2020 Annual Report

Sugar Research Institute of Fiji

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PARLIAMENT OF FIJI
PARLIAMENTARY PAPER NO. 50 OF 2021

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Board Director

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Dr. Sanjay Anand – Former Board Director (Term expired – December 2020)

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Committee Member

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Dr. Sanjay Anand – Former Board Director (Term expired – December 2020)

INSTITUTIONAL INFORMATION

About Us

The Sugar Research Institute of Fiji is an organization that carries out research work for the Sugar Industry in Fiji. Established as an experiment station in 1904 and later became a research institution, operating independently since 2006.

Key Research Areas

The Sugar Research Institute of Fiji is an organization that was established in 2006 to carry out research work for the Sugar Industry in Fiji. 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 seedcane.
- ✓ Conduct donor financed projects for the benefit of the farmers.

Departments

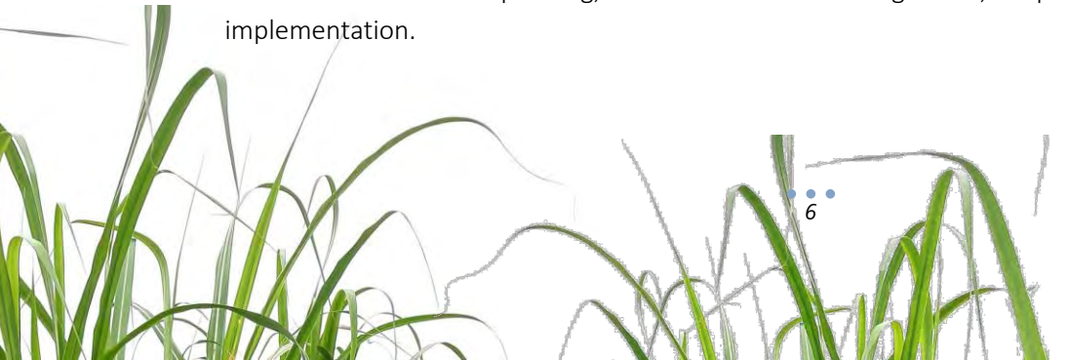
Crop Improvement - Department of Crop Improvement is responsible for breeding new varieties of sugarcane, maintenance of sugarcane germplasm, early stage trials, advance stage trials and Large Mill Trials.

Crop Management - Department of Crop Management is responsible for testing soil, leaf for fertilizer recommendation as well as testing sugarcane for biochemical attributes such as sugar content, fiber, etc.

Crop Protection - Department of Crop Protection is responsible for management of pest & diseases in the sugar industry as well as screening for pest & disease resistance on new sugarcane varieties.

Technology Transfer - Department of Technology Transfer is responsible for transferring research findings to farmers in order to continuously improve sugarcane farming in Fiji as a business.

Finance & Human Resource - Department of Finance & HR is responsible for managing day to day activities on financial spending, stakeholder fund management, employee management and OHS implementation.



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.

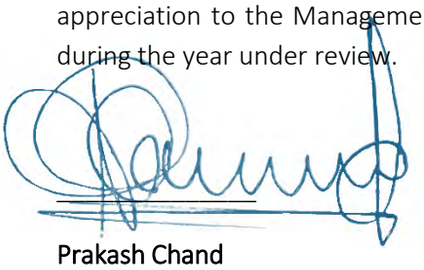
CHAIRMAN`S REPORT

On behalf of the Board of Directors, I am pleased to present the Annual Report and Consolidated Financial Statements of Sugar Research Institute of Fiji for the financial year ended 31 December 2020. FY2020 was a year that presented many challenges stemming from the outbreak of COVID-19 and the Sugar Industry was particularly affected by this pandemic. Across the industry, the cutback on capital expenditure (CAPEX) and operating expenditure (OPEX) had adversely impacted activity levels and created downward pressure on the achievements.

We've significantly advanced the execution of our functions as per the SRIF Act and are proud of the important contributions we make to wider society. At a time of global uncertainty, we believe an important role of business is to seek solutions and create opportunities. Notwithstanding these developments, our activity levels held up well due to our dedicated workforce and services, strong principal relationships with our key stakeholders. Detailed information on the operating and financial performance of our Institute are presented under the Financials section of this Annual Report.

The Board is grateful that we remain focused on core objectives, we continue to commit to support the Industry objectives and to sustain existing operations. Providing solutions that benefit the cane industry is an important element of SRIF's strategy. SRIF remains committed to good corporate governance and ethical conduct in its overall business direction and management to enhance long-term stakeholder's value and to safeguard the interests of our farmers. The Board recognises that maintaining a high level of ethics is critical to business integrity and performance and key to creating value. We are cognisant that business operations must safeguard the interest of the relevant stakeholders, namely our employees, the community at large, the environment and the cane belt in which we operate. We anticipate that the coming year will be equally, if not more, challenging for the Institute. We aim at increasing contributions from the funding stakeholders. The Board is confident that strong principal partnerships, will pave the way to make our business operations leaner and to focus on the variables that we can control.

On behalf of the Board, I wish to thank all our stakeholders, customers, suppliers, business partners and financiers for their strong support, trust and confidence in the Institute throughout the years. In the same vein, I wish to express appreciation to my fellow members of the Board, for their counsel and guidance provided over the years. Last but not least, I wish to extend my sincere thanks and appreciation to the Management and staff for their dedication, professionalism and diligent efforts during the year under review.



Prakash Chand

Chairman

31 December 2020

FOREWORD

Severe tropical cyclone Yasa was the second Category 5 cyclone to make landfall over Vanua Levu in Fiji in December. The very destructive hurricane force winds from the cyclone caused widespread damages to infrastructures and farms and also caused storm surges that resulted in coastal flooding with nearby farms being waterlogged with salt water. A series of troughs of low-pressure system in March resulted in significant rainfall and flash flooding from Sigatoka to Rakiraki. A moderate La Niña event was established in the Pacific in October that was dominated by a series of troughs of low-pressure systems. Generally, 2020 was a very wet year and conditions were not good for cane growth and sucrose accumulation in cane. Development of new varieties is a major function of the Institute and the activities in the plant breeding program progressed well during the year. The Institute is mandated to provide the industry with high performing varieties that are well adapted to the conditions in Fiji. Breeding of sugarcane varieties is a very passionate work as it involves a very lengthy process involving many intricate and difficult procedures that is spread over a 12-15-year cycle. During the year 520 crosses were set, 342 packets of fuzz were sown that produced 8,372 seedlings and varieties evaluated and selected from various stages were progressed to the next stage of selection. The analytical laboratory at the Institute analyses soil, leaf and cane samples and provides recommendations through the fertilizer advisory services to the cane growers.

In 2020 a new laboratory was set up in the Northern division at the Labasa office. This laboratory will help to reduce the turnaround time for analysing soils and providing timely recommendations to the farmers in Labasa mill areas. A total of 2,057 soil samples were received in 2020 for advisory and research trials. The soil health improvement program continued during the year after the government provided some grant for this initiative. Under this program growers were provided with grant to establish 0.4ha of their land with the green manure crop “Black Gram”(urd). Seven hundred ten growers were identified for this program but only 174 growers planted the green manure. One of the functions of the Institute is the protection of the Industry against diseases and pest incursions. The Institute has a routine disease inspection program wherein the cane belt is inspected for diseases and pests. The Institute has managed to keep the industry reasonably free of most of the major pests and diseases. During the year, a special study was carried out on the extraneous matter content in mechanically harvested cane and a maturity study was conducted to re-affirm the maturity trend of some commercial varieties. The dissemination of information continued in 2020 through the Technology Transfer program. A major field day was held in Nadi where the focus was on rehabilitating abandoned cane land. Close to 200 growers attended this field day. I acknowledge the contributions from all the staff for their support and commitment to the Institute and I would also like to thank the Chairman and other board members for their guidance and support.

Chief Executive Officer

Professor Santiago Mahimairaja

PARLIAMENT OF FIJI
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RESEARCH & DEVELOPMENT

MAY
Driest month

16,300+
test clones under testing

1,500+
soil samples analyzed

6,400+
hectares inspected for pest & diseases

1.0 CROP IMPROVEMENT

Summary

- Total of 520 crosses were set in 2020 where 200 crosses were from bi-parental combination and 320 were poly crosses.
- Total of 112 clones were transferred from the germplasm in Drasa to the flowering bed in Dobuilevu.
- Total 173 new varieties were introduced to the flowering bed in 2020 for increasing genetic variation.
- Total of 342 fuzz packets were sown in 2020 and 266 were able to germinate. Hardening and potting of the germinated seedling was carried out.
- Total of 8,372 seedling reaches the Stage 1 planting. They were all planted at Rarawai Estate, field 6 as LF2020 Stage 1 single stool.
- The evaluation on LF2018 and LF2019 Stage 1 trial were carried out. Total of 321 varieties were selected and planted as LF2018 Stage 2 single line while 303 varieties were selected and planted as LF2019 Stage 2.
- Total of 294 varieties were planted as LF2017 Stage 2 in 2019. After evaluation, total of 82 clones were selected and planted as LF2017 Stage 3 observation plot trial.
- The LF2016 Stage 2 trial have a total of 243 varieties however, after evaluation, 52 clones were selected and planted as stage LF2016 Stage 3.
- Final evaluation of 56 varieties for LF2014 Stage 3 were carried out using the biochemical data (in comparison with standards) and as well as the field assessment. Total of 20 varieties were selected and planted as seedbed for stage 4 trial

Recommendation

It is recommended that genetic variability be introduced into the germplasm by means of either Stage 4 promising varieties or imported clones in order to diversify the current sugarcane genetic pool for Fiji.

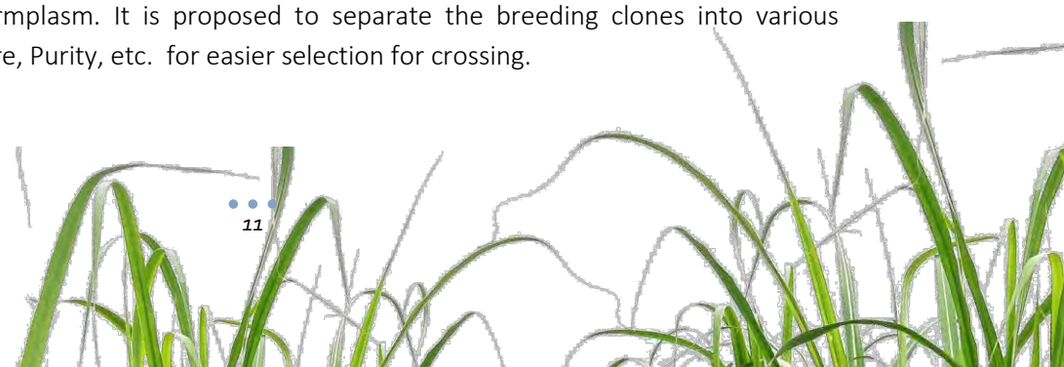
GERMPLASM

The germplasm collection is maintained at the Institutes head office at Drasa and at the Rarawai sub-station. In April 2020, Fiji received tropical cyclone Harold that did cause minor lodging but at that time the cane was at vegetative or tillering stage therefore, there wasn't much damage recorded.

Both Drasa and Rarawai germplasm are in the 2nd ratoon and for the past 2 years a total of 640 breeding clones (320 from Drasa and 320 from Rarawai) have been evaluated and the varieties were categorized according to the desirable traits – POCS, fibre and purity.

A total of 120 breeding clones from Rarawai germplasm have been transferred to the flowering bed after the first ratoon evaluation in 2019. Furthermore, this year 112 breeding clones from Drasa germplasm have been transferred to the flowering bed in Dobuilevu.

64 breeding clones were selected having high POCS and 48 breeding clones having high Fibre compared to the standards in the germplasm. It is proposed to separate the breeding clones into various categories such as POCS, Fibre, Purity, etc. for easier selection for crossing.



The following criteria were used as benchmark for selection:

Table 1.1: Criteria for selecting flowering bed varieties				
Variety	Fibre-AVG	POCS-AVG	Selection criteria	No. of clones selected
Naidiri	10.1	**13.1**	POCS > 13.1	35
Qamea	11.1	12.7	Fibre > 11.9	48
Viwa	**11.9**	12.3	Phenotypic traits and flowering	29
LF91-1925	10.3	12.3		
Kaba	10.6	10.2		

Viwa has the highest fibre at 11.9 and Naidiri has the highest POCS at 13.1, based on these standards selections for advancement to the next stage was carried out. Out of 320 breeding clones in Drasa germplasm, 35 breeding clones has above 13.1 POCS highest being 15.0 for LF70-4541 and 48 breeding clones has above 11.9 fibre highest being 18.4 for NG 51-55. The rest of the 29 clones were based on its physical attributes and profuse flowering.

It was noticed there were volunteer cane present on roadways probably due to scattering of seed cane during mechanical harvesting. This has led to mixing of breeding clones within the plots, therefore its recommended to replant the germplasm to avoid losing the breeding clones and harvesting manually instead of mechanically. It is recommended to bring in new breeding clones from either Stage 4 promising varieties or import, to bring more genetic variability. There are some breeding clones from the 1900's, which have been utilized for many years and we have exhausted our gene pool. Establishing a new germplasm will enable us to strengthen the genetic base for breeding in future.

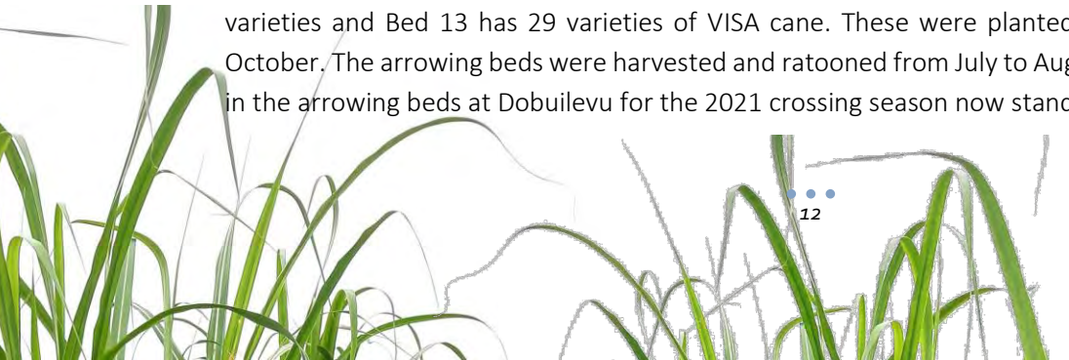
Flowering Bed

Favorable weather conditions assisted in profuse flowering in most breeding clones at Dobuilevu arrowing beds. Table 1.2 below gives the monthly rainfall for the seven months of 2019(Jun-Dec) and seven months of 2020(Jan-Jul) for Ellington II where the arrowing beds are situated.

Table 1.2: Jun 2019 to Dec 2020 monthly rainfall															
Location	2019					2020									
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Ellington II	170	163	57	120	73	184	296	171	235	413	417	328	192	28	2846

There were ten flowering beds in Dobuilevu with a total of 695 clones that were well maintained and produced flowers for 2020 crossing. The flowering beds were slightly lodged after strong winds that was received in the month of April due to Cyclone Harold. The success of sugarcane breeding programs depends on the choice of productive parent lines that have a high yield and are genetically divergent.

Moreover, diversity in varieties brings in genetic variation through breeding, which create more heterogeneity in varieties. Therefore, three new arrowing bed was planted with Bed 11 having a total of 114 breeding clones. 112 breeding clones were selected from Drasa germplasm (these were categorized by 64 high POCS and 48 High fibre), 20 varieties of Visa cane, 5 varieties (LF09 series), 4 varieties (LF13 series), 1 variety (LF11 series) and 2 Commercial varieties. Bed 12 having 8 commercial varieties and Bed 13 has 29 varieties of VISA cane. These were planted in early September to late October. The arrowing beds were harvested and ratooned from July to August. The number of varieties in the arrowing beds at Dobuilevu for the 2021 crossing season now stands at 876.



CROSSING

The 2020 crossing season commenced on 6th May and ended on 13th July. All the flowers that were used during crossing were obtained from Dobuilevu arrowing beds. A total of 520 crosses were set during 2020 that comprised of 200 biparental and 320 poly-crosses. A total of 148 female and 419 male flowers were used in setting the crosses.

Two temporary tents were set-up for poly-crosses. New breeding shed was utilised this year for biparental crosses. Breeding clones from germplasm in Drasa and Rarawai were not used this season because of high cost of transporting few flowers at a time. 2020 crossing was focused mostly on breeding S. *officinarum* hybrids therefore no interspecific or intergeneric crosses were made. In June, cane breeding information day was organized. Stakeholders and farmers were given a rare opportunity to witness crossing, male/female flower identification and pollination at SRIF cane breeding station, Dobuilevu.

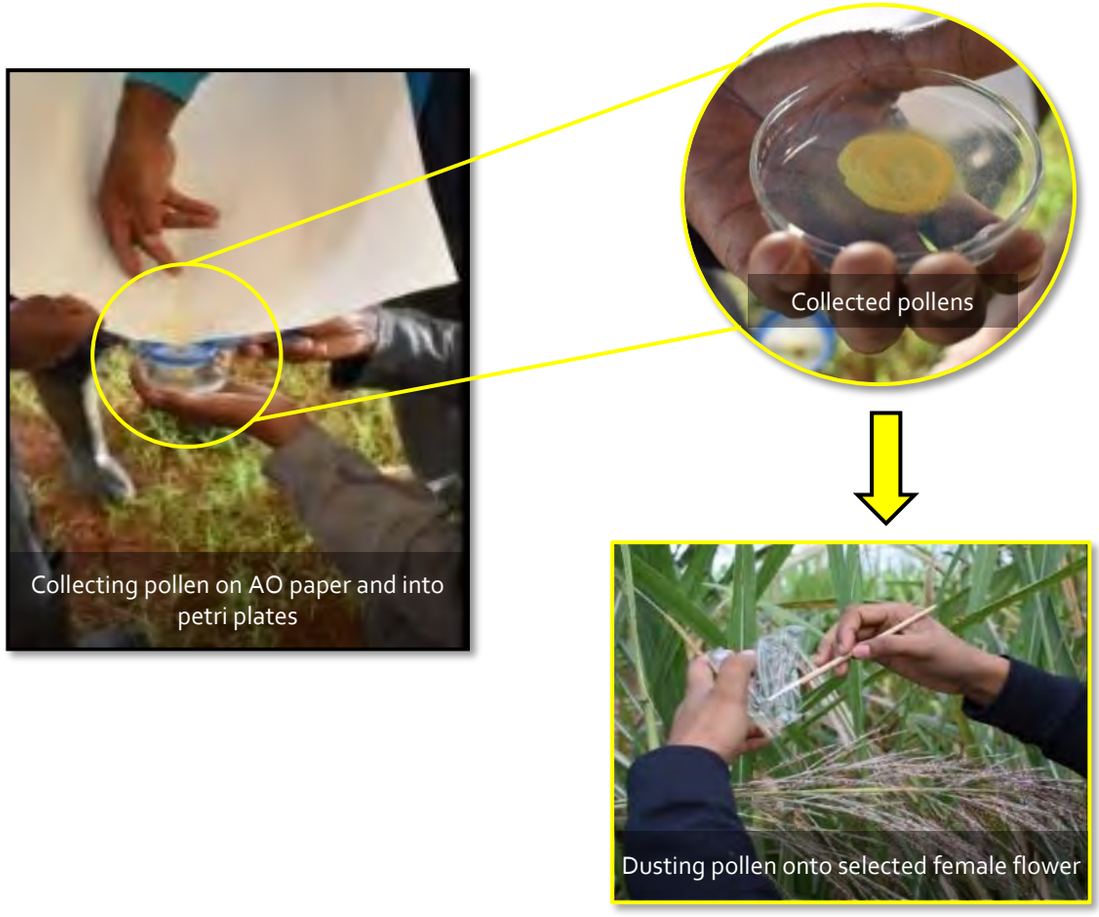
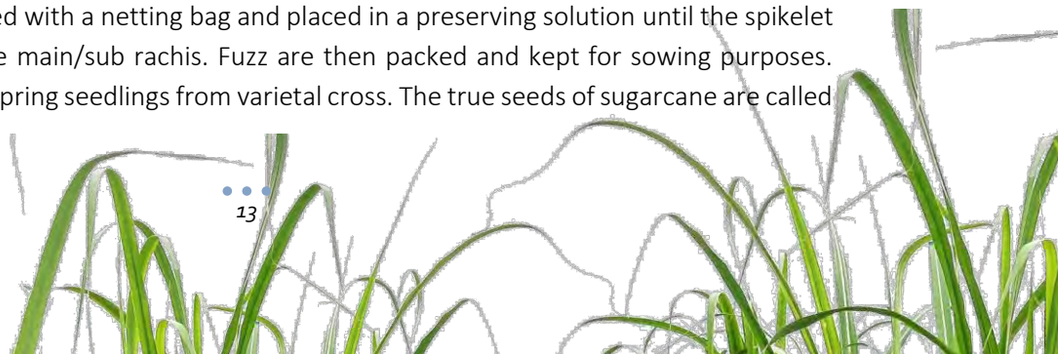


Figure 1.1: Pollen collection and dusting

FUZZ SOWING

New varieties of sugarcane are obtained by cross-pollination between varieties from the same species, different species and genera. The process of pollination is carried out over seven days and thereafter the female flowers are covered with a netting bag and placed in a preserving solution until the spikelet voluntarily detaches from the main/sub rachis. Fuzz are then packed and kept for sowing purposes. Fuzz are sown to produce offspring seedlings from varietal cross. The true seeds of sugarcane are called



fuzz. During fuzz sowing, fuzz packets are open, cross number and parent are recorded on fuzz sowing book for references. Then fuzz is sown in sterilized soil mixed with mill mud. The sown fuzz trays are kept in the germination chamber and germination should occur within 3 to 4 days. Fuzz is one of the important aspects of producing new generation of hybrids. Fuzz should be well kept to maintain its viability in order to produce seedlings when sown. A total of 342 packets of fuzz was sown and 266 packets germinated to produce 15,447 seedlings.

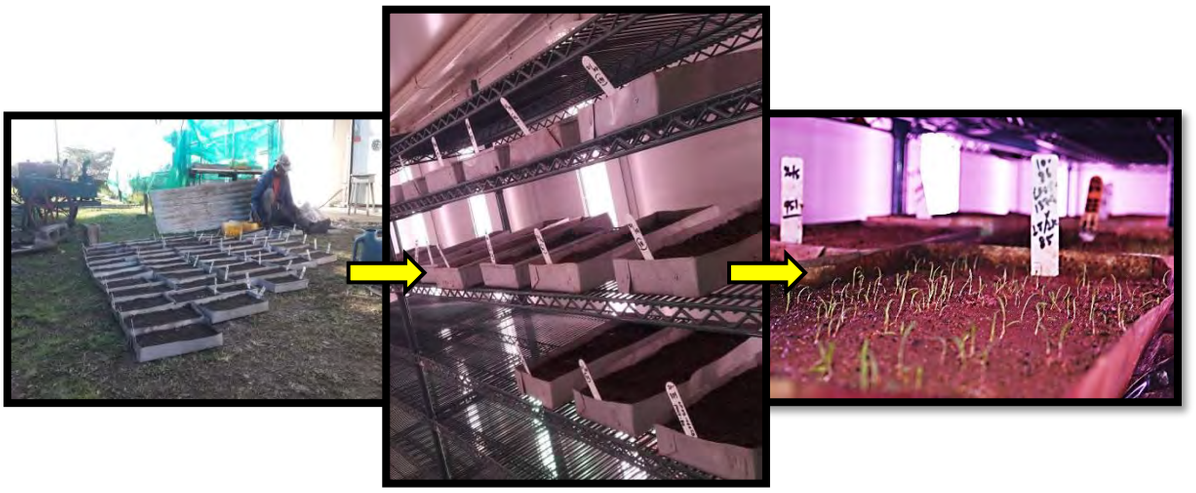


Figure 1.2: left – Fuzz planting, Middle – Fuzz in the germination chamber, Right – Seedlings germinating from fuzz in germination chamber

These seedlings were later reared in a temporary greenhouse for growth and hardening. During hardening process, 64 crosses did not survive and were discarded while 202 crosses were moved to the stage of potting.

FUZZ POTTING

Fuzz potting was done at five six different intervals. Fuzz potting began on 21st August, 2020 and ended on 17th September, 2020. Fuzz from 202 crosses were sown and 15,447 seedlings were raised.

EARLY STAGES SELECTION

Stage 1 trial is described as the single stool seedling stage of the Plant breeding program as each seedling planted is considered as a new variety. The seedlings from the crosses are planted side by side in the field with the standards in rows of 100 seedlings. The selection criterion is limited to the most basic inherited character i.e. sugar which is estimated on the basis of the brix which is a measure of total soluble solids in cane juice that includes sucrose in greater component. In some cases, the clone appeal is taken into consideration in terms of physical appeal and agronomic desirability. This year, 2 series of stage 1 trial have been evaluated and 1 was planted. The detail of stage 1 trials is listed in table 1.3.

