,992,247
Total	13,356,467	11,756,700

9. Employee benefits	$	$
Balance at 1 January	31,896	41,697
Provision created/(utilised) during the year	36,567	(9,801)
Balance at 31 December	68,463	31,896

10. Related parties

Related parties of the Institute include key stakeholders in the Fiji Sugar Industry, namely, the Government of Fiji, Fiji Sugar Corporation Limited, South Pacific Fertilizers Limited, Sugar Cane Growers Fund and Sugar Cane Growers Council.

Transactions with these parties and outstanding balances at year end are disclosed below:

(a) Board members

The names of the Directors at any time during the financial year as follows:

- Mr. Prakash Chand
- Mr. Graham Clark – (Expired – February 2021)
- Mr. Vimal Dutt
- Ms. Reshmi Kumari
- Professor Ravendra Naidu
- Mr. Ashween Nischal Ram
- Mr. Raj Sharma – (Expired – June 2021)
- Mr. Bhan Pratap Singh – (Effective – March 2021)

(b) Amounts receivable from related parties	$	$
Fiji Sugar Corporation Limited- grant income	6,930,870	7,605,085
- other income	20,858	20,858
Allowance for uncollectability - Fiji Sugar Corporation Limited	-	(900,000)
Sugar Cane Growers	3,895,700	2,700,000
Allowance for uncollectability - Sugar Cane Growers	(1,800,000)	(1,800,000)
	9,047,428	7,625,943

Disclosed as:	$	$
Current	1,195,699	1,400,688
Non-current	7,851,728	6,225,255
Total	9,047,428	7,625,943

Reconciliation of Allowance for Uncollectability	$	$
Balance at the beginning of the year	1,800,000	1,800,000
Provision created during the year	-	-
Balance at the end of the year	1,800,000	1,800,000

Receivables from related parties are interest free and receivables as and when required.

10. Related parties (continued)

	2021	2020
(c) Amounts payable to related parties	$	$
Fiji Sugar Corporation Limited	2,265,685	2,265,685

(d) Outstanding debts owed from Fiji Sugar Corporation Limited

Net receivable from Fiji Sugar Corporation Limited ("FSC") amounts to $5,565,185 as at 31 December 2021. On 26 February 2019, a Deed of payment was signed between the Institute and FSC. FSC agreed and acknowledged that it owed a sum amounting to $4,009,314 as at 31 October 2018 to the Institute which was FSC's contribution towards SRIF's operations as per Section 11(2) of the Sugar Research Institute Act 2005.

	$	$
Balance at the beginning of the year	4,439,400	4,734,314
Contributions during the year- receivable	1,195,699	900,000
Payments made in 2021	(969,914)	(1,194,914)
Balance at the end of the year	4,665,185	4,439,400

The payment terms were agreed as follow:

(i) The amount of $250,000 will be paid by FSC in 2019, with 2 equal instalments of $125,000 each payable on 30 August and 31 December respectively.

(ii) The remaining balance of $3,759,314 will be payable by FSC over the next 4 years (2020-2023) in 8 equal instalments of $469,914 payable on 30 August and 31 December each year.

(iii) the repayments will be at zero interest rate.

(iv) Monthly payment of $20,000 would be paid by FSC for Growers' contribution to SRIF for 2018 season.

(e) Transactions with related parties	$	$
Deferred income		
Grant income - Fiji Sugar Corporation Limited	903,360	1,100,800
Grant income - Fiji Government	625,362	640,974
Grant income - Sugar Cane Growers	825,189	825,688
Estate income- Fiji Sugar Corporation Limited	258,519	221,868
	2,612,430	2,789,330

(f) Key management personnel

Key management personnel include the Chief Executive Officer, Deputy Chief Executive Officer and Chief Financial Officer of the Institute.

Transactions with the key management personnel are no favourable than those available, or which might be reasonably be expected to be available, on similar transactions to third parties on an arm's length.

Key management compensation is disclosed under Note 2.5.

11. Commitments and contingencies

(a) Operating lease commitments	2021	2020
Future commitments in respect of operating lease are as follows	$	$
Within one year	8,495	8,495
Later than one year and not later than five years	42,477	42,477
Later than 5 years	580,852	589,347
	631,824	640,319

11. Commitments and contingencies (continued)

(b)	Contingent liability	-	-
(c)	Capital expenditure commitments	-	-
(d)	Finance lease commitments	-	-

12. Subsequent events

No matters or circumstances have arise since the end of the financial year which significantly affected or may significantly affect the operations of the Company, the results of those operations, or the state of affairs of the Company in future financial years.

13. Impact of COVID-19 pandemic on the Institute

The coronavirus disease (COVID-19) outbreak has developed rapidly, bringing a significant health impact globally. Measures taken to contain the virus are already having a significant impact on global markets and economic activity. Fiji is also feeling the impact with business disruption and levels of activity already reducing in several market sectors.

The Institution has remained operational since this declaration and continues to engage in its principal activities. We have not seen a significant impact on our business to date. Directors and management are carefully considering the impact of the COVID-19 outbreak on the Institution and assessing future operational options. The future financial impacts, however, cannot be reasonably estimated at this time, as they will be largely the product of matters the Company cannot control.

Directors and management believe the Institution have sufficient financial resources together with arrangements with their customers and suppliers at this time to be able to successfully manage their business risks despite the current uncertain economic outlook due to the COVID-19 outbreak.

14. Segment Information

Industry segment

The Institute operates predominantly in the sugar industry.

Geographical segment

The Institute operates predominantly in Fiji and is therefore one geographical area for reporting purposes.

15. Principal business activity

The functions of the Institute are outlined under the Sugar Research Institute of Fiji Act No 14 of 2005, which includes promoting by means of research and investigation, the technical advancement, efficiency and productivity of the sugar industry, and to provide its functions, powers, administration and finance and for related matters.

Number of employees

As at balance date, the Institute employed a total of 83 employees (2020: 79).

ACKNOWLEDGEMENT

SRIF sincerely thanks the following for their funding, constant support and contributions towards the growth and development of the institute which enabled sustenance in research and extension programmes of SRIF.

- Government, Republic of Fiji
- Ministry of Sugar Industries (MoSI)
- Ministry of Finance
- SRIF Board
- Fiji Sugar Corporation (FSC)
- Sugarcane Growers Council (SCGC)
- Sugarcane Growers Fund (SCGF)
- Sugar Industry Tribunal (SIT)