Table 1.3: Stage 1 trials

Series	Total number of seedlings	Action taken	Status
LF2018	6300	Brixing and selection	Stage 2 trial (Drasa)
LF2019	4440	Brixing and selection	Stage 2 trial (Rarawai)
LF2020	8372	Planting	Single stool stage 1 trial

LF2020 Stage 1

A total of 8372 seedling were planted as LF2020 Stage 1 single stool trial at Rarawai Estate in the first week of December 2020. A little increase in number in comparison to the number of seedlings planted as stage 1 trial in the last four series.

LF2019 Stage 1

A total of 322 cultivars of LF 2019 series were advanced and planted as stage 2 single lines at Rarawai F5. This was 14.7 % of the total planted (4440). The selection was done 9 months after planting and was based on brix, vigour and disease incidence.

Table 1.4: LF2019 Clone selection with standards as reference

Standard varieties	Standard average brix	Selection range (brix)	No of varieties selected.
Viwa	23.0	23.0 ≥	103
Kaba	22.0	22.0 – 22.9	81
Naidiri	21.0	21.0 – 21.9	112
Mana	20.0	20.0 – 20.9	17
		18.0 – 19.9	9
Total			**322**

The cane was still in the growing phase during selection and the brix values of most of the clones were comparatively lower as compared to past years. There was slight lodging in the trial and this could have also affected and contributed to the low brix.

LF2018 Stage 1

The trial was planted in Drasa Estate on 22nd May 2020. The number of varieties from LF 2018 stage 1 was narrowed down to 321 varieties based on the brix values and physical attributes obtained from stage 1. This was 19.6 % of the total planted (6300). Included in the selected varieties were few with good Agronomic traits but these varieties had low brix. These varieties will be evaluated in stage 2 and based on the biochemical results, a decision will be made whether to progress these varieties to next stage or transfer them to the flowering bed. Due to lack of space in the Rarawai Estate, LF 2018 stage 2 was planted in Drasa Estate. The plot size for Stage 2 trial is 1 row x 6 meters. The field was well prepared and irrigation was done post planting leading to overall good germination. Evaluation and selection for stage 3 will be carried out in 2021.

Table 1.5: LF2018 Clone selection with standards as reference

Standard Varieties	Standards Average Brix	Selection Range (Brix)	No of varieties Selected
Kaba	19.4	19.7- 20.0	25
Viwa	19.2	19.2 – 19.6	43
Qamea	18.2	18.2	170

Stage 2 trials

Stage 2 is referred to as single line plot in the plant breeding program. All the varieties in this stage is evaluated in 2 phases that includes brixing followed by biochemical analysis. Brixing is carried out as a preliminary test to identify varieties with high brix and this is followed by biochemical analysis to assess varieties for advancing to next stage. During 2020 there were 2 stage 2 trials (LF2016 and LF2017 Series) that were evaluated for Advancement to Stage 3 Observation Plot Trial.

Selection

Selection is the process where newly developed varieties are identified based on its sugar content in comparison to existing commercial varieties. The selected varieties are placed under three categories advance, consider and consider for crossing. The advance category varieties are those that have better sugar content than standards while the consider category varieties may have similar or slightly less sugar content than standards but display certain good agronomic characteristics. The consider for crossing category varieties may have desirable traits such as high sucrose content but stunted growth, resistance to lodging, suitable for mechanical harvesting, free trashing and others that will help in future breeding.

Trial Details

There were two series of stage 2 trials which were evaluated in 2020. These trials were irrigated soon after planting and established well, and generally had a good stand of cane. The cane was 10 months old at the time of selection and was not lodged. The varieties were easily accessed.

DISCUSSION

LF2016 Series stage 2

Samples from this trial were sent to small mill for biochemical analysis. Final selection was carried on the 238 varieties based on the bio-chemical data received from the small mill as well as field data recorded during field assessment. The field notes on the agronomic characters was consolidated with the biochemical data and 50 clones were selected and advanced to Stage 3.

Hybrid Clones

There were 11 varieties from inter generic crosses that were also included in these trials. Two varieties from these hybrid offspring were selected for stage 3 trial. Their POCS were relatively higher than the standards and phenotypically good.

Seven varieties were also included in the stage 3 plot even though their POCS were lower than standard but will be further analyzed for signs of gene crossover. Two varieties (A85 and A86) did not progress further to stage 3 due to limited number of stalks however, sample of these two varieties will be taken from stage 2 plot for further analysis.

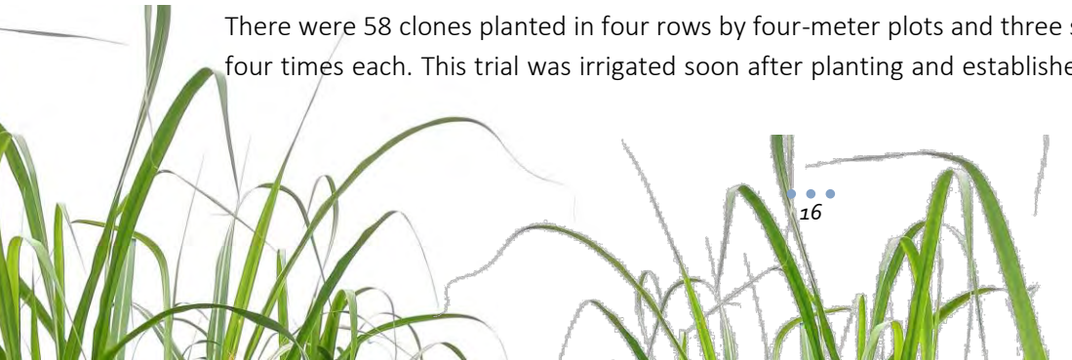
LF2017 Series stage 2

The trial consists of 294 clones that were sampled and sent to the small mill for biochemical analysis. Field observation and assessment were also carried out. The Data obtained from biochemical analysis and field assessment were used for selection. Preliminary selection was carried based on the biochemical data and focused on high POCS. However, final selection was made after the trial was revisited. A total of 82 varieties were selected and planted as stage 3.

Stage 3 Trials: selection of varieties from stage 3 LF2014 for advancement to stage 4 seedbed

Trial Details

There were 58 clones planted in four rows by four-meter plots and three standard varieties replicated four times each. This trial was irrigated soon after planting and established well. It was free of weeds



and generally had a good stand of cane. The cane was 11 months old at the time of selection and was lodged.

Discussion

There was a heavy downpour and strong winds two days before sampling and a lot of varieties were lodged. The sampling was done on 6th July 2020 for small mill analysis. Prior to sampling, field assessment was carried out and information about individual varieties was recorded. The final selection of varieties was based on comparison of test clone's data against standards and the field information that was recorded. The varieties were selected on sucrose content and % fibre. Twenty varieties have been selected (refer table 1.6) and advanced to stage 4 seedbed. The sucrose content of the selected varieties ranged between 7.58 and 11.94 % and the standards from 7.37 and 11.91%. The sucrose content (11.94%) of LF14 - 027 was better than the best standard variety Naidiri (11.91%).

Table 1.6: Selected varieties from the LF2014 series for stage 4 seedbed

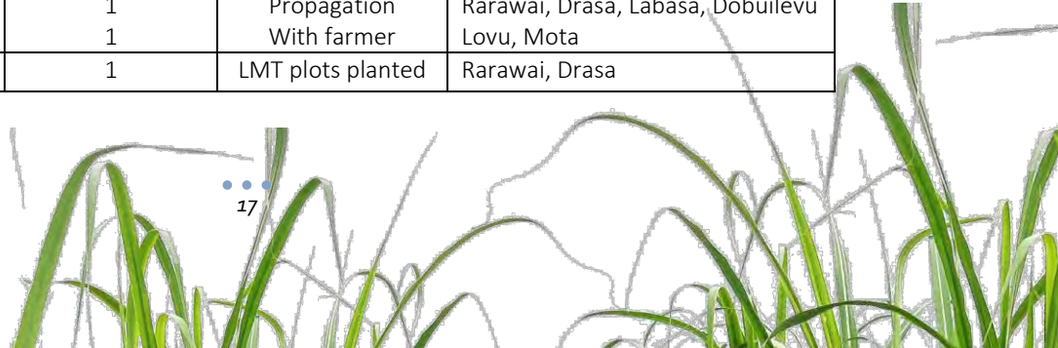
Variety Name	Std	Fiber	Purity	Pol	Brix	POCS
LF14 - 003	BRD	8.7	77.45	12.31	14.03	8.91
LF14 - 009	BRD	10.0	81.82	13.73	14.60	10.21
LF14 - 011	BRD	6.2	79.95	12.54	14.25	9.58
LF14 - 015	BRD	9.8	77.17	12.02	13.59	8.57
LF14 - 016	BRD	9.0	75.32	12.30	14.36	8.68
LF14 - 026	BRD	7.5	82.10	12.96	14.13	9.95
LF14 - 027	BRD	7.7	85.95	15.12	15.71	11.94
LF14 - 030	BRD	10.8	79.91	13.25	14.29	9.59
LF14 - 032	BRD	7.6	77.13	11.46	13.29	8.39
LF14 - 036	BRD	7.9	73.43	10.82	13.14	7.58
LF14 - 042	BRD	9.2	80.79	13.37	14.53	9.94
LF14 - 043	BRD	9.6	81.72	14.94	15.97	11.15
LF14 - 044	BRD	9.3	80.72	13.98	15.19	10.38
LF14 - 046	BRD	12.0	80.20	13.52	14.33	9.66
LF14 - 049	BRD	10.1	79.16	12.23	13.43	8.87
LF14 - 051	BRD	7.6	79.47	13.58	15.28	10.17
LF14 - 052	BRD	9.5	79.29	12.59	13.89	9.20
LF14 - 053	BRD	8.1	80.09	13.83	15.36	10.36
LF14 - 055	BRD	7.9	80.69	13.16	14.53	9.93
LF14 - 057	BRD	6.7	77.77	12.74	14.79	9.47

Stage 4 & Large Mill Trial - Advance Stage Trials and Variety Pre-release Programs

Table 1.7 shows the trials that were carried out for Advance Stages and Variety pre-release program.

Table 1.7: List of stage 4 trials

Type	Series	No. of varieties	Status	Locations
Stage 4	LF2015	20	P	Rarawai, Labasa
Stage 4	LF2013	13	1R	Rarawai, Drasa, Dobuilevu, Labasa
Stage 4	LF2012	17	2R	Rarawai, Drasa, Dobuilevu, Labasa
Stage 4 seed bed	LF2014	20	Propagation	Rarawai, Labasa
Farmer feel effect	LF2009 LF2011	1 1	Propagation With farmer	Rarawai, Drasa, Labasa, Dobuilevu Lovu, Mota
Large Mill Trial	LF2011	1	LMT plots planted	Rarawai, Drasa



There were 3 Stage 4 trials in 2019-2020, whereas seed bed for a new trial was established in Rarawai. All the trials were progressively visited, cultivated and evaluated (sampled and plot weighing) and the data recorded and analysed. For pre-variety release program, 2 varieties were in the Farmer feel effect– LF09-1707 and LF11-233 from LF2011 series. LF09-1707 had already been given out to 2 farmers.

This variety is being further propagated to be given out to a few other farmers and also for establishment of seed bed for Large mill trial. On the other hand, LF11-233 LMT plots have been established, it also has been given to two farmers for feedback. Variety LF11-233 LMT plots have also been established at Rarawai and Drasa Estates with Ragnar and Naidiri as standards and will be tested in 2021.

LF2012 Stage 4

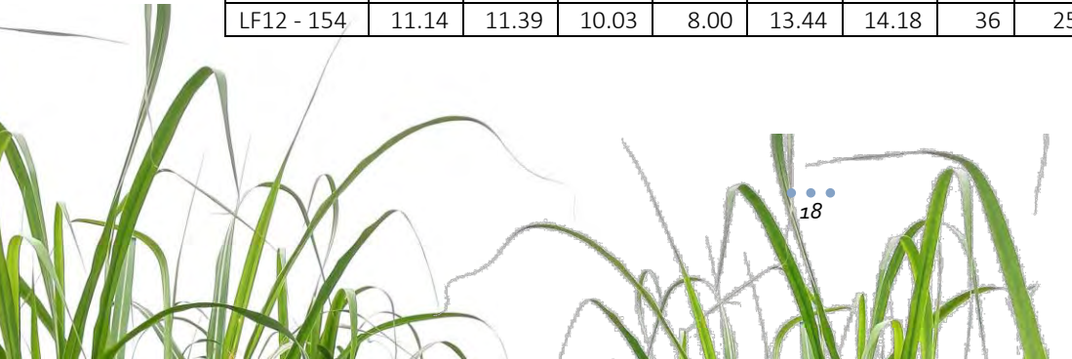
The LF2012 Stage 4 trials were located in Drasa, Rarawai, Penang and Labasa. A total of 17 varieties were planted in this trial with commercial varieties as standards. The results from all crop cycles and mill location are discussed below.

Rarawai

The trial was planted in October 2017 in Field 5, Rarawai Estate using RCBD (Randomized Complete Block Design) with 17 varieties and 3 standards (Ragnar, Naidiri and Mana) in 4 replicates. This field had river alluvial soil with high sand content. The table 1.7 summarizes the bio-chemical data for LF2012 series in Rarawai.

Table 1.8: Stage 4 LF2012 series bio-chemical data for Rarawai

Variety	Fibre (P)	Fibre (1R)	Fibre (2R)	POCS (P)	POCS (1R)	POCS (2R)	TCH (P)	TCH (1R)	TCH (2R)	TSH (P)	TSH (1R)	TSH (2R)
Mana	8.37	8.34	7.54	13.02	12.14	12.87	80	84	101	10	10	13
Naidiri	11.20	10.02	10.14	15.03	13.15	14.64	86	75	89	13	10	13
Ragnar	11.15	9.03	8.71	14.35	12.06	14.27	86	74	72	12	9	10
LF12 - 282	12.44	11.57	10.51	14.02	12.30	13.15	96	85	109	13	10	14
LF12 - 233	11.55	10.57	10.47	12.99	10.65	12.54	80	105	107	10	11	13
LF12 - 2	9.71	9.13	9.90	15.29	12.36	14.20	81	89	93	12	11	13
LF12 - 153	10.34	10.38	10.32	13.99	13.27	14.23	89	78	92	12	10	13
LF12 - 22	15.05	12.19	12.10	13.62	11.74	13.71	107	85	87	15	10	12
LF12 - 114	12.05	11.30	10.76	14.93	12.18	13.81	91	86	84	14	11	12
LF12 - 63	11.78	12.11	12.15	13.57	11.43	13.20	89	88	88	12	10	12
LF12 - 276	8.88	8.35	8.67	15.69	13.43	15.46	95	67	74	15	9	11
LF12 - 31	10.15	8.97	9.72	11.78	10.22	12.41	105	89	87	12	9	11
LF12 - 76	10.72	10.43	9.54	13.15	8.37	13.26	73	94	132	10	8	17
LF12 - 40	12.44	12.49	12.60	12.91	13.67	13.85	55	85	91	7	12	13
LF12 - 253	13.20	13.19	13.11	13.42	11.16	13.55	72	74	82	10	8	11
LF12 - 112	9.65	9.54	9.02	13.91	13.22	13.79	55	65	69	8	9	10
LF12 - 255	12.51	11.83	11.11	13.46	11.15	13.14	74	67	71	10	7	9
LF12 - 34	11.07	11.17	10.86	15.12	12.90	14.66	29	64	52	4	8	8
LF12 - 74	14.00	13.17	12.67	12.25	11.13	11.99	51	55	43	6	6	5
LF12 - 154	11.14	11.39	10.03	8.00	13.44	14.18	36	25	31	6	3	3



The variety LF12-282 has stood out well in terms of being consistent with data in all crop cycles (P, 1st Ratoon and 2nd Ratoon) as well as being comparable to the best standard (Naidiri). Varieties LF12-233, LF12-2 and LF12-153 were also consistent in all crops compared to data of the lowest standard in Plant crop and with the best standard in 1st and 2nd ratoon.

Varieties LF12-22 and LF12-114 were comparable to best standard in plant and 1st ratoon and being close to the best standard in 2nd ratoon. All these varieties will be assessed again especially LF12-282 which was consistent in all crops cycles and selected for farmer feel effect program.

Drasa

This trial was planted in September 2017 at Drasa Estate Field 24 in RCBD design with 17 varieties and 2 standards (Naidiri and Mana) in 4 replicates. This trial established poorly with gaps and volunteers in the plots. The data from all crops is summarized in table 1.9:

Table 1.9: Stage 4 LF2012 series bio-chemical data for Drasa

Variety	Fibre (P)	Fibre (1R)	Fibre (2R)	POCS (P)	POCS (1R)	POCS (2R)	TCH (P)	TCH (1R)	TCH (2R)	TSH (P)	TSH (1R)	TSH (2R)
Mana	9.55	8.79	6.53	12.17	13.70	10.34	42	70	32	5	10	3
Naidiri	9.96	10.44	8.89	12.78	13.57	13.25	65	63	44	8	9	6
LF12 - 153	10.07	11.79	10.16	11.99	13.78	12.27	68	79	43	8	11	5
LF12 - 114	11.65	12.50	11.65	13.01	12.40	13.01	49	69	47	6	9	6
LF12 - 282	11.11	11.42	10.17	11.70	12.69	11.47	62	77	45	7	10	5
LF12 - 22	12.25	14.14	12.22	11.36	13.74	11.58	62	81	36	7	10	4
LF12 - 154	11.20	10.63	8.14	12.94	13.62	13.81	50	71	20	6	10	3
LF12 - 233	10.55	11.59	10.99	10.43	13.83	10.78	59	81	28	6	11	3
LF12 - 31	10.84	10.15	8.94	9.26	11.96	11.02	63	83	31	6	10	4
LF12 - 112	9.49	10.52	7.99	12.27	13.46	12.40	41	82	31	5	11	4
LF12 - 76	9.72	10.31	9.33	13.16	14.29	11.28	62	54	33	8	7	4
LF12 - 2	10.38	9.31	7.12	12.78	13.22	12.37	53	47	37	7	7	4
LF12 - 74	13.67	12.12	10.72	11.38	14.33	11.52	65	64	19	7	8	2
LF12 - 255	11.46	12.78	12.40	11.34	13.38	11.13	59	61	45	7	7	5
LF12 - 34	9.72	11.15	11.39	11.72	13.10	13.29	54	57	30	6	8	4
LF12 - 276	10.14	8.66	8.29	12.01	12.90	11.09	51	55	34	6	8	4
LF12 - 40	11.80	13.85	11.95	13.09	11.61	12.30	40	41	33	5	5	4
LF12 - 253	11.78	14.72	11.93	11.16	12.45	11.56	47	54	41	5	7	5
LF12 - 63	11.92	11.62	8.35	10.37	13.61	8.76	34	120	42	3	13	3

Unlike Rarawai trial, no variety was found to be consistent and comparable to best standard in the three crop cycles at Drasa. However, variety LF12-153 was found to be comparable to best standard at least in Plant and 1st Ratoon and close to best standard in 2nd ratoon.

Varieties LF12-114, LF12-282, LF12-22, LF12-154, LF12-233, LF12-31, LF12-112 and LF12-76 were found to be better or similar to the best standard in at least one of the crop cycles. The variety LF12-282 which was best in Rarawai was also found in this list and will be re-visited together with other above-mentioned varieties and a final list recommended for Farmer Feel Effect program.

Penang

This trial was planted in a farmer's cane farm in Dobuilevu, Ra which had poor to medium soil. The trial had some problems with germination and cane stools were sent from Rarawai to do the gap filling. The trial was well maintained and the sampling and plot weighing were done in a timely manner.

Table 1.10: Stage LF2012 series bio-chemical data for Penang

Variety	Fibre (P)	Fibre (1R)	Fibre (2R)	POCS (P)	POCS (1R)	POCS (2R)	TCH (P)	TCH (1R)	TCH (2R)	TSH (P)	TSH (1R)	TSH (2R)
Mana		8.64	8.93	14.69	12.61	14.90	49	56	52	7	7	8
Naidiri		10.58	9.31	14.66	13.50	14.26	38	62	56	6	8	8
Ragnar		9.83	9.42	15.43	12.38	15.84	38	49	46	6	6	7
LF12 - 2		9.41	8.53	15.07	14.22	15.07	47	60	55	7	8	8
LF12 - 22		13.76	12.49	14.53	13.12	13.96	46	61	52	7	8	7
LF12 - 276		9.01	8.98	15.43	14.57	13.71	36	61	53	6	9	7
LF12 - 233		11.35	10.95	14.26	12.36	11.80	39	80	56	6	10	7
LF12 - 40		12.73	11.97	13.77	12.66	13.75	47	60	51	6	7	7
LF12 - 255		13.11	11.04	13.03	10.14	12.85	45	56	51	6	6	7
LF12 - 154		11.08	10.20	14.29	12.00	12.90	39	59	51	6	7	7
LF12 - 144		13.27	10.44	14.12	12.08	14.22	37	56	51	5	7	7
LF12 - 253		12.98	11.99	12.92	11.70	14.12	36	52	49	5	6	7
LF12 - 153		10.89	9.88	14.89	13.67	13.96	37	54	48	5	7	7
LF12 - 76		10.84	9.77	14.47	12.47	14.23	31	50	47	4	6	7
LF12 - 282		11.84	11.02	14.01	12.99	13.95	38	49	46	5	6	6
LF12 - 34		12.16	12.08	13.13	12.87	12.52	29	57	52	4	7	6
LF12 - 74		14.00	12.84	12.76	10.21	12.13	37	54	51	5	6	6
LF12 - 31		9.75	10.30	13.03	10.18	12.24	42	58	49	5	6	6
LF12 - 63		12.04	9.73	12.86	11.50	11.23	45	59	50	6	7	6
LF12 - 112		9.50	8.74	13.82	12.72	11.67	42	49	48	6	6	6

Variety LF12-2 was found to be consistent compared to the best standard (Naidiri) in terms of sugar per hectare in above trial. However, variety LF12-22 was found to be consistent with the best standard whereas LF12-276 and LF12-233 to be consistent only in 1st ratoon.

Varieties LF12-40, LF12-255 and LF12-154 were found to be consistent with the lowest standard. Remaining varieties were found to be comparable to the lowest standard at least in one of the crop cycles. These varieties will be visited again and a final list will be selected for Farmer Feel Effect program.

Labasa

This trial was planted during 2017 in the poor soils in Solove, Seaqaqa. A total of 13 varieties were planted in 4 replicates. Each replicate having 4 commercial standard varieties. The plot size was 4 rows by 6 meters. Moreover, age of crop during analysis was 9-10 months for plant until 2nd ratoon. The trial was maintained well and trial activities were carried out in a timely manner.

Table 1.11: Stage 4 LF2012 series bio-chemical data for Labasa												
Variety	Fibre (P)	Fibre (1R)	Fibre (2R)	POCS (P)	POCS (1R)	POCS (2R)	TCH (P)	TCH (1R)	TCH (2R)	TSH (P)	TSH (1R)	TSH (2R)
Naidiri	12.49	5.10	6.20	15.02	13.58	16.60	182	80	85	27	11	14
Qamea	10.06	4.48	6.23	13.98	15.88	16.78	110	84	84	15	13	14
Ragnar	12.66	1.65	6.10	14.35	16.18	15.35	107	72	76	16	12	12
Kuiva	11.89	4.18	6.93	14.77	12.78	15.73	115	74	74	17	9	12
LF12-255	12.09	4.00	5.60	14.09	13.20	14.58	110	75	69	16	10	10
LF12-276	9.84	3.50	5.25	14.19	13.60	12.15	115	69	72	16	9	9
LF12-112	12.20	3.53	6.58	13.57	12.50	13.48	147	65	80	20	8	11
LF12-40	13.55	5.98	6.13	13.33	13.68	14.43	84	63	66	11	9	10
LF12-223	5.70	6.68	7.80	15.65	13.13	12.93	111	54	72	18	7	9
LF12-31	14.39	4.85	5.60	13.02	13.15	14.60	125	54	59	16	7	9
LF12-34	12.55	4.55	6.13	13.58	13.70	13.10	165	53	66	22	7	9
LF12-63	9.52	4.35	5.70	13.77	12.53	12.73	124	60	66	17	8	9
LF12-282	13.51	2.45	7.03	13.53	14.23	13.83	137	58	61	18	8	8
LF12-154	13.60	3.20	7.35	14.07	13.63	13.40	112	53	62	16	7	8
LF12-74	9.98	3.33	5.18	14.10	14.05	13.50	131	59	61	19	8	8
LF12-76	12.06	13.13	5.55	13.57	12.13	14.45	95	52	69	13	7	10
LF12-22	14.43	2.88	5.45	13.29	14.55	14.70	89	51	66	12	7	10

None of the varieties were found to be better than the best standard at Labasa, however, varieties LF12-255 and LF12-276 were found to be comparable to the lowest standard at least in 2 crop cycles.

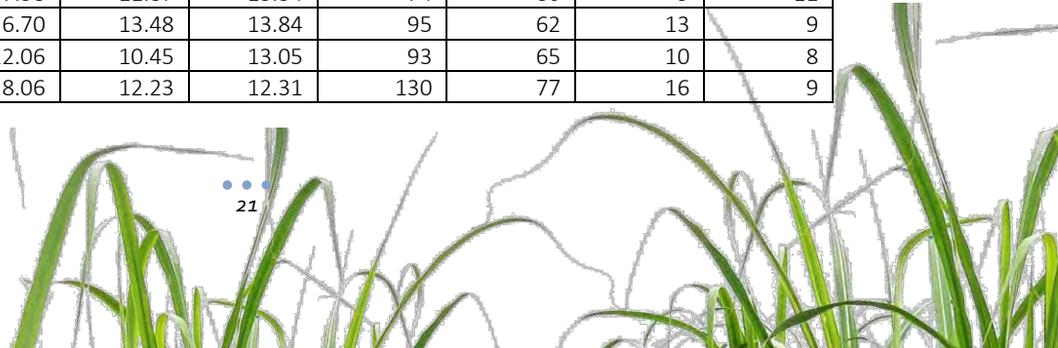
LF2013 Stage 4

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

Rarawai

This trial was planted in Field 5 at Rarawai Estate in 2018 with 13 test varieties and another imported variety R570. The field has 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 1.12: Stage 4 LF2013 series bio-chemical data for Rarawai								
Variety	Fibre (P)	Fibre (1R)	POCS (P)	POCS (1R)	TCH (P)	TCH (1R)	TSH (P)	TSH (1R)
Mana	7.76	7.02	12.49	12.65	112	103	14	13
Naidiri	9.75	8.32	13.93	14.24	121	98	17	14
LF13-468	9.31	8.50	12.70	12.54	109	106	14	14
LF13-454	9.80	7.43	12.40	13.16	140	99	17	13
LF13-468	8.92	7.28	11.44	12.78	119	107	14	13
LF13-427	8.85	7.20	12.20	14.24	108	113	13	16
LF13-116	8.58	7.65	12.50	13.95	98	108	12	15
LF13-485	8.11	6.95	12.71	13.85	104	108	13	15
LF13-452	9.77	8.18	13.88	13.62	102	63	14	9
LF13-410	8.94	6.93	13.20	12.77	90	102	12	13
LF13-405	9.06	8.55	13.42	13.34	78	91	8	12
LF13-238	9.67	7.85	13.39	13.13	92	90	12	12
LF13-460	9.82	7.58	11.87	13.34	74	80	9	11
LF13-441	7.98	6.70	13.48	13.84	95	62	13	9
LF13-543	15.41	12.06	10.45	13.05	93	65	10	8
R570	9.37	8.06	12.23	12.31	130	77	16	9



The varieties LF13-468 and LF13-454 were found to be consistent with the best and the lowest standards at least in one of the crop cycles. Varieties LF13-427, LF13-116 and LF13-485 were found to be comparable to the best standard in 1st ratoon, whereas LF13-452 and LF13-410 were comparable to the lowest standard in the Plant and 1st ratoon, respectively.

Drasa

This 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 weighing were also done as per schedule.

Table 1.13: Stage 4 LF2013 series bio-chemical data for Drasa

Variety	Fibre (P)	Fibre (1R)	POCS (P)	POCS (1R)	TCH (P)	TCH (1R)	TSH (P)	TSH (1R)
Mana	9.02	7.53	11.69	12.83	71	73	8	9
Naidiri	7.98	8.12	9.80	12.03	66	83	6	10
LF13 - 454	10.15	10.52	11.56	13.33	74	74	8	10
LF13 - 485	9.32	7.46	11.57	13.40	73	71	8	10
LF13 - 405	10.99	9.60	11.35	11.89	83	76	9	9
LF13 - 116	8.97	10.14	11.13	13.44	88	80	10	8
LF13 - 468	9.18	9.08	10.18	10.39	95	75	10	8
LF13 - 441	10.24	8.98	9.98	13.23	43	75	4	10
LF13 - 238	9.71	8.74	10.56	11.13	53	83	5	9
LF13 - 452	9.20	10.03	10.45	12.41	77	67	8	8
LF13 - 460	8.37	8.65	9.36	11.42	93	88	9	8
LF13 - 468	9.34	8.83	9.97	11.56	75	80	7	7
LF13 - 410	9.62	8.37	9.25	11.12	69	58	7	7
LF13 - 543	15.08	11.99	9.63	11.09	66	54	6	6
LF13 - 427	9.53	8.23	10.67	12.20	87	58	9	6

Varieties LF13-454 and LF13-485 were consistent compared to the data of the best standards in both Plant and 1st ratoon. LF13-405 was found to be better than best standard in Plant crop whereas comparable to the lowest standard in 1st ratoon.

Varieties LF13-116 and LF13-468 were found to be better than the best standard in 1st ratoon but lower than the lowest standard in 1st ratoon. Except for LF13-441 and LF13-238, all other varieties were found to be either comparable to the best standard or the lowest standard. The varieties which had shown consistency would be revisited in the trials and confirmed for Farmer Feel Effect program.

Penang

This trial was planted in a farmer's cane farm at Dobuilevu, Ra which had poor soil. The trial had established well and all trial maintenance work was done in a timely manner. The sampling for small mill and plot weighing were also done in a timely manner. The data collected in the 2 crop cycles is summarized in the following table and discussed thereafter.

Table 1.14: Stage 4 LF2013 series bio-chemical data for Penang								
Variety	Fibre (P)	Fibre (1R)	POCS (P)	POCS (1R)	TCH (P)	TCH (1R)	TSH (P)	TSH (1R)
Mana	7.56	7.21	10.35	12.62	99	101	10	13
Naidiri	9.81	9.34	11.22	15.39	87	91	10	11
Kaba	9.31	9.14	10.98	13.61	114	112	13	15
LF13-485	8.96	8.20	10.67	13.24	100	103	11	14
LF13-468	8.77	8.92	9.62	12.49	131	109	13	13
LF13-468	8.91	9.52	8.96	10.99	131	114	12	13
LF13-116	8.19	7.67	9.37	11.27	104	119	10	13
LF13-427	9.46	9.42	11.67	12.44	98	101	12	12
LF13-543	12.65	12.19	7.73	12.30	86	102	7	13
LF13-410	7.88	7.67	9.54	12.70	82	101	8	13
LF13-441	8.17	7.78	10.38	13.93	85	90	9	12
LF13-454	9.22	8.82	8.75	12.08	121	107	11	9
LF13-452	8.20	9.73	10.49	13.08	68	77	7	10
LF13-460	8.53	8.67	8.20	11.37	114	108	9	9
LF13-405	9.27	10.37	9.40	12.51	77	91	7	8
LF13-238	10.01	7.55	11.71	12.03	49	66	6	8

Variety LF13-485 was seen to be comparable to the lowest standard in the Plant crop and the best standard in the 1st ratoon whereas it was vice versa for LF13-468.

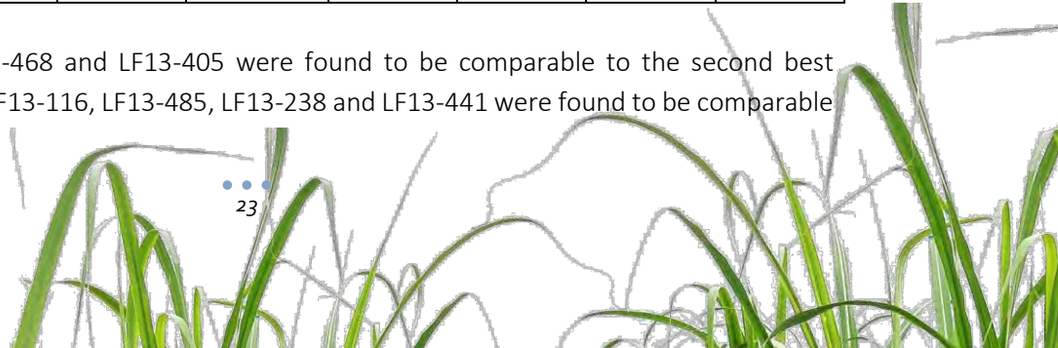
The variety LF13-454 can be seen to be comparable to the lowest standard in the Plant crop. The above varieties would be assessed for other traits in terms of appearance, appeal, growth and other physical attributes before being recommended for farmer feel effect.

Labasa

Stage 4 trial of LF13 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 there were seed cane issues. Each replicate had 3 commercial standard varieties.

Table 1.15: Stage 4 LF2013 series bio-chemical data for Penang								
Variety	Fibre (P)	Fibre (1R)	POCS (P)	POCS (1R)	TCH (P)	TCH (1R)	TSH (P)	TSH (1R)
Naidiri	5.65	10.13	13.85	13.20	67	83	9	11
Qamea	6.50	12.13	13.68	13.63	63	71	9	10
Ragnar	5.78	10.50	13.93	13.75	63	69	9	9
LF13-452	6.23	10.23	13.03	13.33	61	75	8	10
LF13-468	6.68	9.55	13.20	13.43	60	74	8	10
LF13-405	8.58	8.70	13.98	13.85	58	70	8	10
LF13-116	7.80	8.35	12.95	13.55	58	67	7	9
LF13-485	6.00	8.35	12.23	12.68	69	72	8	9
LF13-238	8.23	9.10	12.85	13.75	56	63	7	9
LF13-441	8.10	8.28	12.03	13.28	55	65	7	9
LF13-543	7.43	9.70	11.75	12.08	59	67	8	8
LF13-427	7.53	8.60	13.30	12.70	57	62	8	8

The varieties LF13-452, LF13-468 and LF13-405 were found to be comparable to the second best standard whereas, varieties LF13-116, LF13-485, LF13-238 and LF13-441 were found to be comparable



to the lowest standard. These varieties will be revisited in the trials and assessed for other physical attributes before recommended for Farmer Feel Effect program.

LF2015 Stage 4

Only 2 trials were planted for this series due to not enough 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 varieties were planted in RCBD with 4 replicates in Rarawai and Labasa. The results from both trials are discussed below.

Rarawai

This trial was planted in the Field 6 at Rarawai Estate in 2019 which has rich alluvial soil. The trial established well and all the cultivation work as well as trial evaluation activities (sampling and plot weighing) were carried out in a timely manner. The results from the trial are discussed below.

Table 1.16: Stage 4 LF2015 series bio-chemical data for Rarawai

Variety	Fibre (P)	POCS (P)	TCH (P)	TSH (P)
Mana	15.07	9.49	82	8
Naidiri	18.51	13.70	106	14
Viwa	17.24	13.37	76	10
LF15-321B	18.09	13.21	142	19
LF15-458	16.62	11.95	147	18
LF15-387	17.90	13.64	122	17
LF15-259	18.65	14.31	116	16
LF15-447	18.73	14.09	111	16
LF15-398	17.81	13.56	114	15
LF15-111	17.80	12.77	118	15
LF15-196	15.65	10.17	143	15
LF15-418B	17.96	13.55	102	14
LF15-308	16.26	11.19	114	13
LF15-250	17.54	12.67	98	12
LF15-451	18.78	14.07	87	12
LF15-386A	18.87	13.30	91	12
LF15-98	18.00	12.91	79	10
LF15-427	17.99	13.19	72	9
LF15-011	16.79	11.75	74	9
LF15-492	16.15	10.75	81	9
LF15-432	17.04	12.07	67	8

The varieties LF15-321B, LF15-458, LF15-387, LF15-259, LF15-447, LF15-398, LF15-111, LF15-196 and LF15-418B have been found to be comparable to the best standard, whereas the varieties LF15-308, LF15-250, LF15-451, LF15-386A, LF15-98, LF15-427, LF15-011, LF15-492 and LF15-432 were found to be comparable to the lowest standard.

These varieties will be monitored for consistency in the 1st ratoon before identifying any variety for the farmer feel effect program.

Labasa

Stage 4 trial of LF 15 was planted in August 19th 2019 in SRIF Estate, Labasa Sector. A total of 18 varieties were planted in 4 replicates. Each replicate had 2 commercial standard varieties. The summary of the trial data is provided in the table below followed by discussions.

Table 1.17: Stage 4 LF2015 series bio-chemical data for Labasa

Variety	Fibre (P)	POCS (P)	TCH (P)	TSH (P)
Mana	7.73	14.28	89	13
Naidiri	8.15	15.13	114	17
LF15 - 458	8.68	14.63	111	16
LF15 - 259	7.90	15.63	101	16
LF15 - 432	8.45	15.53	101	16
LF15 - 492	7.38	15.23	100	15
LF15 - 387	8.30	15.70	100	15
LF15 - 427	7.78	14.13	104	15
LF15 - 98	7.30	14.08	103	14
LF15 - 447	7.68	15.43	93	14
LF15 - 011	8.40	14.65	97	14
LF15 - 418 B	8.73	14.48	91	13
LF15 - 321 B	10.03	13.80	92	13
LF15 - 398	7.50	13.63	92	12
LF15 - 196	7.73	14.15	87	12
LF15 - 308	7.50	14.15	88	12
LF15 - 111	8.98	16.30	74	12
LF15 - 386 A	7.78	13.03	95	12
LF15 - 451	7.88	14.63	79	12
LF15 - 250	8.33	13.68	81	11

None of the varieties were 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. These varieties will be monitored in the 1st ratoon and recommended for propagation for Farmer Feel Effect program if there is improvement or consistency in the results.

LF2014 series

A total of 20 varieties are being propagated at Rarawai and Labasa for planting of LF2014 Stage 4 at Drasa, Rarawai, Penang and Labasa in 2021. The trial will be planted in RCBD design with 4 replicates and standards.

Farmer Feel Effect

One farmer each in Nukuloa and Lovu has been supplied with the seed material for LF11-233 whereas LF09-1707 seedcane is being propagated for the program at SRIF Estates in Drasa, Rarawai, Dobuilevu and Labasa.

LF2009 series

The LF2009 series Stage 4 was established in 2013 and 5 varieties were identified after scrutinizing all data from the 3 crop cycles and mill areas. The following Table 1.17 summarizes the data:

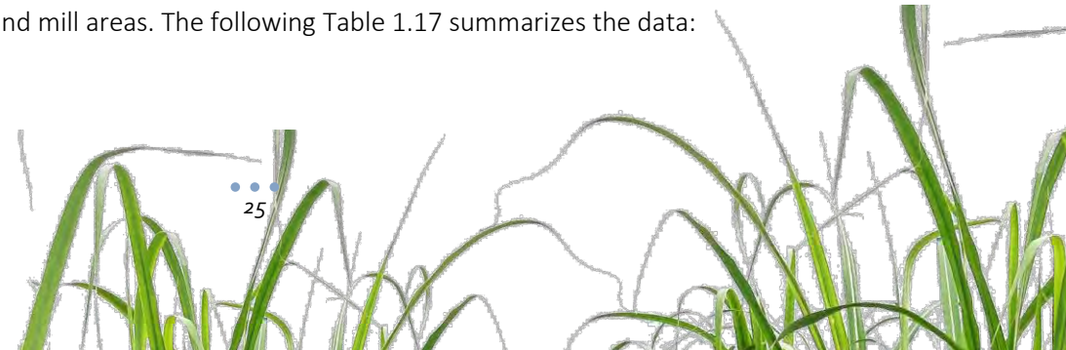


Table 1.18: Stage 4 LF2009 series bio-chemical data												
Variety	Fibre P	Fibre 1R	Fibre 2R	POCS P	POCS 1R	POCS 2R	TCH P	TCH 1R	TCH 2R	TSH P	TSH 1R	TSH 2R
Mana	9.25	13.32	7.22	15.47	9.74	14.28	125	128	49	19	9	7
Kaba	9.63	12.02	9.02	13.76	7.90	13.48	133	118	46	18	6	6
Naidiri	11.02	13.09	9.38	15.69	7.72	13.33	92	102	35	14	6	5
LF09-1707	11.23	12.71	8.47	15.62	10.50	13.19	144	125	57	22	10	7
LF09-1536	10.90	12.88	8.43	14.86	7.20	13.09	122	105	44	18	5	6
LF09-1558	12.34	13.53	8.44	12.99	13.83	12.81	111	122	52	14	13	7
LF09-1632	10.13	12.74	7.98	15.29	14.52	13.83	104	114	62	16	12	9
LF09-635	9.45	15.46	8.22	15.62	5.91	13.83	106	104	59	17	7	8

Out of the five varieties, LF09-1707 has been identified and currently being propagated for planting of large mill trial seedbed in 2021, planting of large mill trial in 2022 and conducting LMT in 2023-2024 and possible release in 2025.

LF2011 series

The seedcane for LF11-233 was given to two farmers in Lovu Sector, Lautoka and in Naloto Sector, Ba. The feedback from the farmers has been positive and they have promised to provide more details and possibly radio/ TV interviews after harvesting this variety in 2021.

Large Mill Trial

In 2020, large mill plots of variety LF11-233 was planted and will be sent to the mill in 2021 with Naidiri and/ or Ragnar. Following table shows the data for this variety.

Table 1.19: Bio-chemical data of promising variety LF11-233												
Variety	Fibre P	Fibre 1R	Fibre 2R	POCS P	POCS 1R	POCS 2R	TCH P	TCH 1R	TCH 2R	TSH P	TSH 1R	TSH 2R
Mana	6.88	9.00	9.57	13.35	12.10	15.02	116	125	62	16	15	10
Naidiri	9.38	10.44	10.05	11.84	13.32	16.06	114	135	70	14	18	11
LF11-233	8.10	10.08	10.54	12.98	12.45	14.70	106	91	77	14	13	11

Full report on the outcome of the mill trial will be presented in 2021 report.

Future work with Promising Varieties:

1. The promising varieties identified are propagated as early as 1st ratoon.
2. Consistency in data is seen in 2nd ratoon and the variety is pushed further into farmer feel effect program and propagated for large mill trial.
3. Conduct large mill trial.

2.0 CROP MANAGEMENT

ANALYTICAL LABORATORY

Introduction

SRIF is a leading provider of independent analytical services to cane farmers. The analytical laboratory acts as a link between the growers and the industry by providing analytical services for advisory and research programs. This service is essential due to the rising cost of fertilizers and to maintain optimum production in the future.

Analytical services provided at SRIF analytical laboratory includes soil, foliar and cane analysis. Soil and leaf samples are received from all sugar cane districts namely Penang, Rarawai, Lautoka and Labasa for fertilizer recommendation and from SRIF research trials. All analytical procedures are fully documented.

The in-house validated analytical methods give consistent and reliable lab reports on the samples. Grower service team has created a detailed sample and report tracking system to assure prompt communication to our growers on lab results and to maintain traceability on samples and reports. All cane farmers planning to plant must have their soils analyzed to get the correct fertilizer recommendation to achieve optimal production.

Summary

1. A total of two thousand and fifty-seven (2057) soil samples were received for analysis comprising of one thousand one hundred and ninety-nine (1199) advisory soil samples and eight hundred and fifty-eight (858) research soil samples.
2. Only four (4) plant samples were received for analysis for fertilizer recommendation.
3. A total of 2,501 sugarcane samples from various ongoing trials and experiments were analyzed in 2020 for quality indexes such as %pol, %brix, %fibre and the %POCS.

Table 2.1 Soil and plant samples received

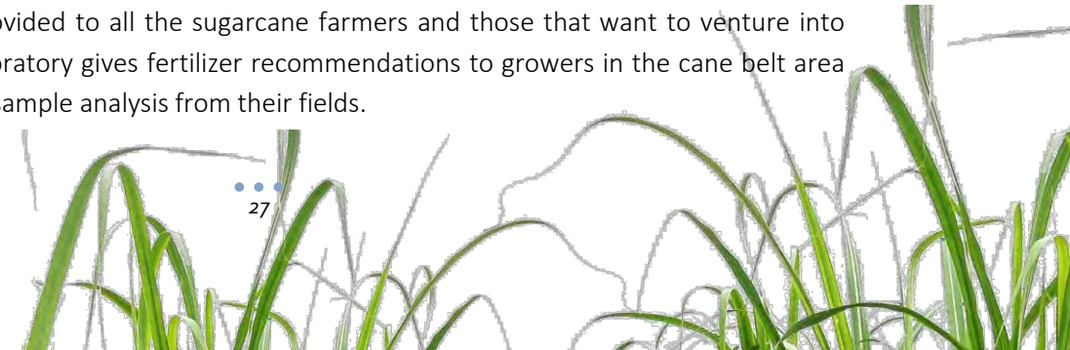
Type	Soil Status			Plant Status		
	Received	Analysed	Pending	Received	Analysed	Pending
Advisory	1199	1199	0	4	4	0
Research	858	511	347	0	0	0
Total	**2057**	**1710**	**347**	**4**	**4**	**0**

Recommendations

Improve turnaround time for analyzing and dispatching soil and foliar samples fertilizer recommendations. Soil and leaf samples received by the lab has a turn-around time of 2-6 weeks, from the date the sample is received - to the date fertilizer recommendation is sent to the respective sectors. Sometimes the farmers plant the cane before receiving the results and this defeats the purpose of analyzing soils. It is recommended soil samples are collected soon after first ploughing and sent for analysis so that there is ample time for analysis and providing recommendation before planting.

Beneficiaries

Farmers - fertilizer advisory service (FAS) which includes fertilizer recommendation and soil status for new farm assessment is provided to all the sugarcane farmers and those that want to venture into sugarcane farming. The laboratory gives fertilizer recommendations to growers in the cane belt area on the basis of soil and leaf sample analysis from their fields.



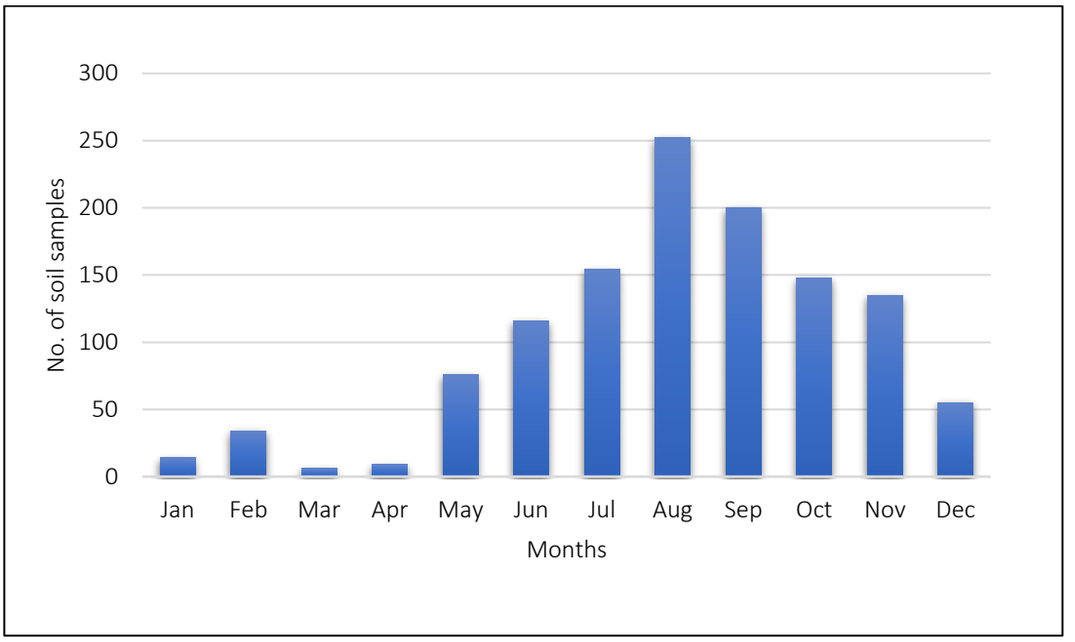


Figure 2.1 Total no. of advisory soil samples received per month

Plant Analysis

Analysis of plant is an extremely useful tool for growers. Not only can plant testing be used to monitor the nutrient status of plants but it can help identify nutrient deficiencies and imbalances. This allows growers to more effectively tailor their nutrient management programs to meet a crop's specific needs.

Nutrients Plant Analysis Measure

The SRIF analytical lab tests for total nitrogen, phosphorus, potassium, sodium, calcium and magnesium along with the micro nutrients like copper, iron, manganese and zinc.

Results will indicate whether each nutrient is within sufficiency or average ranges. The SRIF analytical laboratory had received only 4 plant advisory samples for analysis during 2020. All 4 samples have been analyzed and fertilizer recommendations sent for the next year ratoon crop.

Attachments

The institute continues to provide attachment training to University students to gain hands -on experience and in 2020 four students were the beneficiaries of this initiative.

Labasa Laboratory Setup

A laboratory similar to the one at Drasa has been setup in Labasa, which was fully operational from April 2020. All soil and water samples from all the sectors in Vanua Levu were analyzed there and fertilizer recommendations sent to the FSC extension team.

The instruments purchased for this lab are:

1. Atomic Absorption Spectrophotometer (PinAAcle 500) which has the ability to analyze all the macronutrients (calcium, magnesium, sodium and potassium) and micronutrients (copper, zinc, manganese and iron).
2. Lambda 320 UV Spectrophotometer which can analyze Phosphorus.

Calibration

A calibration test is carried out on all instruments before a batch of soil, leaf and cane samples is analyzed. Commercial standards are used for these calibration runs. A correlation coefficient of more than 0.995 is accepted.

Logs

Each time an instrument is in use, a log is filled which captures the date, time, the number of samples, the operator name, the elemental code and the calibration results. It also captures any machine malfunction, reason for breakdown or failure, corrective actions taken, date returned to use and change in maintenance. This helps in tracking and trouble-shooting (function checks).

TRAINING

Soil Sampling

A training was provided to the farm advisories (FA) of FSC on "Strengthening Farm Advisory Services" The benefits and importance of sampling were discussed, besides sampling procedures. Various chemical analysis, fertilizer recommendation and interpretation were explained. A field visit was also conducted whereby a representative of FSC demonstrated how they will take the soil samples for analysis.

Leaf Sampling

In the sugarcane belt area, 85% to 90% of the cane is ratoon crop. A refresher training on leaf sampling was conducted by the SRIF team to all the sector field staffs. Leaf samples are collected in plant crop and analysed to identify nutrient deficiencies. Information on the subject matter was distributed through factsheets, pamphlets and verbal instructions, which included field demonstration. Overall, a majority of the officers had managed to clarify doubts and promote better understanding and seriousness of the issue.

Grower Information Day

A grower information day with the theme "Improving Soil Health Through Green Manuring" was organized in January to educate growers on benefits of green manuring. The incorporation of green manure was demonstrated. In addition, importance of soil sampling and application of recommended rate of fertilizer to get optimum production was also discussed.

Extraneous Matter Project

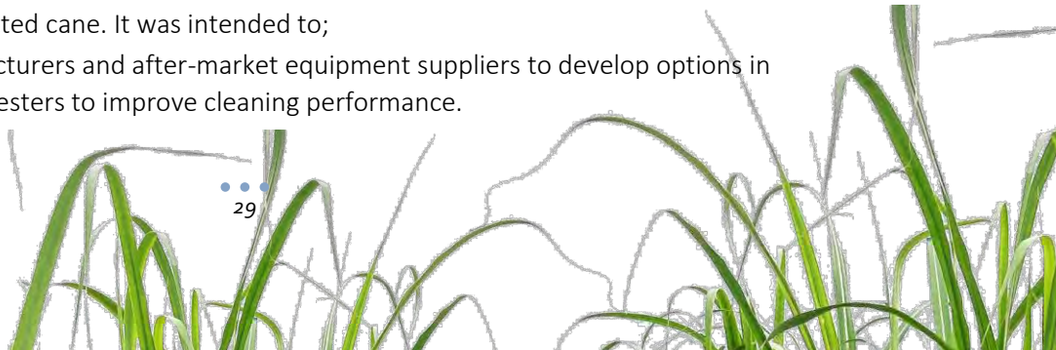
Executive Summary

Extraneous matter (EM) is any material processed in the mill other than clean billet canes. This project involved the collection of samples from lorries/cage bins queued at the mills, removing the extraneous matter from a set of samples, weighing and analysing it in the NIR to study the biochemical parameters (POCS, Brix, Purity, Fibre, and Pol)

Objective

This project's initial objective was to determine the percentages of extraneous matter acceptable for milling in mechanically harvested cane. It was intended to;

i.) Interact with manufacturers and after-market equipment suppliers to develop options in modifications of harvesters to improve cleaning performance.



ii.) Extend this information to the industry by developing "best practice" guidelines to minimize extraneous matters in billet cane.

This project's revised objective was to ascertain the level of extraneous matter and its impact on the biochemical parameters (POCS, Brix, Purity, Fibre, and Pol). This was achieved by:

i. Determining the weight of extraneous matter (tops, leaves, roots, weeds, and dirt) and millable cane in bags of samples of mechanically harvested billet cane.
ii. Determining the biochemical properties (POCS, Brix, Purity, Fibre, and Pol) of cane with extraneous matter and cane without extraneous matter and comparing the difference.
iii. Comparing the level of extraneous matter in billet harvested burnt and green cane at different conditions such as harvesting time and field condition (presence of weeds / no weeds).
iv. Quantifying the effects of extraneous matter on the millable cane.
v. Review harvester conditions for efficient harvesting

Materials & Methodology

Current conditions of the field and harvesting operations were considered, and data were evaluated. Trials had been conducted on a commercial scale and required considerable planning to have representative results. The samples were collected from the lorries and cage bins waiting in the queue at the mill. Eight bags (~20kg) of samples were taken manually (collected by hand) from each load and weighed. Then, four bags of the samples were hand-sorted into the clean cane and extraneous matter (leaves, tops, roots, trash, and loose dirt) components. These two components were weighed and recorded. The trash percent was then calculated (Ahmed and Alam-Eldin, 2015);

$$\text{Trash \%} = (\text{trash weight} \div \text{sample weight}) \times 100$$

The extraneous matter was discarded, and only clean cane from the four bags was analysed for biochemical parameters. The remaining four bags were examined directly for the extraneous matter, and biochemical parameters were recorded. Data were organized and compared for clean cane and cane with the extraneous matter according to the following treatments:

i. Time of Harvest – Early morning, Afternoon/Night & After the rain
ii. Field condition (weeds / no weeds)
iii. Green/Burnt harvest
iv. Type of harvester – Case 4000 (standard and modified extractor fan), Shaktiman, and others.

Trial Results

During the 2020 crushing season, 52 loads (lorries and cage bin) were sampled and analyzed for extraneous matter levels and its impact on biochemical parameters. The project commenced in late July, with preliminary studies being conducted for a total of 5 lorries/cage bins. Initially, two cage bins (~3 tons/bin) were brought to the SRIF office to measure the level of extraneous matter in the bin. The main objective was to measure the level of EM in the whole cage bin. However, it was very time consuming and labor-intensive to analyze the entire bin; thus, it was decided to analyze eight bags (~20kg/bag) per load to represent the whole sample. The project's consistency was hindered due to a reduced workforce and unfavorable weather conditions, making it difficult to get a consistent data set. Despite several hindrances, the trial analysis was conducted, and the following results were collated for different treatments.

Crop Harvest Type

Green Harvest

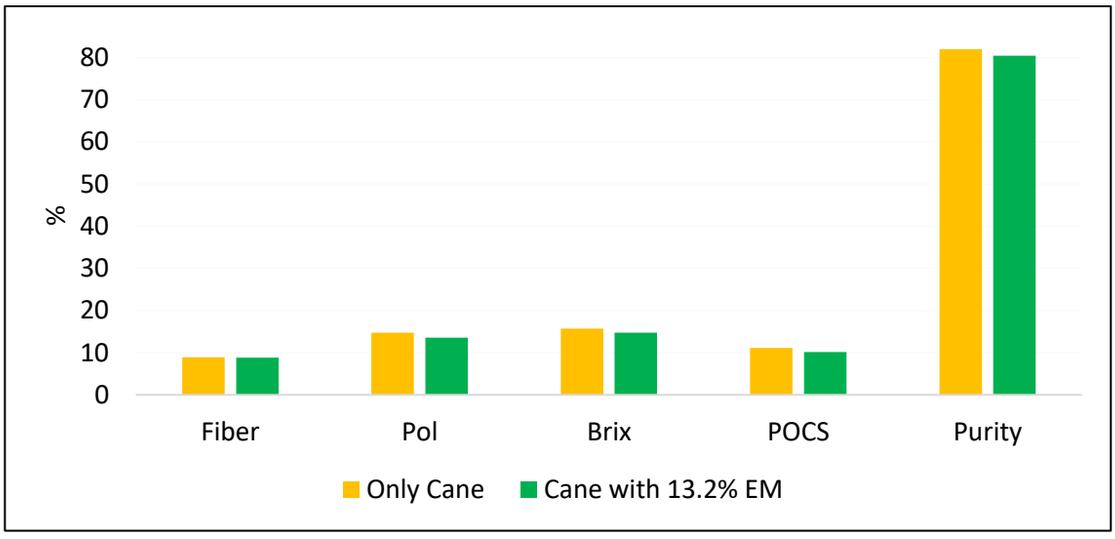


Figure 2.2 – Biochemical parameters of Green cane (with EM and without EM)

Figure 2.2 shows the biochemical parameters of green harvested billet cane, with and without extraneous matter. A total of 22 loads sampled had green cane. The range of extraneous matter levels was approximately 9.0% - 24.8%, with an average of 13.2%. An increase in the extraneous matter shows an evident 1 unit decrease in Brix and POCS in cane and 1.2 unit in Pol, affecting sugar production. There is a decrease in the Purity also by 1.5 unit.

Burnt Harvest

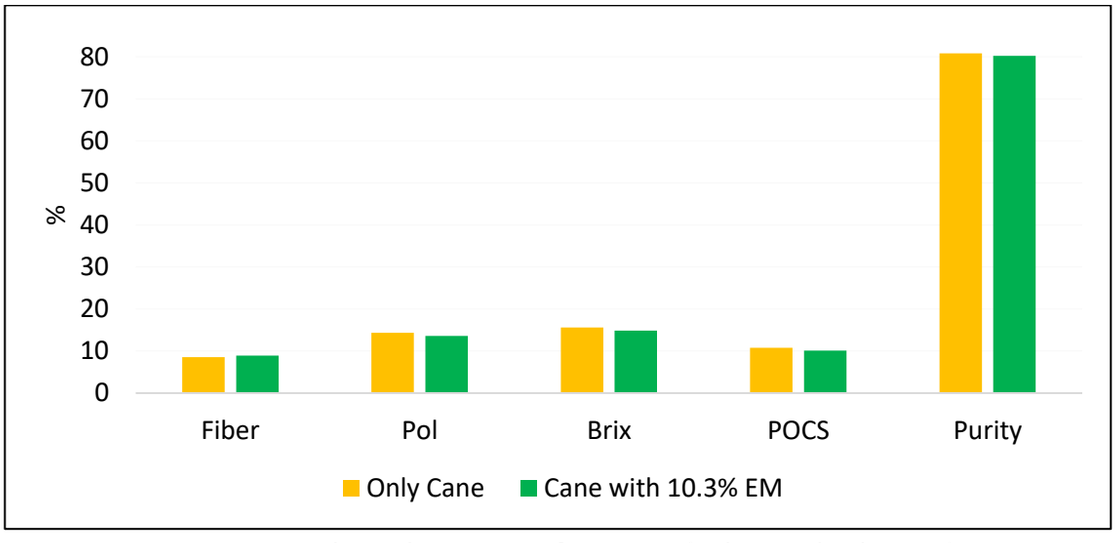
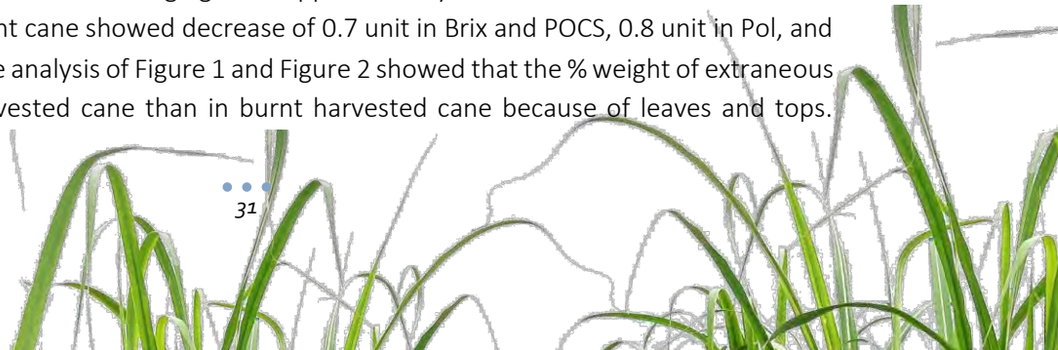


Figure 2.3 - Biochemical parameters of Burnt cane (with EM and without EM)

Figure 2.3 shows the biochemical parameters of burnt harvested billet cane, with and without extraneous matter. A total of 30 loads were sampled that contained burnt cane. There is an average of 10.3% extraneous matter in burnt cane ranging from approximately 5.1% - 21.2%. An increase in the extraneous matter in the burnt cane showed decrease of 0.7 unit in Brix and POCS, 0.8 unit in Pol, and 0.6 unit in Purity. Comparative analysis of Figure 1 and Figure 2 showed that the % weight of extraneous matter is more in green harvested cane than in burnt harvested cane because of leaves and tops.



However, observations made during the process showed that some burnt cane samples also had leaves contributing to the weight.

I. Field Condition

A. Clean field without weeds

Green Cane

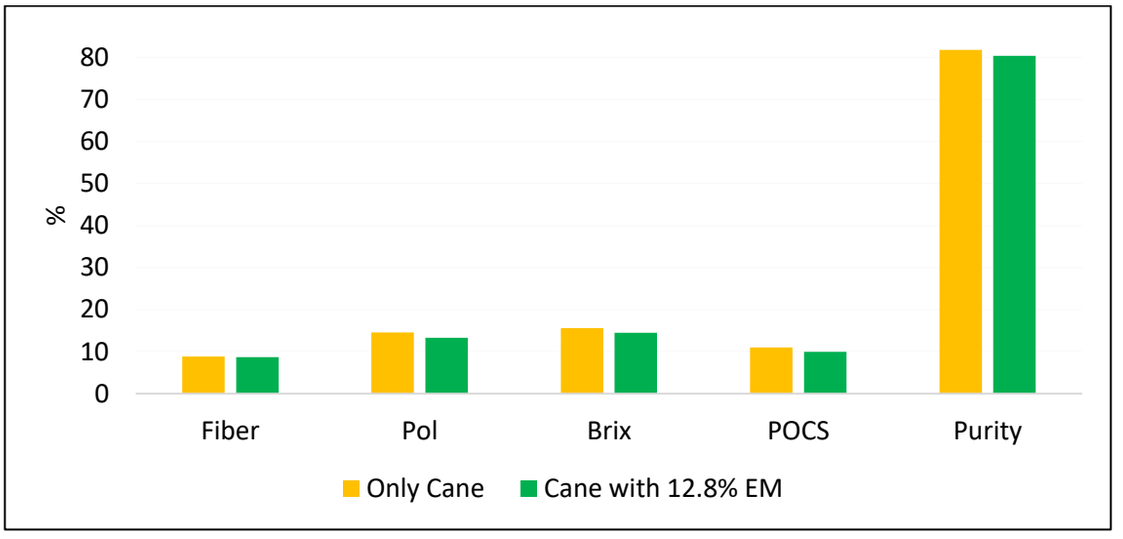


Figure 2.4 – Biochemical Parameters in green cane in a clean field

Figure 2.4 shows the biochemical parameters of green cane in a clean field, with and without extraneous matter. There was a total of 13 loads randomly chosen and sampled that were green and had a clean field without weeds. An increase of approximately 12.8% extraneous matter had a decrease of approximately 1.1 unit in Pol, Brix, and POCS. The level of extraneous matter ranged from 9.0% - 24.8%. The samples had no visible weeds in the process of removing of extraneous matter.

Burnt Cane

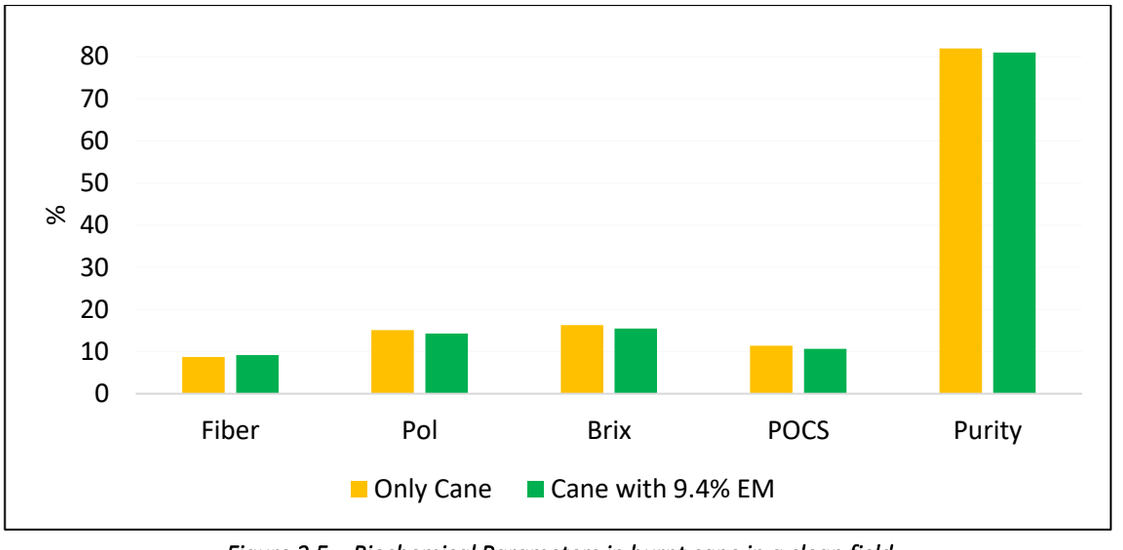


Figure 2.5 – Biochemical Parameters in burnt cane in a clean field

Figure 2.5 shows the biochemical parameters of burnt cane in a clean field, with and without extraneous matter. A total of 18 loads were sampled with an average of 9.4% extraneous matter

ranging from 5.1% - 16.8%. As per Figure 4, there is a decline in Pol, Brix, and POCS by approximately 1 unit with the presence of extraneous matter.

B. Dirty field with weeds

Green Cane

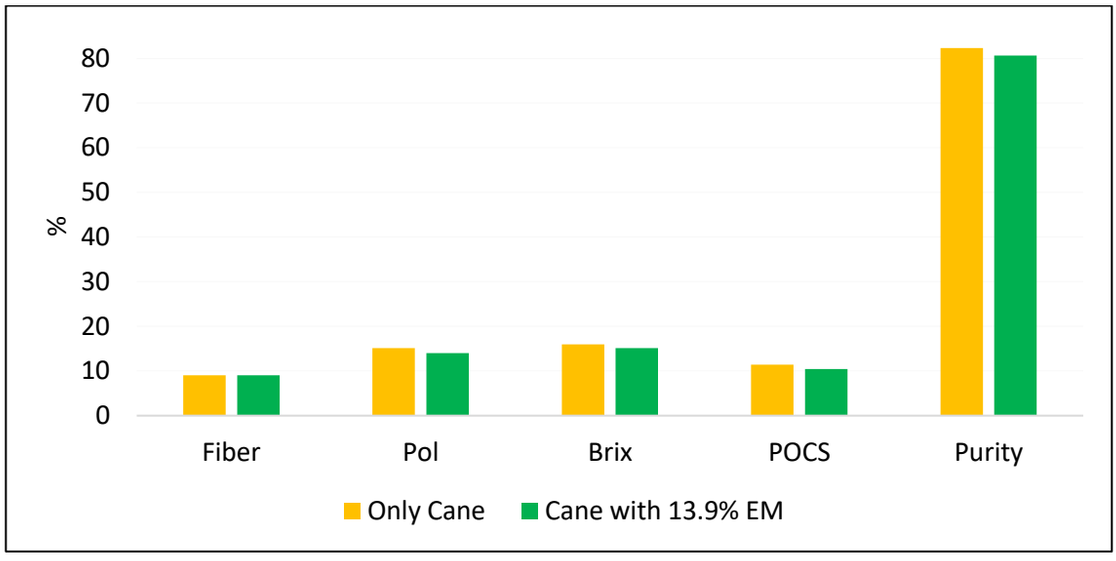


Figure 2.6 - Biochemical Parameters in green cane in a dirty field

Figure 2.6 shows the biochemical parameters of green cane in a dirty field, with and without extraneous matter. A total of 9 loads were randomly chosen and sampled that were harvested green from a dirty field. There was an average of 13.9% extraneous matter in this treatment ranging from 10.1% - 16.4%. A decline of approximately 1 unit in Pol, Brix, and POCS and 1.8 units in Purity was visible during the biochemical analysis.

Burnt Cane

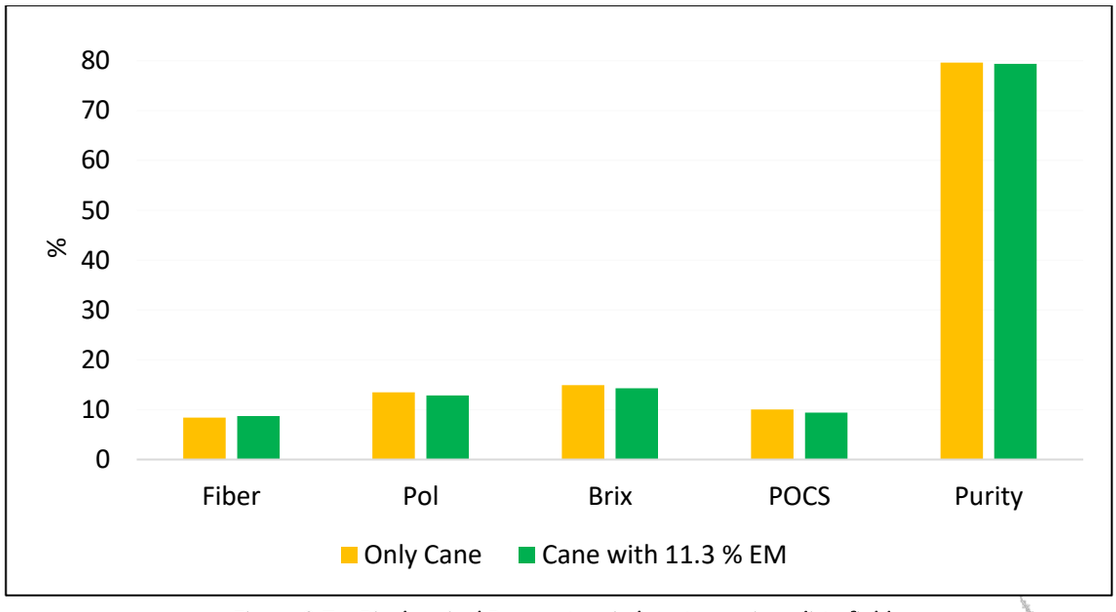


Figure 2.7 – Biochemical Parameters in burnt cane in a dirty field

Figure 2.7 shows the biochemical parameters of burnt cane in a dirty field, with and without extraneous matter. A total of 12 loads with burnt cane from a dirty field was randomly chosen and sampled. An average of 11.3% extraneous matter was calculated, ranging from 7.9% - 21.2%. A decline of 0.6 units in the Pol, Brix, and POCS was seen, and a drop of 0.2 units in Purity.

Table 2.2: Difference in the extraneous matter (%) between cane type in different field condition:

	Clean Field	Dirty Field	Difference
Green	12.8	13.9	1.1
Burnt	9.4	11.3	1.9
Difference	3.4	2.6	
Average	**11.1**	**12.4**	

Table 2.2 shows the difference in the extraneous matter between cane type in different field condition. The difference in extraneous matter in a clean field is 3.4% more in green cane than burnt cane and 2.6% more in green cane than burnt cane in a dirty field. The determination and evaluation of extraneous matter showed that there is an average of 12.4% extraneous matter in a dirty field and 11.1% extraneous matter in a clean field. There was a higher level of extraneous matter in a dirty field which was 1.1% and 1.9% in green and burnt cane, respectively. This indicated that a dirty field, with the presence of weeds and vines contributed to the weight. Although cane was burnt, the weeds were still visible and thus could have contributed to the weight.

II. Time of Harvest

A. Early morning Harvest

Data was organized for the early morning from 0100hrs to 0900hrs, assuming the impact of moisture (dew) on the extraneous matter and eventually on the biochemical parameters. It was assumed that the presence of dew makes the leaves dense thus makes it difficult to be blown out by the extractor fans.

Green cane

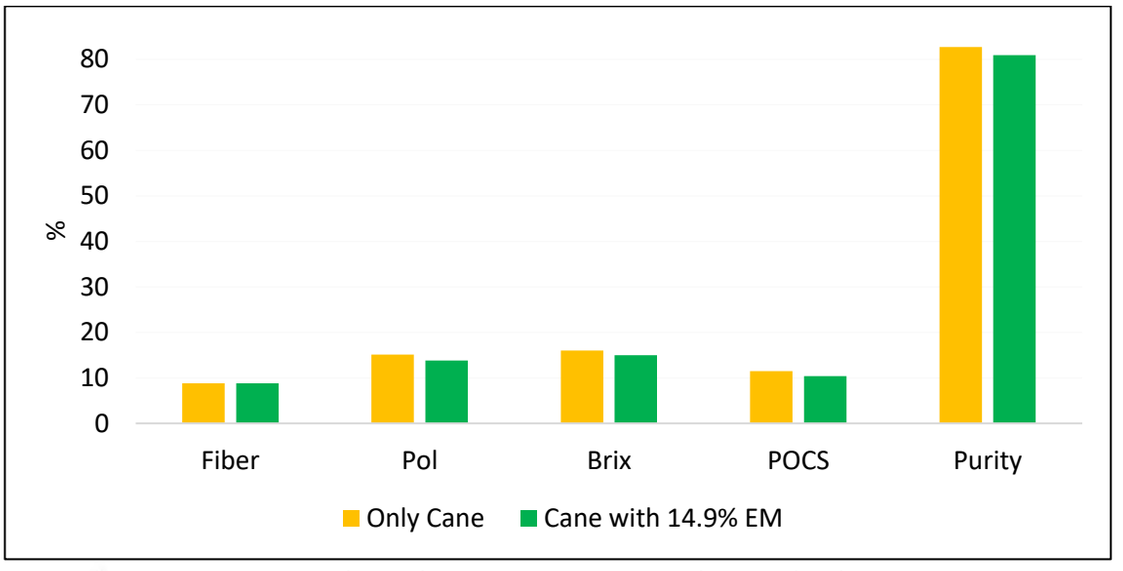


Figure 2.8 – Biochemical Parameters in green cane harvested early morning

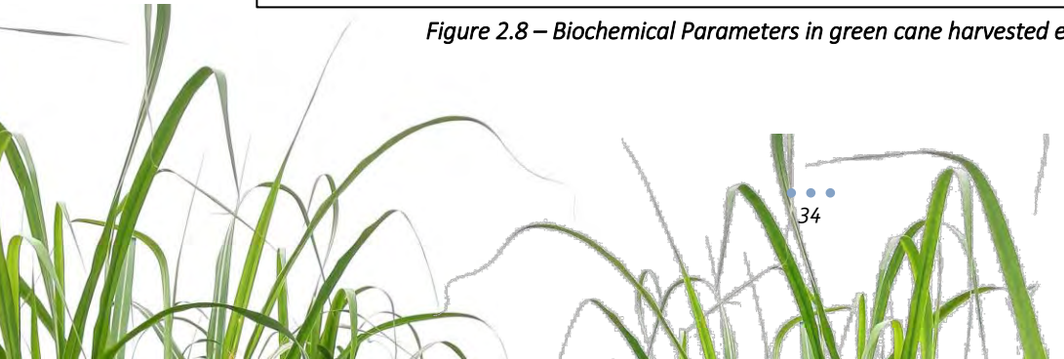


Figure 2.8 shows the biochemical parameters in green cane harvested early morning. A total of 10 loads were sampled with extraneous matter ranging from 10.5% to 24.8%. Approximately 1 unit decrease in Pol, Brix, and POCS in cane with an increase of 14.9 % extraneous matter.

Burnt Cane

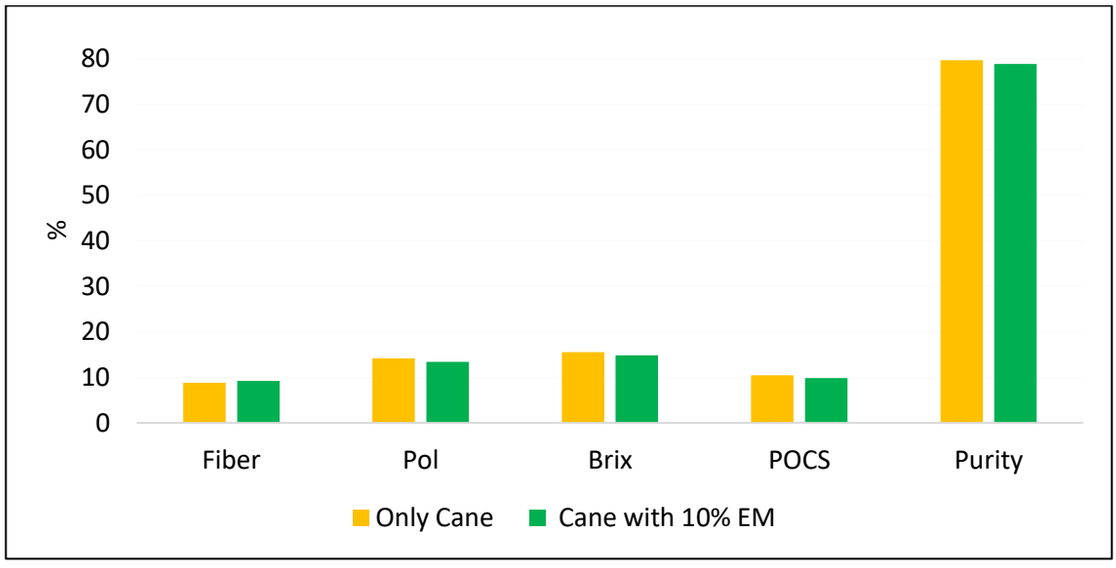


Figure 2.9 – Biochemical Parameters in burnt cane harvested early morning

Figure 2.9 shows biochemical parameters in burnt cane harvested early morning which has approximately 0.7 unit decrease in Pol, Brix, and POCS and 0.9% in Purity with an increase of 10 % extraneous matter. A total of 13 loads were sampled with extraneous matter ranging from 5.9% to 16.4%.

B. Afternoon – Night Harvest

Data was organized for the early morning from 1000hrs to 0100hrs assuming that the sunlight's heat will dry the moisture and allow easier blowing out of extraneous matter through the extractor fans.

Green Cane

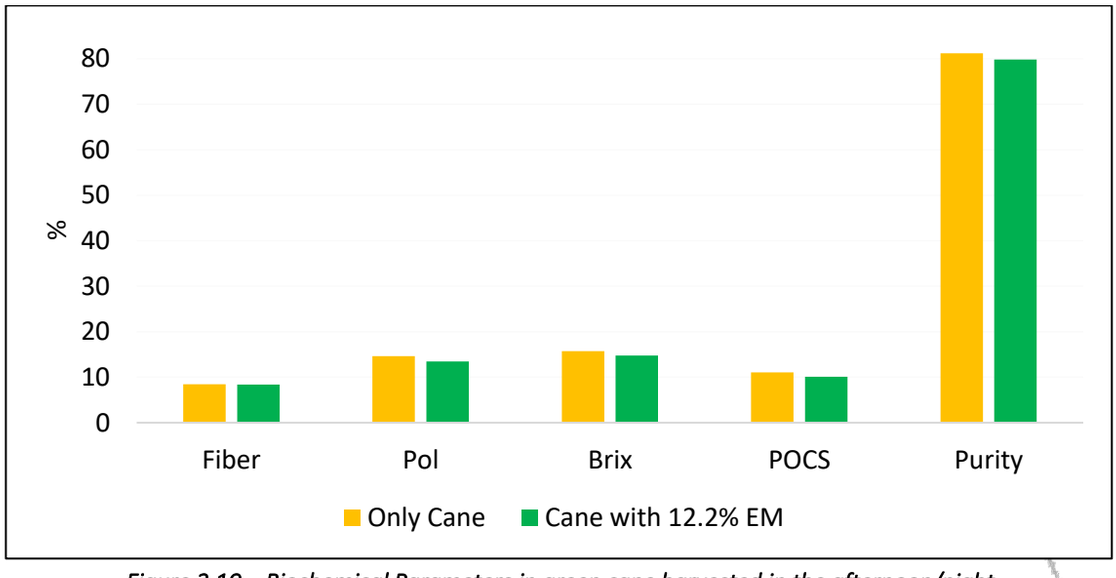


Figure 2.10 – Biochemical Parameters in green cane harvested in the afternoon/night

Figure 2.10 shows the biochemical parameters in green cane harvested in the afternoon/night with approximately 1 unit decrease in Pol, Brix, POCS and 1.4 % in Purity with an increase of 12.2 % extraneous matter. A total of 10 loads were sampled with extraneous matter ranging from 9.0% to 16.4%.

Burnt Cane

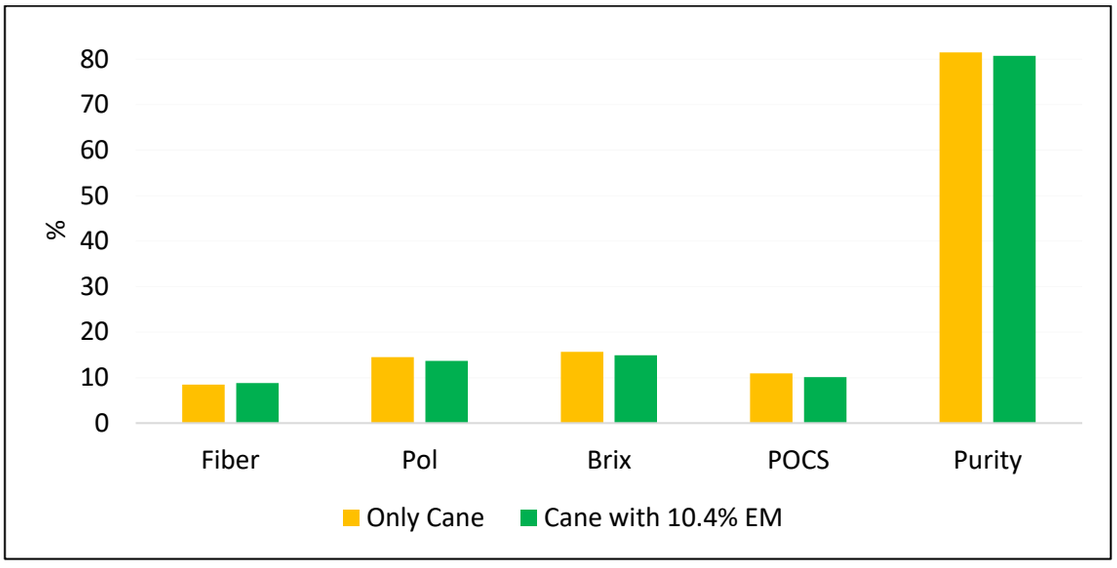


Figure 2.11 – Biochemical Parameters in burnt cane harvested in the afternoon/night

Figure 2.11 shows the biochemical parameters in burnt cane harvested in the afternoon/night with approximately 0.8 unit decrease in Pol, Brix, POCS, and Purity in cane with an increase of 10.4 % extraneous matter in burnt cane harvested in the afternoon – night. A total of 14 loads were sampled with extraneous matter ranging from 5.1% to 21.2%.

C. After Rain Harvest

Green Cane

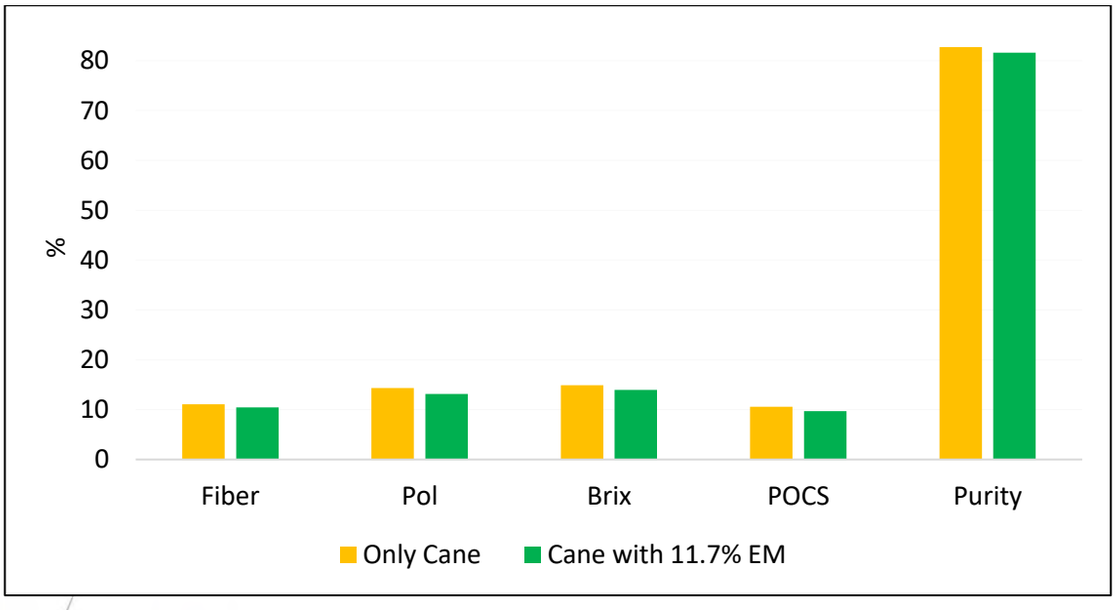


Figure 2.12 – Biochemical Parameters in green cane harvested after rain

Figure 2.12 shows the biochemical parameters in green cane harvested after rain. Only 2 loads with green cane were available just after the rain at the mill that was chosen for sampling. An average of 11.7% extraneous matter was determined with Pol, Brix, POCS, and Purity having an average of 1±0.1 unit decline in cane with extraneous matter.

Burnt

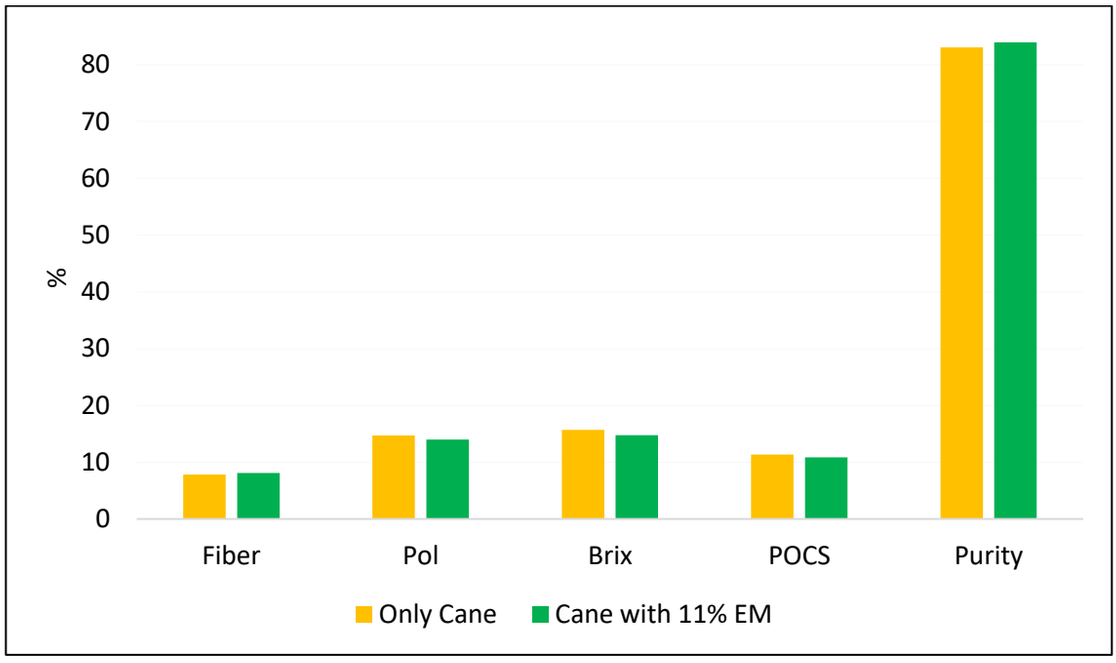


Figure 2.13 – Biochemical Parameters in burnt cane harvested after rain

Figure 2.13 shows the biochemical parameters in burnt cane harvested after rain. Only 3 loads with burnt cane were available just after the rain which were chosen for sampling. An average of 11% extraneous matter was determined in burnt cane harvested after rain.

As per Figure 12, with extraneous matter, the Pol decreased by 0.7 units, Brix decreased by 0.9 units, and POCS decreased by 0.5 units. However, Purity increased by 0.9 units with the extraneous matter, which could have been due to sampling error. The results for the treatment with the time of harvesting was not as expected. Table 2.3 shows a higher level of extraneous matter in the afternoon–night than green cane harvested after rain and burnt cane harvested in the morning.

Table 2.3: Difference in the extraneous matter between cane type in different harvesting time:			
	Early Morning	Afternoon - Night	Rain
Green	14.9	12.2	11.7
Burnt	10	10.4	11

Green cane harvested in the morning and Burnt cane harvested after rain showed a higher extraneous matter than the other treatments.

III. Harvester Type

Lorries with harvested cane chosen for sampling were from different harvesters as per Table 2.4.

Table 2.4: Difference in the extraneous matter between cane type in different harvesters

Harvester Type	Extraneous Matter %	
	Green	Burnt
Case 4000 (regular)	14	11
Case 4000 (modified extractor fan)	10	14
Case 7700	13	12
Shaktiman	15	17

Table 2.4 shows that cane harvested by Case 4000 with a 4-blade extractor fan had 10% EM only. The EM percentage in the burnt cane is higher with this harvester because cane was harvested after rain, and a lot of mud and dirt was observed that contributed to the increase in EM. There were limited lorries with sugarcane harvested from Shaktiman. However, the average % EM difference when comparing a Case 4000 and Case 7700 harvester with Shaktiman is not extreme. The EM percentage in the burnt cane is higher in Shaktiman due to presence of mud and dirt. Taking the results into consideration, harvester Case 4000 with a modified extractor fan could reduce % EM.

Conclusion

The level of extraneous matter in billet harvested cane is a major concern in the mills. It was noted that extraneous matter was approximately 2.9% higher in green cane than burnt cane irrespective of different treatments focused in this project. The difference was mainly due to tops, leaves, roots and dirt. The increased EM reduces juice purity, increases sugar production cost, and causes a consequent drop in POCS, resulting in high TCTS (Lionnet, 2016). It also decreases sucrose content in the total cane and increases the fibre content.

Based on the results obtained, it can be concluded that extraneous matter has adverse effects on bin weight and the biochemical parameters affecting crystal sugar production. It was also evident that there is a decline in the Pol, Brix, POCS, and Purity with an increase in the extraneous matter. An average of 12% extraneous matter increase leads to approximately 1 unit decline in Pol, Brix, POCS, and Purity. It can be concluded after the progress of the project that an acceptable level of extraneous matter is difficult to ascertain due to the imprecise sampling method and not practical to measure continuously during crushing in the current setup at the mills. Thus, considerable research on the sampling method needs to be carried out further to ensure realistic and accurate commercial level results.

Recommendation

i.) SRIF, together with FSC, should review the sample collection process to avoid biases in results
ii.) Set up theNIR system in the mills for continuous measurements of bio-chemical parameters and extraneous matter
iii.) SRIF needs to do more trials for this project from different areas to develop improved harvesting operations and get more precise data to make applicable recommendations to the industry.
iv.) Trials on cane loss in the field to be conducted
v.) SRIF requires more field staff to allow no delay in the project's progress.
vi.) A monitoring and enforcement committee comprising of stakeholders should be formed to implement recommended procedures for efficient harvesting.

Photographs

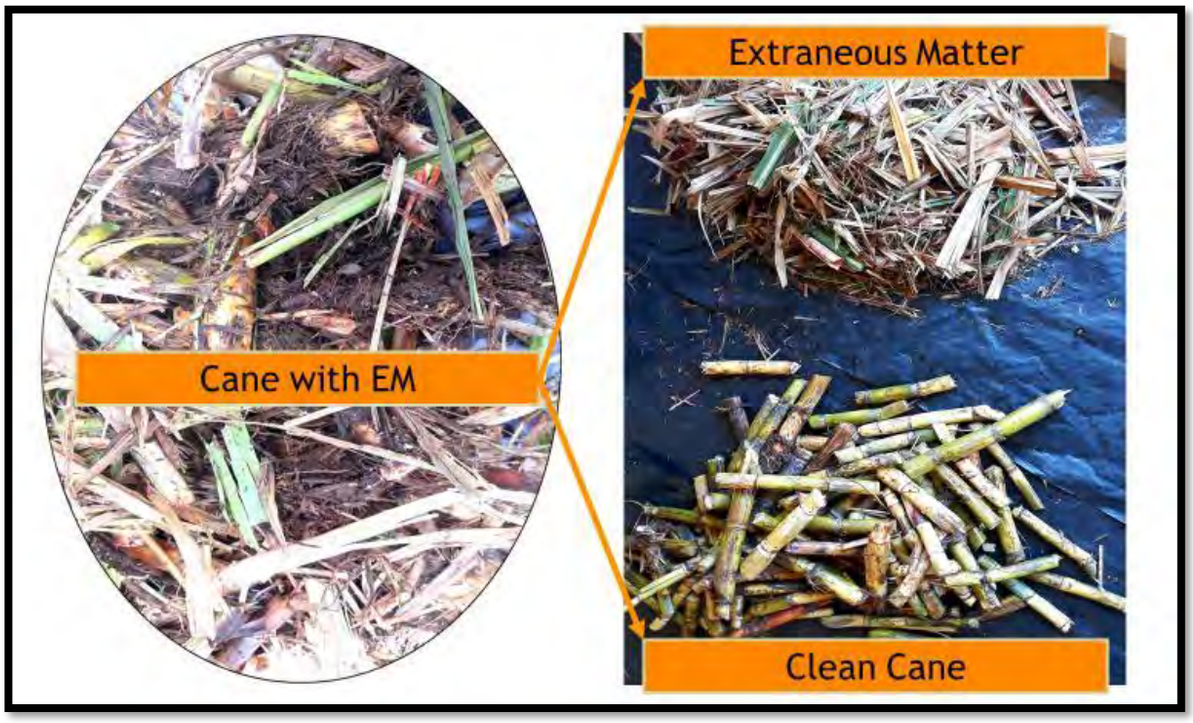


Figure 2.14: Sample processing – separation of millable cane & extraneous matter

Figure 2.15: Samples processed through SpectraCane NIR for biochemical parameters at SRIF facilities.

Figure 2.16: Observation of samples with a lot of tops, variable billet sizes, and billets with rough cuts indicating blunt harvester blades.

Figure 2.17: Sample collected after rain showed huge clumps of mud, weeds & vines

Maturity Trend

The experiment was conducted at SRIF, Drasa, Lautoka where maturity trend of 6 commercial varieties were studied from May to August 2020. Samples were harvested early morning and analyzed through NIR for biochemical indexes, fortnightly, for the first two run and weekly thereafter. Details of the trials are as follows:

Trial	:	Maturity Trend Study
Location	:	Drasa, Lautoka
Soil Type	:	Humic latosols (medium fertile soil) with clay soil texture
Varieties	:	LF91-1925, Mana, Naidiri, Qamea, Ragnar, Viwa

The number of samples analyzed every week varied, however, there were 12 weeks of sampling from 14th May to 7th August. The data for every sampling to represent the analysis carried out is presented in table 2.5 and figure 2.19 The weather observations rainfall, maximum temperature and minimum temperature were recorded 7 days prior to sampling and for the duration of the trials.

Table 2.5: Weekly POCS

Varieties	%POCS readings by date											
	14/05	28/05	04/05	11/06	19/06	26/06	03/07	10/07	17/07	24/07	31/07	07/08
LF91-1925_F24	8.1	8.28	8.50	8.87	9.90	10.79	11.63	11.79	12.74	13.02	13.48	13.34
Mana_F8	4.7	7.21	5.93	13.27	6.82	7.26	7.72	8.78	9.31	8.94	9.62	10.04
Naidiri_F8	6.7	8.63	9.16	14.43	9.60	9.93	11.00	11.41	11.81	11.34	12.49	13.24
Qamea_F24	8.3	9.38	11.11	9.12	9.82	11.32	11.57	12.34	12.58	12.10	12.74	13.25
Ragnar_F8	5.6	7.81	5.08	8.55	8.58	8.29	9.14	10.00	10.17	9.40	11.05	13.00
Viwa_F11	10.0	9.84	11.44	8.87	10.78	10.85	11.56	11.57	12.08	Harvested	Harvested	
Naidiri_F10		11.61	12.17	8.76	12.38	11.82	12.67	13.16	14.32	12.55	13.99	13.52
LF91-1925_F10		9.42	10.59	9.50	10.74	10.49	10.61	12.33	12.20	12.62	12.87	12.95

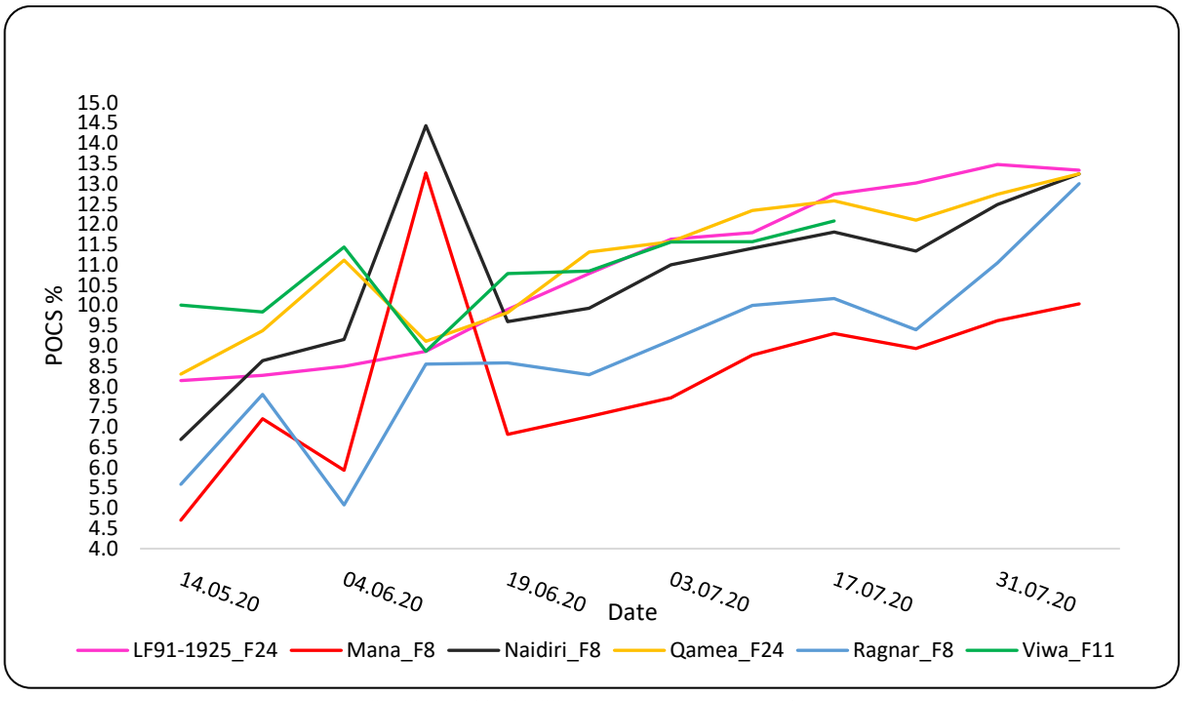
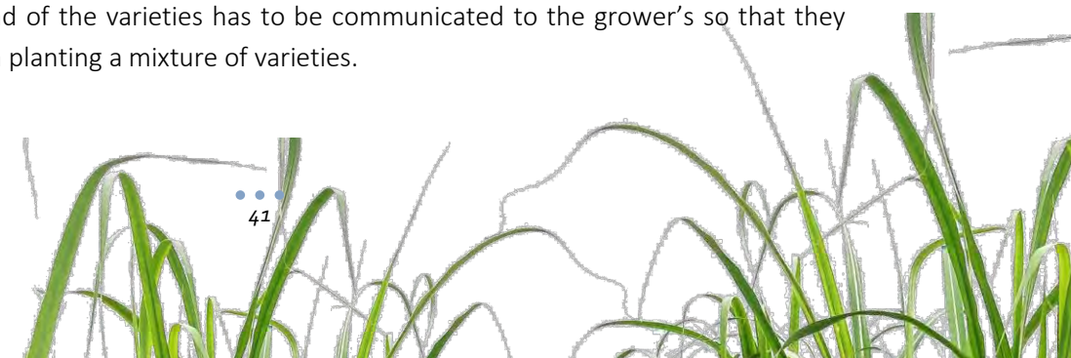


Figure 2.18: Weekly POCS content in commercial varieties

The graph above shows that generally amongst the varieties under study, there is an increase in %POCS from May to August. The sucrose content in all varieties rises from mid-June onwards that is expected as the varieties go through the maturity phase from May onwards.

Closer observation of the data indicates that the varieties Naidiri, Viwa, Qamea and LF91-1925 have higher sucrose content from mid-June to early August and these varieties are early maturing. The sucrose content of Mana and Ragnar are lower in the same duration and these varieties are mid-late maturing. The maturity trend of the varieties has to be communicated to the grower's so that they understand the benefit from planting a mixture of varieties.



Currently Mana which is a mid-late season maturing, is the dominant variety and farmers are very reluctant to plant other varieties. Grower demonstration trials have to be planted in all sectors so that the potential of early maturing varieties can be clearly understood by the growers and a powerful persuasion drive is needed to convince the growers on the advantages of planting varieties with different maturity pattern on their farms. Having early, mid and late maturing varieties will ensure continuous supply of matured cane from the start of the crushing season until closing.

Brix

The weekly Brix data for the varieties are presented in the table below.

Table 2.6: Weekly Brix

Varieties	%Brix readings by date											
	14/05	28/05	04/05	11/06	19/06	26/06	03/07	10/07	17/07	24/07	31/07	07/08
LF91-1925_F24	13.4	12.94	13.01	14.48	14.43	15.07	15.70	15.93	16.99	16.54	17.13	17.15
Mana_F8	10.6	12.32	11.79	13.27	12.58	12.69	13.28	13.83	14.87	13.75	14.48	14.17
Naidiri_F8	11.9	13.43	13.23	14.43	14.28	14.21	15.28	15.67	16.39	15.39	16.67	17.05
Qamea_F24	13.3	13.71	15.11	15.04	14.34	15.50	15.79	16.71	16.86	16.13	17.04	17.09
Ragnar_F8	11.2	12.06	10.89	13.99	13.89	13.18	14.13	14.58	14.38	14.20	15.67	17.14
Viwa_F11	13.8	13.78	14.92	14.48	14.81	14.85	15.60	15.55	15.74	Harvest	Harvest	
Naidiri_F10		14.20	15.70	13.58	16.21	16.00	16.93	17.05	17.71	16.55	18.04	17.41
LF91-1925_F10		13.99	14.60	15.00	15.02	14.99	15.32	16.30	15.95	16.71	16.77	17.06

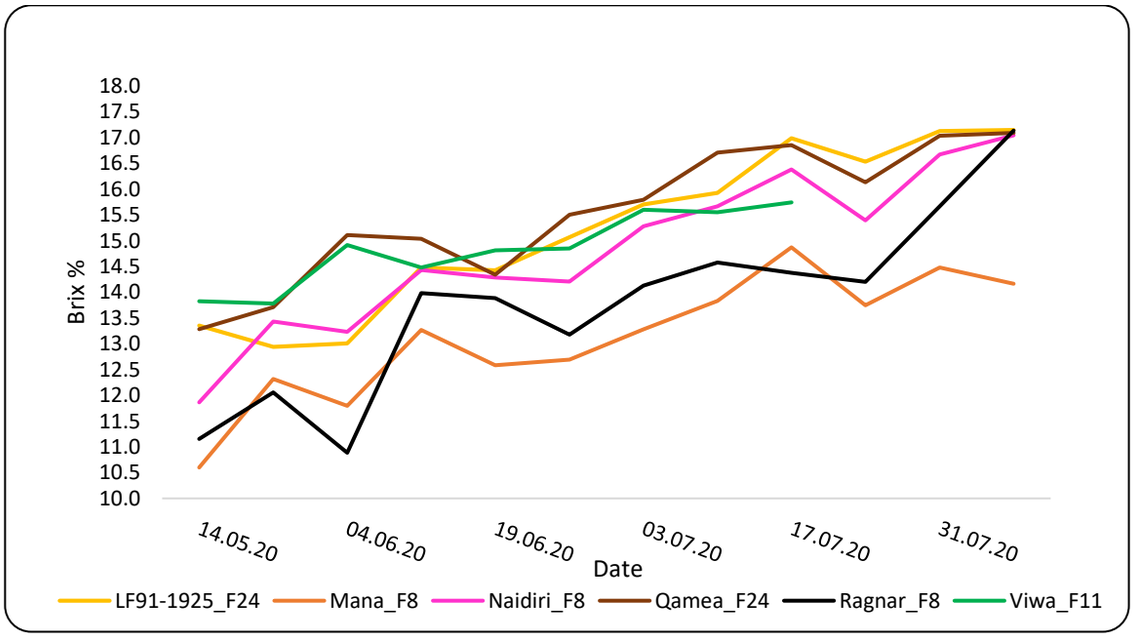


Figure 2.19: Brix content of Varieties

The Brix content of the varieties Naidiri, Viwa, LF91-1925 and Qamea were higher than Mana and Ragnar over the duration of this trial. These varieties are early maturing. The brix value of Mana was lower than the rest of the varieties and this was expected as Mana is a mid to late maturing variety.

Generally, the Brix content in the varieties were lower than you would actually get for the same varieties in the same duration. This could be due to age of the cane at the sampling date as the varieties analyzed were less than 12 months old.

Purity

The weekly Purity data for the varieties are presented in the table below.

Table 2.7: Weekly Purity

Varieties	%Purity readings by date											
	14/05	28/05	04/05	11/06	19/06	26/06	03/07	10/07	17/07	24/07	31/07	07/08
LF91-1925_F24	75.6	75.00	76.44	74.17	80.86	82.89	84.58	84.60	85.23	87.82	87.82	87.18
Mana_F8	63.8	73.49	66.83	74.97	71.05	72.97	73.74	77.33	76.78	78.42	79.37	82.62
Naidiri_F8	72.5	76.25	79.39	74.48	79.93	81.77	83.20	83.81	82.91	84.38	85.22	87.12
Qamea_F24	76.6	79.03	82.25	73.78	80.81	83.92	84.09	84.49	84.05	85.21	85.14	86.98
Ragnar_F8	68.1	77.24	64.38	74.10	76.12	76.78	78.17	80.90	79.59	79.17	82.21	85.86
Viwa_F11	83.5	80.27	84.45	74.17	83.85	84.02	84.70	84.97	86.55	Harvest	Harvest	
Naidiri_F10		87.70	84.90	76.62	86.21	84.51	85.19	86.78	89.30	85.84	87.06	87.08
LF91-1925_F10		78.09	81.67	75.45	82.82	81.82	81.25	85.69	85.74	85.60	86.47	85.90

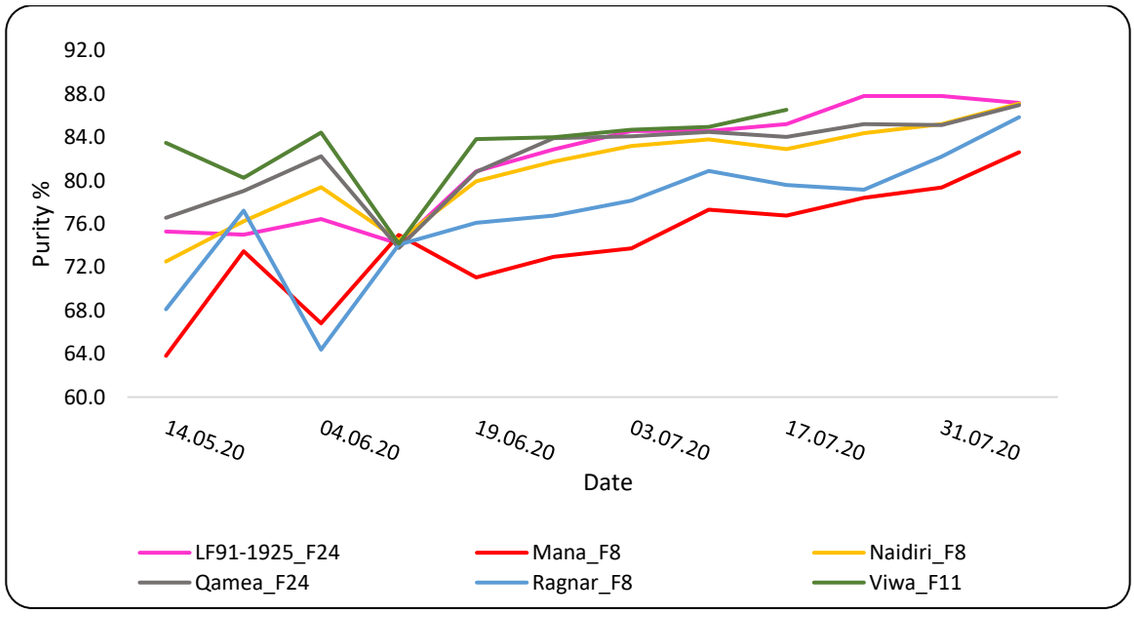


Figure 2.20: Purity of all Varieties

A cane crop can be harvested if it has attained a minimum of 16% sucrose and 85% purity. Based on this assumption, the varieties LF91-1925, Naidiri, Qamea and Viwa attained this level around mid-July. The purity levels otherwise were lower. The purity levels in Mana and Ragnar were lower than 85% until late July.

3.0 CROP PROTECTION

HIGHLIGHTS

Spore Trap Detection & Contingency Planning of Sugarcane Smut

- Varieties sent to Sugar Research Australia for disease screening

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

- Mass production of Nitrogen fixing bacteria for black gram and sugarcane inoculation
- 3 field trials under close monitoring and related pot trials conducted.

Integrated pest management of sugarcane termites, *Coptotermes gestroi*

- Re-survey of sugarcane belt areas
- Assessment of farms: small mill analysis
- Management of termite fields with the application of Fipronil powder in collaboration with Biosecurity Authority of Fiji.

Contingency Planning of Fall Armyworm

- Pheromone trapping and Scouting

RECOMMENDATIONS

Spore Trap Detection & Contingency Planning of Sugarcane Smut

- ✓ Multiplication of smut resistant varieties (Kiuva, Vomo and Vatu) in all mills
- ✓ Improve on communications and responsibilities of the Smut committee

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

- ✓ More pot trials to be conducted to study the influence of N-Fixing bacteria inoculation over the time span of a year.
- ✓ Staffs to get trained for mass production and quality standards.

Contingency Planning of Fall Armyworm

- ✓ GPS markings of all traps
- ✓ Monthly checking of all traps

NEMATOLOGY

Screening sugarcane varieties for tolerance to Plant Parasitic Nematodes

Unlike many plant diseases, the problem from plant-feeding nematodes comes from the populations in the soil within the field. A survey was carried out in 2017 to assess the occurrence and population density of plant-parasitic nematodes (PPN). From the survey, 10 species of PPN (table 3.1) were identified that are present in sugarcane growing soils of Fiji which may be causing damage to the crops. However, further studies are needed to confirm this and develop management strategies.

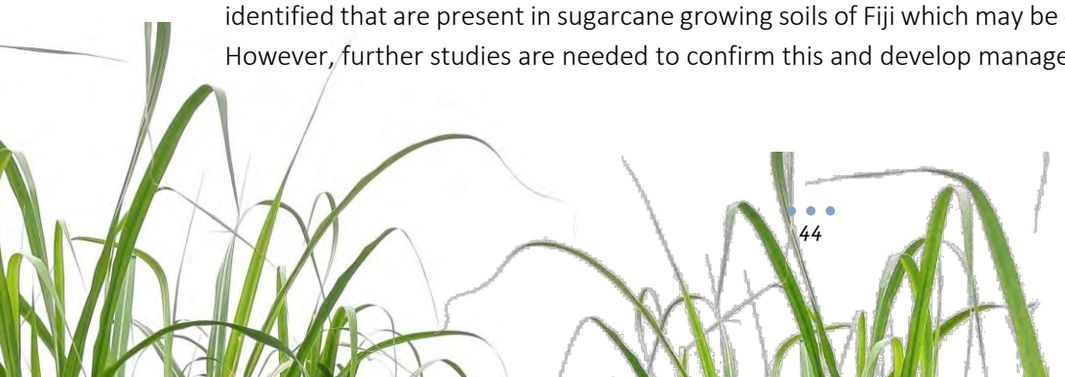


Table 3.1: Population density per 5ml of 200g soil sample												
District	Parameter	Lesion	RKN	Renifrom	Ring	Stubby	Dagger	Spiral	Stunt	Pin	Lance	FLN
Rakiraki	Absolute frequency (%)	88	58	60	50	8	8	98	15	3	33	100
	Relative Density (%)	12	13	13	4	0	0	56	0	0	2	24
BA/Tuva	Absolute frequency (%)	86	90	81	53	17	45	92	15	2	17	100
	Relative Density (%)	18	12	26	6	1	4	29	1	0	2	40
Lautoka	Absolute frequency (%)	82	85	67	55	20	53	90	3	0	18	100
	Relative Density (%)	21	26	18	6	1	6	20	0	0	1	34
Nadi	Absolute frequency (%)	84	74	54	46	22	32	80	16		10	100
	Relative Density (%)	17	21	18	8	2	3	31	1	0	1	34
Sigatoka	Absolute frequency (%)	70	47	57	60	7	7	70	7		10	100
	Relative Density (%)	20	8	32	10	1	0	27	1	0	1	7
Labasa	Absolute frequency (%)	84	74	54	46	22	32	80	16		10	100
	Relative Density (%)	29	24	11	6	1	0	28	0	0	0	15

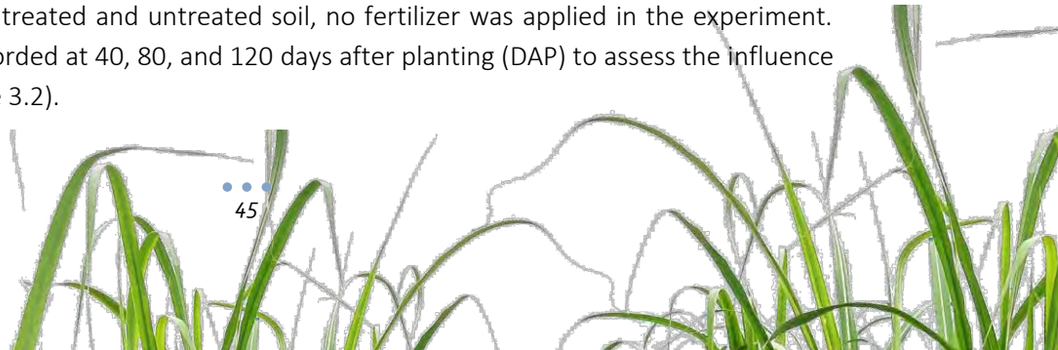
The extent of damage caused by nematodes depends on a wide range of factors, such as their population density, the virulence of the species or strain, and the resistance (the ability of the plant to reduce the population of the nematode) or tolerance (the ability of the plant to yield despite nematode attack) of the host plant. Other factors also contribute to a lesser extent, including climate, water availability, soil conditions, soil fertility, and the presence of other pests and diseases.

Although we have some knowledge on the nematode–crop relationship and influencing factors much depends on the adoption of best farming practices to reduce damages caused by the nematodes. According to Vaughan Spaull of the South African Sugarcane Research Institute (Vaughan S., 2003), it has been estimated that nematodes causes more than a million tonnes loss of sugarcane crop in a conducive environment.

To overcome the issues related to sugarcane yield decline, it is recommended to practice planting green manuring as a break crop, it will help to increase the population of the beneficial organism in the soil which itself becomes a biological control for a pathogenic organism. The Sugar Research Institute of Fiji has been conducting trials to find out ways to manage the plant-parasitic nematodes.

The pot trials were carried out from 2019 to 2020 to test the influence of plant-parasitic nematodes on different sugarcane varieties that are commercially grown. The cultivars that were included in the trials were Vomo, Kaba, Mali, Ragnar, Beqa, Kivua, and Vatu. The pot trials were carried out inside the poly house using commercial sugarcane varieties to test for PPN tolerance using treated and untreated soil. In this trial, two types of soil were used: the treated and untreated soil.

The untreated soil was collected from a farmer's field which showed a high density of PPN. The soil was sterilized at 120◦C for 20 minutes in an autoclave to get treated soil. A single seed sett was planted in each five-liter pot filled with treated and untreated soil, no fertilizer was applied in the experiment. Data on plant height was recorded at 40, 80, and 120 days after planting (DAP) to assess the influence of PPN on plant growth (table 3.2).



A combination of plant-parasitic nematodes was observed in the untreated soil used in this study. The collected data were compared among the treatment (treated and untreated soil) and the variety at the plant height of 40, 80, and 120 DAP using the general ANOVA. The statistical analysis data revealed that there was no significant difference in the means of plant height in the two groups (treated and untreated) at 40 (p=0.50) and 80 DAP (p=0.90).

However, the two groups have shown significant differences at 120 DAP ($p \leq 0.0098$). Further analysis was carried out between the cultivar and the treatment. There was a significant difference between the cultivar and the treatment at 80 (p= 0.041) and 120 DAP (p= 0.0001) whereas there is no significant difference at 40 DAP. Based on the result, the pairwise comparison was done between the two groups with the cultivars. The mean values amongst them were significantly different.

Table 3.2: Impact of plant-parasitic nematodes on different varieties in treated (T) and untreated (UT) soil, according to the plant height

Varieties	Treatment	40 DAP	80 DAP	120 DAP
Kiuva	Treated	21.75 bcdef	42.75 cde*	63.50 cde
	Untreated	21.25 cdef	58.25 a*	46.00 efg
Vatu	Treated	23.75 bcde	55.25 ab	56.0 cdef*
	Untreated	24.50 bcd	50.75 abc	91.75 ab*
Mali	Treated	31.25 a	48.75 abcd	49.50 defg
	Untreated	28.00 ab	43 cde	99.25 a
Kaba	Treated	16.75 f	43.25 cde	29.00 g*
	Untreated	18.00 def	47.50 bcd	75.75 bc*
Ragnar	Treated	21.00 cdef	39.00 def	75.25 bc
	Untreated	19.50 cdef	34.00 efg	89.25 ab
Vomo	Treated	24.75 abc	31.50 fg	37.50 fg
	Untreated	20.00 cdef	27.75 g	37.50 fg
Beqa	Treated	17.25 ef	32.75 fg	70.75 bcd
	Untreated	17.75 ef	34.50 efg	63.25 cde
Mean	Treated	22.36 a	41.89 a	54.29 b*
	Untreated	21.29 a	42.25 a	71.82 a*

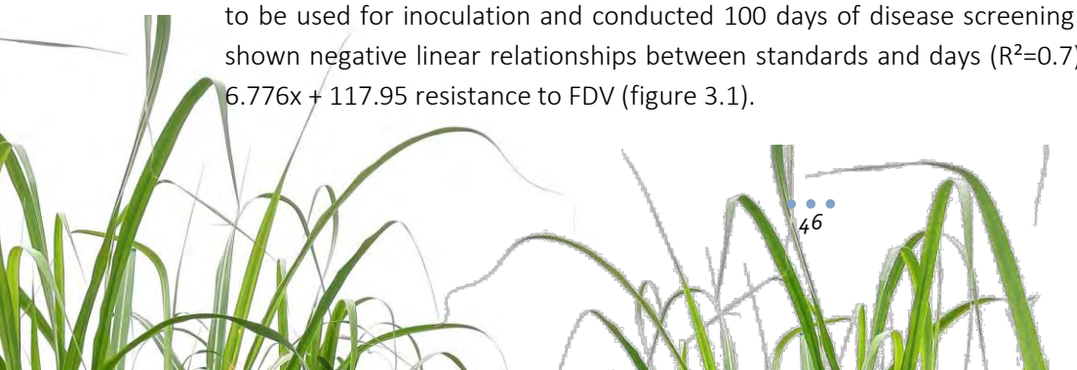
Means followed by different letters are significantly different at *P≤0.05 amongst treatment*varieties.*

Moreover, the sugarcane roots were taken from the untreated pot and stained. It was observed that the nematodes were feeding inside the cells of sugarcane roots.

FIJI LEAF GALL DISEASE

Screening of stage 3 clones against Fiji Disease Virus (FDV)

A standard procedure was developed many years ago and it is still being followed to provide resistant rating. During the 2020 season a total of 100 varieties were tested for resistance to FDV. 58 of LF2014 series and 42 of Visa cane from France were tested. The plant hopper, *Perkensiella vitiensis,* collected from commercial field from the end of March to June. The Insect collected and bred on diseased plants to be used for inoculation and conducted 100 days of disease screening till October. The result has shown negative linear relationships between standards and days (R^2=0.7). The linear equation is Y=-6.776x + 117.95 resistance to FDV (figure 3.1).



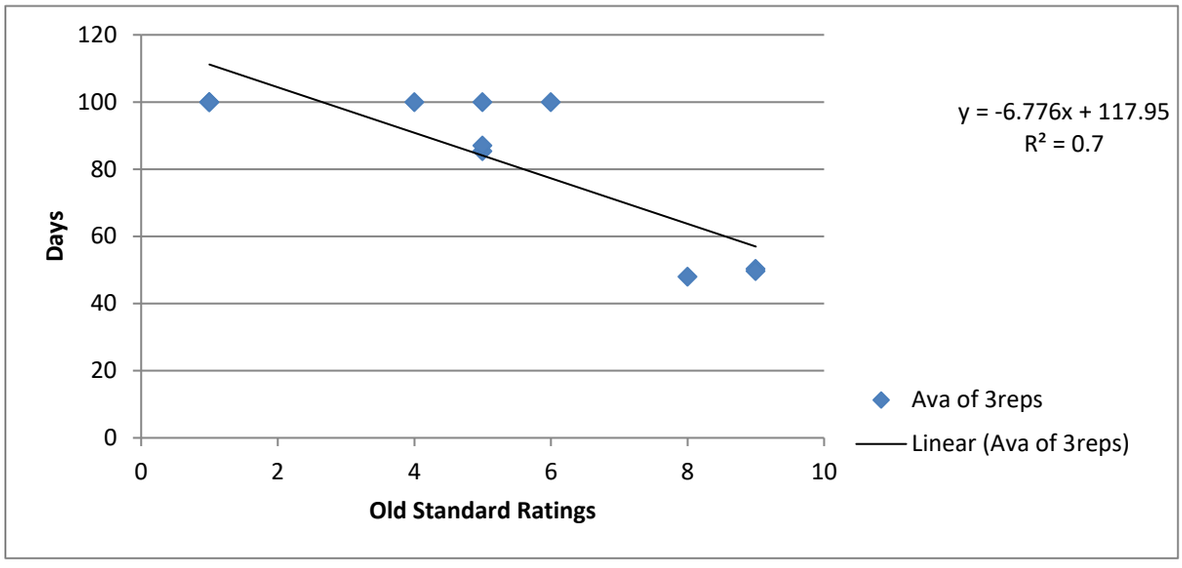


Figure 3.1: Linear Regression graph between standards and days of RD50 (Ava. of 3 days)

Out of 100 varieties, 59 varieties were resistance, 18 varieties were moderate, and 23 varieties were susceptible.

ROGUING

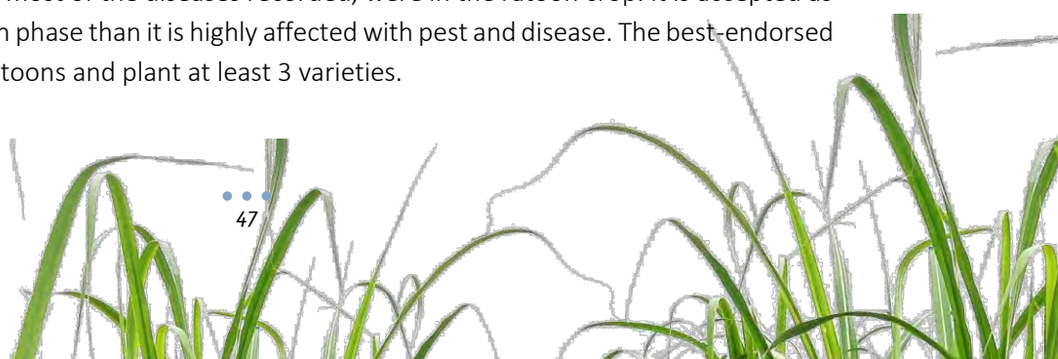
Inspection of commercial sugarcane farms (Roguing)

Fiji disease is still considered to be one of the major cane diseases in Viti Levu mill areas. During the inspection of the plant and ratoon crops, 4046 disease stools were rogued out (table 3.3). All the Fiji disease found and removed during this season was from Mana variety. The inspectors covered an area of 10, 061 hectares. This consisted of 5545.05 hectares of plant cane and 4359.35 hectares of ratoon crop. All the sectors of sigatoka district, recorded the highest disease incidence (table 3.3).

Table 3.3: Summarized Rouging Inspections in 2020

Mill District	No. of Farms Inspected	Area Rouged (Ha)		No. of FLGD stools Rouged
		Plant	Ratoon	
Lautoka	264	71.88	719.63	217
Nadi	272	154.70	698.75	302
Labasa	346	446.54	1349.73	0
Sigatoka	311	114.62	570.64	3353
Rarawai/Tavua	347	224.97	539.76	174
Penang	457	72.99	480.84	0
Total	**1997**	**1085.70**	**4359.35**	**4046**

The recorded data from the past 10 years is showing that there is an increase in the number of stools being rogued out in 2020 and most of the diseases recorded, were in the ratoon crop. It is accepted as when crops are in more ratoon phase than it is highly affected with pest and disease. The best-endorsed practice is, do not keep old ratoons and plant at least 3 varieties.



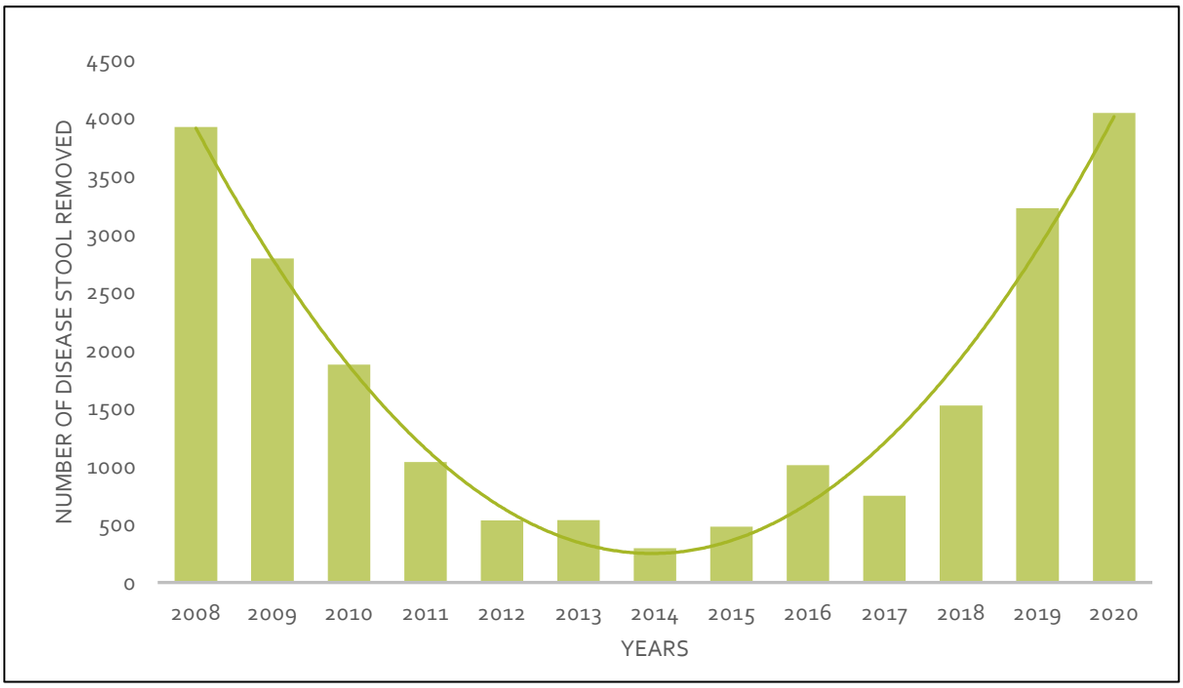


Figure 3.2: Disease Trend in Last Decade (2008 -2020)

Moreover, with Rouging a preliminary survey has been initiated to find out the grower's view on SRIF's Crop Protection services. A total of 113 (1%) Lautoka mill growers were interviewed from August to November 2020. The Fiji sugar industry has 11,638 active growers and the following questions were asked during the field inspection to individual growers (table 3.4)

Table 3.4: Farmer field inspection survey questionnaire and results

Questions	% Yes	% No
Do you know the Sugar Research Institute of Fiji?	87	13
Do you know what work SRIF is doing?	91	9
Do you know about Fiji Disease?	86	14
Does your farm advisor advise you about Fiji Disease?	79	19
Have you attended any Grower Information Day or Field Day?	73	27
Are you satisfied with SRIF roguing?	98	2
Do you need the roguing team to inspect your farm regularly?	100	0
Do you know about the Pest Cane Weevil Borer?	85	15
Does your farm advisor advise you about CWB?	77	23
Is the information provided during the Field day and Grower information Day useful?	73	27
Do you know about any other Pests and Diseases?	80	19

Monitoring of Minor Disease

During the inspection of Fiji Leaf Gall disease, simultaneously a preliminary survey was carried out on the minor diseases of sugarcane in Fiji from January to December. The % infestation of the identified minor diseases was calculated based on the number of farms inspected as shown in graph 3. The graph shows that the incidence of leaf scorch disease is high (34.9%) followed by leaf scald (25.3%) and pokkah boeng (22.9%). Monitoring of these diseases are required to further evaluate if they are a threat to the industry. The leaf scorch disease is a fungal disease affecting the leaves of the sugarcane plant. The infected portion and its surrounding tissues become scorched (dries up) thus reducing the green photosynthetic area of the leaf. The disease has been present in Fiji for a long time. This disease causes

up to 20% loss in other countries with susceptible varieties. Leaf scald is a bacterial vascular disease of sugarcane and it is present in Fiji for more than a decade. For the sugar industry in Australia, leaf scald is considered a serious disease that causes extensive yield loss in highly susceptible varieties. Pokkah boeng is an air-borne fungal disease of sugarcane, highly observed on Mana variety, at age of 3 to 4 months old crops. The disease symptoms are seen in both, plant and Ratoon crops and won't last long. The disease has been present in Fiji for a long time.

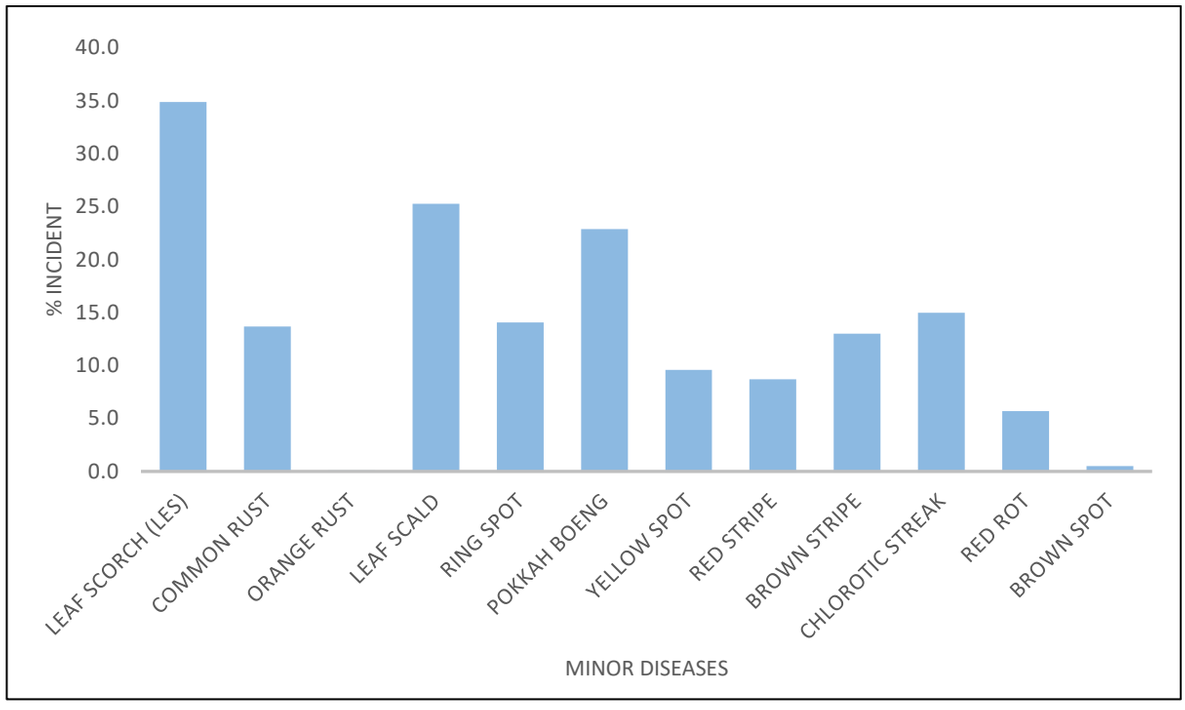


Figure 3.3: % Infestation of Minor Disease in all Mill Areas

SETT ROT

Sett Rot Assessment

In the 2020 planting season, generally poor germination was observed that contributed to gaps in plant crops. Upon inspection it was discovered the cane setts were rotting, leading to germination failures and poor crop establishment. Sugarcane sett rot is a disease that affects the germination of the buds in planting material and is known as pineapple sett rot and Fusarium sett rot. Both diseases are soil-borne and are favored by cold wet soil conditions or excessively dry soil that slows the germination of the cane. The fungus is present in all sugarcane soils and it multiplies on any organic matter. It infects the sett through cut ends or damaged areas to the sett. A preliminary survey was carried out by disease control unit. The roguing standard operating procedure (row by row inspection) was applied to examine the plant crops that were 2–3 months old. The data was collected on the number of gaps in each field that had germination failures.

Percent germination gaps were calculated by using the following formula:

$$\% \text{ germination gaps} = \frac{\text{Total length of gaps(m)}}{\text{Total length in a field(m)}} \times 100$$

Three mill districts, Labasa, Lautoka, and Rarawai were surveyed by randomly selecting the plant crop which was less than 3 months old. The survey was initiated from late June to early August and a total of 89 farms were inspected for germination gapsthat were more than 1.5-2m long. It was found that the setts in all the farms were rotting and the symptoms were consistent wih pineapple sett rot (*Ceratocystis paradoxa*) (Figure 3.4) and Fusarium sett rot (*Fusarium moniliforme*).

Figure 3.4: Pineapple sett rot caused by fungus Ceratocystis paradoxa

It is recommended that the following preventive measures be adopted to reduce germination gaps:

1. Use a registered fungicide such as copper oxychloride 84 and ensure thorough coverage of the sett, particularly the cut ends.
2. If possible, plant when conditions favor rapid germination and soil temperatures are above 28°C.
3. Both diseases are soil-borne, therefore plough out and replant should be avoided because it provides ideal food for multiplication of the fungus, creating high numbers of spores in the soil. The use of some rotational crops or a fallow period between cane crops can reduce this spore load and the potential of the disease. If maize is used as rotation crops and the fresh green stalks are ploughed into the soil, they can provide a food source for the build-up of the Pineapple sett rot fungus.
4. The use of three bud setts will increase the chance of germination. The nodes act as a barrier that can slow the spread of the fungus in the sett and provide the buds with sufficient protection until they germinate.
5. Ensure planting material is free of damage from stalk and bud borers, rats, and stalk rots. Avoid lodged cane, if possible.
6. Seed cane should be sourced from the approved seedbed.

Seed Cane Certification

An approved seed scheme provides cane growers with the disease-free seed of varieties that are true-to-type (varietal purity). The seed cane certification has been re-introduced in 2019 to ensure that the growers are planting quality seed cane, free from Fiji leaf gall disease. The disease control team conducted the seed cane certification this year and 118.7 ha of plant cane and first ratoon was certified as clean seed cane. The plant cane in all the sectors was inspected by SRIF Disease Control Unit (DCU) and only 11.1% of plant crop qualified to be used as seed material.

UNAPPROVED VARIETIES

During the inspection of major diseases in commercial farms, the SRIF DCU has also identified that some growers in all mill districts continue planting unapproved varieties in their fields. In 2020, 78 farms were identified that were planted with unapproved varieties.

CANE WEEVIL BORER

Monitoring of Borer Population

The major insect pest of sugarcane in Fiji is the sugarcane weevil borer (*Rhabdoscelus obscurus*) from a beetle family that originated from New Guinea and has been here since late 1890's. This species has also invaded sugarcane farms in Australia, Hawaii, and Indonesia and is found in all the mill districts of Fiji. To manage CWB in a farm ,billet cane traps and pheromone traps are placed. This year 61 farms were placed with split traps from July to October in Lautoka and Rarawai mill districts to monitor the borer population. The result has shown an average of 12 adult borers were counted per trap.

Table 3.5: Number of borers collected from the sectors where traps were placed.

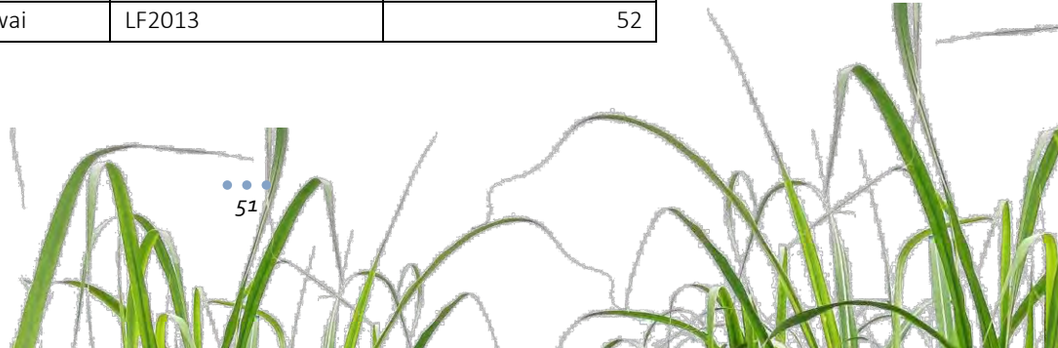
Sectors	Date trap laid	No. of Visit made	No. of Farm selected	No. of Trap laid	Total Adult collected
Drumasi	03/07/20	14	10	100	1212
Tagitagi	17/08/20	5	10	100	512
Drasa	02/09/20	6	10	100	1713
Yaladro	11/09/20	3	10	100	854
Legalega	17/09/20	5	10	100	617
Veisaru	02/10/20	4	10	100	1862
Mota	02/10/20	3	1	10	566
Total		**40**	**61**	**610**	**7336**

Stage 4 varietal Screening against Cane Weevil Borer

The stage 4 promising varieties of the LF 2012 and LF2013 series were screened against Cane Weevil Borer under natural field conditions. Ten stalks from each variety were split and assessed for borer damage by recording the parameters, such as length of stalks and internodes damaged. The results have shown that all the varieties were found resistant to CWB in the trial.

Table 3.6: Number of clones screened from each series at different location

Mills	Series	Number of Clones
Lautoka/Rarawai	LF2012	68
Lautoka/Rarawai	LF2013	52



Insect resistance in crop plants is an important component of Integrated Pest Management (IPM) and it is considered as a non-monetary input at farmers end. Resistant and tolerant cultivars form the basic component over which other components are to be built up. Even a low level of tolerance in plants has a dramatic effect, which reduces the need for insecticides. The use of resistant or less-susceptible cultivars is one of the most important methods of keeping insect populations below economic threshold levels. However, host-plant resistance is not a cure for all pest problems. It is most useful when carefully utilized with other components of pest management such as the application of bait traps.

SPORE TRAP DETECTION and CONTINGENCY PLANNING OF SUGARCANE SMUT

Introduction

The protection of the industry against Diseases and Pests incursions is a high priority task for the institute and warrants a proactive approach. The Institute's stringent monitoring of pests and diseases in the cane belt has contributed to keeping the industry reasonably safe. There is a high risk that some of the diseases and pests that have not been found in Fiji could make its way into the country. One such disease is Sugarcane Smut that has had a long history of distribution around all sugar producing countries. Currently, Fiji is the only country that has not been infected by Smut that is a high-risk disease. The risk of Smut spores reaching Fiji is very high. It is most likely that it could be spread from Australia, Indonesia and Papua New Guinea under natural conditions, i.e. cyclones, hurricanes, strong winds. The Institute works in collaboration with the Biosecurity Authority of Fiji in terms of monitoring the entry of this exotic disease into the country.

Discussion

The institute sent three varieties: Viwa (existing commercial variety), LF11-233, LF09-1707 (promising variety), to Sugar Research Australia for smut screening, unfortunately, due to Covid flight restrictions the sample had to be sent via Sydney. Despite several documentations & communications between SRA and Australian Quarantine, the cane samples were not received by SRA. One spore trap was placed for sample collection for molecular analysis in Drasa, Lautoka. The Smut spore traps will be placed in the airports and port of entries and monitored by the Institute and BAF. Strong support will be needed by the smut technical committee during the movement and placements of traps especially for security purposes.

ISOLATION AND INVENTORY OF POTENTIAL SOIL MICROBES FOR NITROGEN FIXING AT SEEDLING STAGE IN RHIZOSPHERE OF SUGARCANE AND OTHER CASH CROPS IN FIJI

Introduction

Three Nitrogen fixing trials were planted in Lautoka (31/05), Nadi (23/05) and Labasa (04/06) last year and monitored frequently.

The treatments for the trials were as follows:

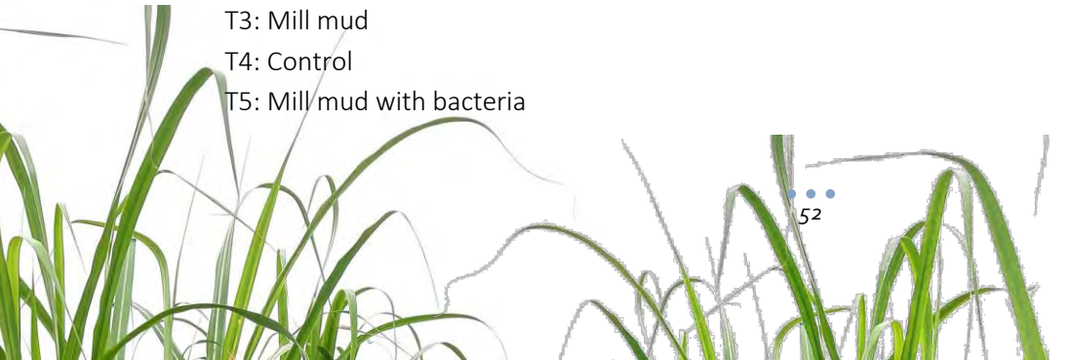
T1: Sett dipped in bacteria

T2: Compost with bacteria

T3: Mill mud

T4: Control

T5: Mill mud with bacteria



Method

The first trial was planted at Drasa FSC Estate in a Randomized complete block design with 4 replications. The plot size was 10m x 1.37m x 6 rows. The bacteria were isolated in the lab on agar, mass produced in broth and mixed with water (8l) for treatment 1. The cane setts were dipped into the mixture and planted immediately.

In treatment 2, the compost was sterilized, weighed (274g) and liquid bacteria (17ml) was added to this. This was applied on furrows before covering the setts. Treatment 3 was mill mud (274g), which was applied by broadcasting in the furrows before covering while treatment 5: mill mud (274g) with bacteria (17ml) was derived and applied similarly as T2.

The Rainfall received throughout the trial period in the Lautoka Mill Area (Lautoka and Nadi trial) and Labasa Mill Area are shown below in figure 3.6.

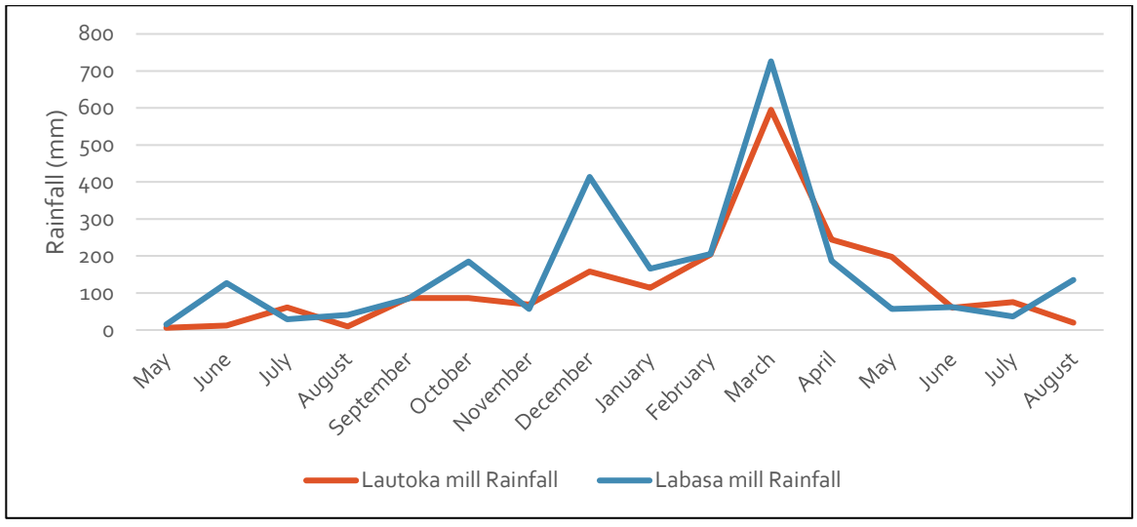


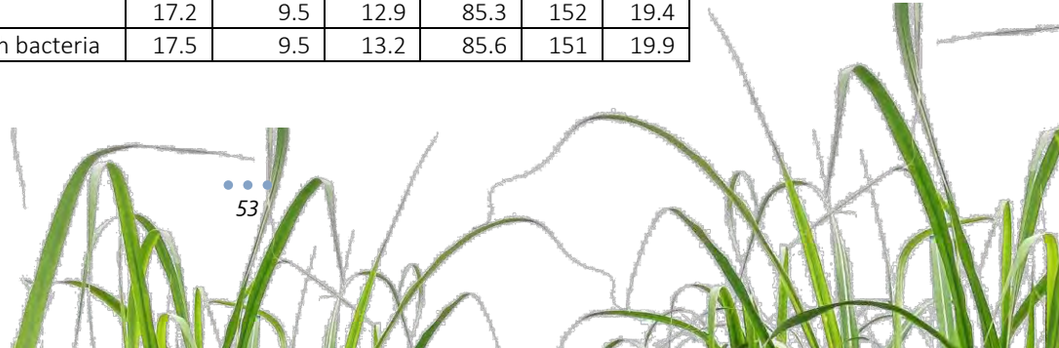
Figure 3.6: Lautoka and Labasa rainfall

Discussion

The biochemical analytical results for the Drasa trial showed that the Treatment 5 (Mill mud + Bacteria) resulted in the highest tonnes of sugar per hectare (TSH), % pure obtainable cane sugar (POCS), brix, and purity. There wasn't much difference in the cane and sugar yields among all the treatments. The second trial was planted at Mate Rd, Malolo, Nadi, in the Randomized complete block design with 4 replications. The plot Size was 10m x 6 rows. This trial was accidently sprayed with glyphosate by the contractor, thus, data was hindered. Nonetheless, some data was collected later.

Table 3.7: Bio-chemical Analytical Data for Drasa Trial

Treatment	Brix	% fibre	POCS	Purity	TCH	TSH
T1 - Sett dipped in bacteria	16.9	9.7	12.4	83.9	147	18.5
T2 - Compost with bacteria	17.4	9.7	13.1	85.5	152	19.8
T3 - Mill mud	17.3	9.3	12.8	84.7	152	19.5
T4 - Control	17.2	9.5	12.9	85.3	152	19.4
T5 - Mill mud with bacteria	17.5	9.5	13.2	85.6	151	19.9



The germination and tiller count were done initially (first 3 months) to study the impact of the treatments on the cane followed by the crop height which was monitored until the field was not accessible.

Table 3.8: Germination, tiller count and growth height (cm) - Drasa Trial					
Treatment	Average Germination at 4 weeks	Average No. of Tiller/stool at 20weeks	Average Height at 3 months (cm)	Average Height at 5 months (cm)	Average Height at 7 months (cm)
T1 - Sett dipped in bacteria	21.2	9.8	22.1	68.4	118
T2 - Compost with bacteria	20.5	12.8	22.7	73.4	119
T3 - Mill mud	23.1	11.5	24.8	75.9	121
T4 - Control	40.1	12.5	22.4	62.1	126
T5 - Mill mud with bacteria	23.3	10.8	25.4	80.9	134

The physical parameters studied showed that the control had given better germination at four weeks after planting and also the tiller count recorded at 4 weeks and 20 weeks, followed by treatment 5 giving the optimum height. For further analysis, soil samples were collected before planting and after harvesting and 6 stalks from each plot were taken from each field trial for biochemical analysis. Another observation noted was weevil borer infestation during the 3-month assessment.

Table 3.9: Bio-chemical Analytical Data for Malolo Trial						
Treatment	Brix	% fibre	POCS	Purity	TCH	TSH
T1 - Sett dipped in bacteria	17.9	10.6	14.3	88.7	55	7.9
T2 - Compost with bacteria	17.4	10.4	13.6	87.5	56	7.6
T3 - Mill mud	17.2	10.9	13.4	87.1	58	7.8
T4 - Control	17.7	11.0	13.8	87.4	66	9.1
T5 - Mill mud with bacteria	17.4	11.2	13.7	87.9	59	8.0

Treatment 4 (control) gave the highest tonnes cane and sugar per cane per hectare. Treatment 1 (sett dipped in bacteria) gave highest purity, brix and POCS. There wasn't much difference in the cane and sugar yields among treatments 1, 2, 3 and 5. Glyphosate causes disruption of soil microbial communities and their processes; thus, the control (T4) gave the best outcome as shown in table 3.9.

Table 3.10: Germination, tiller count and growth height (cm)				
Treatment	Average Germination at 4 weeks	Average No. of Tiller/stool at 20weeks	Average Height at 5 months	Average Height at 7 months
T1 - Sett dipped in bacteria	35.2	11	48.4	97.3
T2 - Compost with bacteria	35.5	11	41.7	94.4
T3 - Mill mud	25.7	7	35.9	88.6
T4 - Control	30.7	8	43.4	95.5
T5 - Mill mud with bacteria	28.7	9	38.0	93.3

The physical parameters for Malolo trial were not recorded at 3 months as the grower had sprayed the trial with a low strength of glyphosate that affected the germination. From the cane that did germinate, treatment 2 gave the maximum germination of 35.5%, with treatment 1 and 2 giving better tiller count at an average of 11 tillers. Treatment 1 gave best height results. The third trial was planted at SRIF Estate, Labasa in the randomized complete block design with 4 replications. The plot size was 10m x 1.37m x 6 rows.

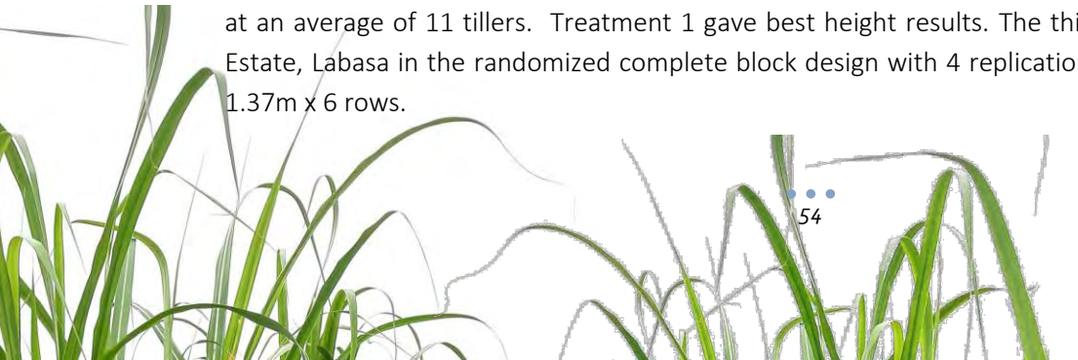


Table 3.11: Bio-chemical Analytical Data for Labasa Trial					
Treatment	Brix	POCS	Purity	TCH	TSH
T1 - Sett dipped in bacteria	19.1	12.4	87.4	43	5.2
T2 - Compost with bacteria	20.2	14.0	88.5	42	6.0
T3 - Mill mud	18.7	13.3	89.0	54	7.1
T4 - Control	19.0	12.7	89.6	58	7.2
T5 - Mill mud with bacteria	19.6	13.5	89.7	44	6.0

The biochemical analysis for the trial in Labasa gave the highest brix and POCS in treatment 2. The control gave the highest cane and sugar yield.

Table 3.12: Germination, tiller count and growth height (cm)					
Treatment	Average Germination at 4 weeks	Average No. of Tiller/stool at 20 weeks	Height 3 months	Height 5 months	Height 7 months
T1 - Sett dipped in bacteria	9.7	7.8	16.0	32.4	96.8
T2 - Compost with bacteria	15.3	8.7	21.9	34.6	86.7
T3 - Mill mud	16.1	7.8	22.7	35.8	99.4
T4 - Control	17.6	7.7	22.2	33.6	113.6
T5 - Mill mud with bacteria	15.4	7.2	20.4	29.3	97.1

Treatment 4 which was the control showed the highest germination and T2 gave the highest tiller count at 5 months. The height bloomed for T3 at 3 months and 5 months, however, the average height at 7 months was better with the control.

Conclusion & Recommendations

It can be concluded from the trials data that the Nitrogen fixing bacteria that was mixed and applied in the treatments did not show differences among the parameters studied since the LSD All-pairwise comparison test for all parameters produced a maximum of three different homogenous groups (A, AB, B & C) for which the means were not significantly different at Alpha 0.05.

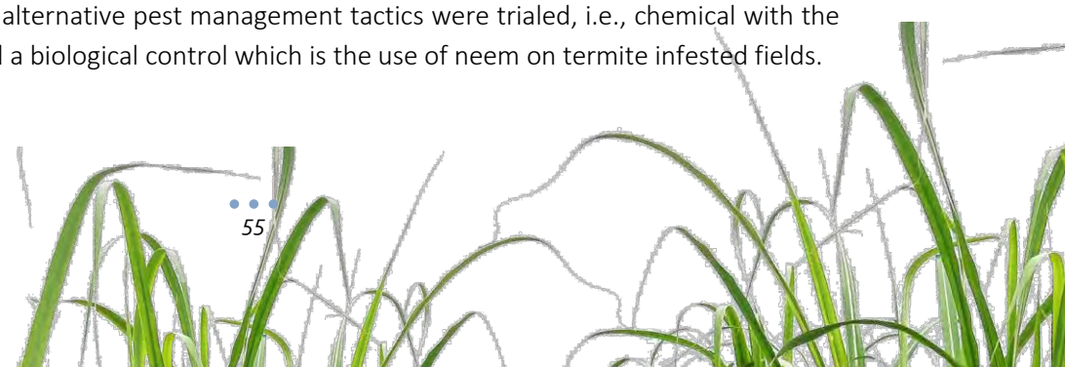
INTEGRATED PEST MANAGEMENT OF SUGARCANE TERMITES, *COPTOTERMES GESTROI*

Introduction

Survey and monitoring of termite continued from mid-October 2019 and a total of 282 farms had been surveyed. The ongoing survey which is being done through SRIF's routine roguing inspection procedure is to provide status and margins of the termite zone.

Discussion

Termite in sugarcane is currently restricted in the Lautoka district namely, Drasa, Lovu and Lautoka as it was in the previous survey. With the ongoing survey, the stand point that was taken into consideration was the decline in the initial number of farms that had termites. The number of new farm emergence highlighted the spread of the termites, however, these new farms appeared from the locality of the infested farms indicating that the spread is within the existing sectors. Furthermore, apart from the routine inspection, alternative pest management tactics were trialed, i.e., chemical with the active ingredient Fipronil and a biological control which is the use of neem on termite infested fields.



The farms sprayed with treatments (Fipronil and Neem), were monitored monthly and no termites were observed in these farms. A trial planted in an infested area in 2019 that had been sprayed with Attrathor using a boom sprayer and harvested at the beginning of 2020 crushing season showedzero infestation upon assessment. The neem trial on the other hand has been inspected for 5 months consecutively and no sign of termite infestation was seen. Additionally, this year, 10 farms with a history of AST was studied to evaluate the damages to quality of the cane as well as the % incidence and % severity. It was found in this survey that 2.22% of the farms were infested with a severity of 1.34%.

Table 3.13: Bio-chemical data of samples from surveyed farms

Parameter	Good	Infected	% difference
Average % fibre	7.4	9.4	-2.0
Average % purity	86.1	81.2	4.9
Average % pol	16.8	14.0	2.8
Average % brix	17.5	15.0	2.5
Average % POCS	13.4	10.6	2.8

The bio-chemical data of the samples from the surveyed farms shows that the % fibre had increased in the infected samples. This may be due to biotic stress the plant underwent. However, the rest of the analysis showed a decrease in the %purity, %pol, %brix and %POCS.

Conclusion

From this year's outcomes it can be concluded that a faster and thorough means of survey will be needed for an effective next best approach of control in case of spread. More trials to be held in collaboration with farmers using integrated pest management practices.

CONTINGENCY PLANNING OF FALL ARMYWORM

Introduction

Fall army worm (FAW), Spodoptera frugiperda, is an insect pest from the Order Lepidoptera. It was first sited in Africa in 2016 and has spread to other continents recently attacking North of Australia. FAW is an aggressive feederand has a preference of maize, however, it is also reported to feed on sugarcane.

According to Sugar Research Australia Factsheet,the damage by fall armyworm is the reduction of the sugarcane leaf area, which affects the normal function of the sugar cane plant, thus, reducing yield .

Discussion & Conclusion

SRIF has successfully established grounds where the baits will be placed to track the entry of this pest. The institute is working in partnership with ACIAR to initiate effective means of encountering FAW. The Spodoptera frugiperda Lures will be used in Bucket funnel traps.

4.0 METEOROLOGY

Highlights

1. Jan - most parts of the country registered drier conditions.
2. Feb - second consecutive month with significantly drier condition. As at end of February, a number of stations in the Western Division was in a meteorological drought state on a 3 and 6-month timescales.
3. Mar - series of troughs of low-pressure system, together with moist north-easterly wind flow resulted in significant rainfall and flash flooding from Sigatoka to Rakiraki. Due to prolonged wet weather, there were reports of loss of lives (drowning) in swollen creeks at Lautoka and Tavua. It rained almost every day at Penang Mill with 27 rain days. This was the wettest month of the year with little over 2,000mm rainfall across the sugarcane belt with Naloto recording the highest rainfall of 1090mm.
4. Apr - The weather varied during the month with widespread rainfall and severe tropical cyclone Harold, followed by a period of dry conditions and then the month ended with significant rainfall and flooding. Severe TC Harold affected Fiji as a Category 4 system with destructive hurricane force winds, making landfall on Kadavu. Harold resulted in storm surges and phenomenal seas bringing significant, high intensity rainfall.
5. May - rainfall variation was seen across the sugarcane belt. Majority of the stations in the Western and Northern Divisions experienced a wetter month.
6. Jun - little over 200mm of rainfall was received across the sugarcane belt.
7. Jul - rainfall varied considerably across the sectors with some stations recording more than 100mm rainfall in less than 3 days and some sector like Malau and Nanuku registering only 0.2mm of rain.
8. Aug – the 2nd driest month after July with Natova sector recording the lowest rainfall of 10mm.
9. Sep – all sectors received more than 30mm rainfall with Cuvu recording the highest, 291mm.
10. Oct - A moderate La Niña event was established in the Pacific with reports of flash flooding. October was dominated by a series of troughs of low-pressure systems.
11. Nov - La Niña event which was established in October extended to November. The sugarcane belt areas experienced rainfall over all places, the lowest being 61mm at Bucaisau and highest being 429mm at Naloto. In the later half of the month, rainfall activity was intense. There were reports of flooding in parts of Western Division particularly in low-lying areas between Lautoka and Rakiraki.
12. Dec - The highlight of the month was severe TC Yasa, which made a landfall as a Category 5 tropical cyclone over Vanua Levu. Very destructive hurricane force winds resulted in widespread damages to infrastructures and farms. Storm surges resulted in coastal flooding with nearby farms being waterlogged with salt water. Above average rainfall was noted across the sugarcane belt with each sector registering over 100mm of rainfall. There was flash flooding in Sigatoka, with Cuvu recording the 2nd highest rainfall of 857mm and Vunimoli in Labasa recording the highest rainfall of 861mm.
13. The 2nd and 3rd National Climate Outlook Forum was held in Navua and Suva.
14. Installation of automatic weather station (AWS) at SRIF-Drasa.

Introduction

The Meteorological Station at Sugar Research Institute of Fiji (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 centers. Climatological stations are manned by observers who take climate readings of 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. Similarly, rainfall figures from each sector from the eight districts are compiled and this data is used to estimate cane production. The climatic data is used to produce climate summary and predicting of weather forecast for the country. SRIF provides a summary statement towards the Fiji Sugar Cane Rainfall Outlook (FSCRO) that includes advice to farmers on possible farm activities such as land preparation, cultivation, fertilizer application, weedicide application, drainage 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, and 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).

Rainfall

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 and 3000mm. From the table below, it can be seen that the annual rainfall for the mills was in the annual average rainfall range.

Table 4.1: Monthly rainfall (mm) figures recorded at each of the 4 mills for 2020

Month	Lautoka mill		Rarawai mill		Labasa mill		Penang mill	
	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days
JAN	114	12	88	12	166	17	128	18
FEB	204	8	121	10	205	9	170	18
MAR	595	25	534	25	726	28	446	27
APR	244	17	276	16	187	25	166	16
MAY	198	8	211	9	57	11	276	10
JUN	60	2	51	9	62	13	58	20
JUL	75	2	8	3	37	3	0.2	1
AUG	20	2	29	3	135	4	39	3
SEP	32	2	64	4	112	8	50	10
OCT	74	10	86	8	252	12	192	12
NOV	104	9	247	11	131	10	248	19
DEC	111	13	137	21	532	23	449	22
Total	1830	110	1850	131	2601	163	2221	176
Average	152	9	154	11	217	14	185	15

Generally, July was the driest month while March was the wettest month. Labasa mill recorded the highest annual rainfall while Lautoka mill recorded the lowest annual rainfall.

Table 4.2: Monthly Rainfall figures for Lautoka with the Long-Term Averages													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly rainfall	114	204	595	244	198	60	75	20	32	74	104	111	1831
No. of rain days	12	8	25	17	8	2	2	2	2	10	9	13	110
50 yrs avg. (1970-2019)	355	325	326	196	89	68	51	68	73	100	133	192	1975
% of avg.	32	63	183	125	224	89	148	29	44	74	78	58	95

Table 4.3: Monthly Rainfall figures for Rarawai with the Long-Term Averages													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly rainfall	88	121	534	276	211	51	8	29	64	86	247	137	1852
No. of raindays	12	10	25	16	9	9	3	3	4	8	11	21	131
50 yrs avg. (1970-2019)	378	349	362	205	93	77	39	62	73	105	151	235	2129
% of avg	23	35	148	135	228	66	21	47	88	82	163	58	91

Table 4.4: Monthly Rainfall figures for Penang with the Long-Term Averages													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly rainfall	128	170	446	166	276	58	0.2	39	50	192	248	449	2222
No. of raindays	18	18	27	16	10	20	1	3	10	12	19	22	176
50 yrs avg (1970-2019)	409	353	365	257	149	101	48	69	83	116	150	267	2367
% of avg	31	48	122	64	185	58	0.4	57	60	165	165	168	94

Table 4.5: Monthly Rainfall figures for Labasa with the Long-Term Averages													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly rainfall	166	205	726	187	57	62	37	135	112	252	131	532	2602
No. of raindays	17	9	28	25	11	13	3	4	8	12	10	23	163
50 yrs avg (1970-2019)	381	365	371	255	103	73	49	58	77	124	177	258	2290
% of avg	44	56	196	73	55	85	76	235	146	203	74	206	121

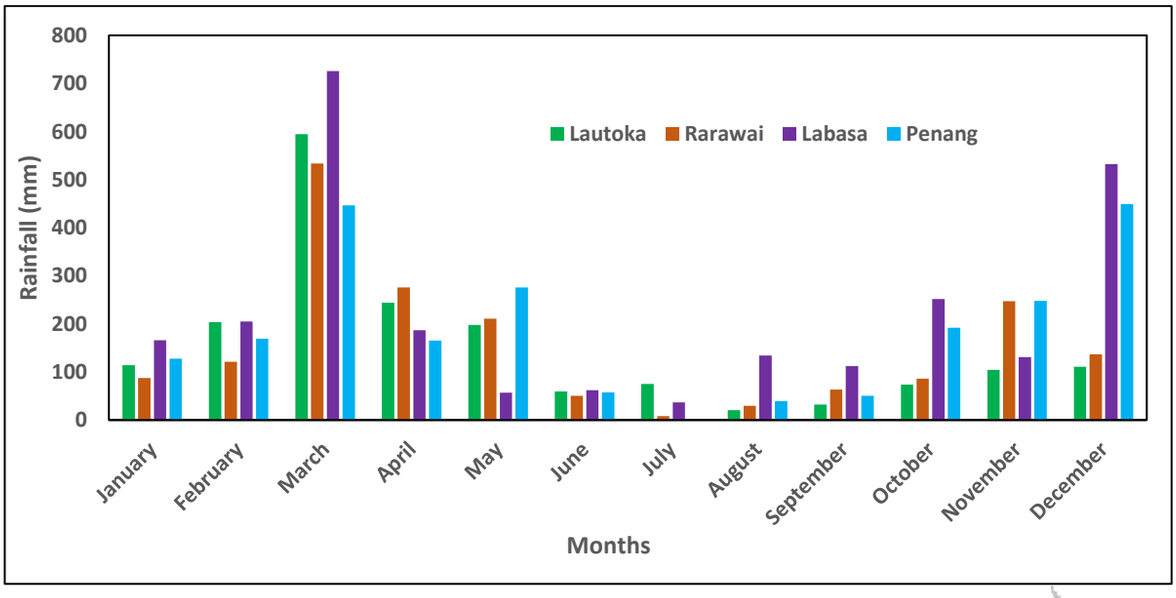


Figure 4.1: Monthly rainfall for the 4 mills

Table 4.6: Rainfall (mm) figures for each sector of the Lautoka Mill													
Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Drasa	83	167	654	130	171	37	84	14	51	121	268	185	1963
Saweni	188	174	820	337	155	31	34	14	34	102	163	166	2218
Natova	331	220	1115	185	154	37	100	10	35	102	108	203	2599
Legalega	93	63	653	151	240	42	41	35	86	182	120	206	1912
Meigunyah	116	78	791	135	160	28	42	14	59	102	110	173	1808
Yako	22	45	526	119	61	81	103	19	42	128	80	142	1368
Malolo	102	105	810	281	159	53	86	24	87	220	193	210	2327
Nawaicoba	193	125	580	116	77	88	69	45	65	145	145	343	1991
Lomawai	96	47	482	170	66	59	38	36	72	89	87	298	1539
Cuvu	65	103	651	684	228	104	56	132	291	256	280	857	3707
Olosara	13	38	283	171	60	54	20	62	84	63	146	367	1361

Table 4.7: Rainfall (mm) figures for each sector of the Rarawai Mill													
Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Varoko	88	195	590	311	186	9	20	20	43	82	260	158	1962
Mota	168	176	855	301	236	138	17	42	130	289	358	412	3120
Koronubu	89	139	774	264	211	39	84	16	88	170	163	275	2311
Rarawai	88	121	534	276	211	51	8	29	64	86	247	137	1851
Veisaru	55	203	805	258	281	14	4	31	61	58	178	172	2120
Varavu	25	38	522	348	130	14	10	13	107	75	96	128	1506
Naloto	215	185	1090	411	193	98	41	45	89	305	429	515	3616
Tagitagi	58	62	643	441	228	30	16	24	100	103	173	274	2152
Drumasi	124	102	664	385	247	15	4	24	125	119	166	348	2323
Yaladro	124	51	571	340	262	21	9	19	77	106	168	346	2094

Table 4.8: Rainfall (mm) figures for each sector of the Penang Mill													
Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Ellington I	80	77	216	258	85	133	10	25	56	287	207	423	1858
Malau	128	170	446	166	276	58	0.2	39	50	192	248	449	2221
Nanuku	108	93	344	172	291	16	0	40	37	126	110	239	1576
Ellington II	171	235	413	417	328	192	28	53	140	412	182	455	3025

Table 4.9: Rainfall (mm) figures for each sector of the Labasa Mill													
Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Waiqele	211	203	427	214	103	60	24	91	92	179	132	429	2161
Wailevu	231	239	482	204	109	50	20	56	86	144	170	428	2218
Vunimoli	412	296	563	214	58	45	37	146	102	235	175	861	3144
Labasa	166	205	726	187	57	62	37	135	112	252	131	532	2600
Bucaisau	268	254	563	224	142	111	24	69	58	226	61	316	2316
Wainikoro	291	250	494	174	127	168	19	96	74	264	92	389	2438
Seaqaqa	319	146	424	262	147	46	30	103	74	133	200	527	2411

Table 4.10: Total Rainfall Figures for all the Four Mills for the past 25 years										
Year	Lautoka	Rarawai	Penang	Labasa		Year	Lautoka	Rarawai	Penang	Labasa
1996	2242	2704	2404	2716		2009	2870	3556	3041	2480
1997	2319	2648	3174	2734		2010	1228	1686	1644	2321
1998	1213	1266	1274	1585		2011	3028	3140	3239	2831
1999	3457	3354	3848	3141		2012	3744	3265	3957	2894
2000	3017	3464	3750	3655		2013	2501	2353	2343	2757
2001	2041	2121	2114	2147		2014	1199	1318	2110	1654
2002	1704	1741	1819	2418		2015	1043	1158	1310	1168
2003	1459	2033	1886	1834		2016	2098	1883	2126	1773
2004	1488	1955	1573	1568		2017	1739	2134	1802	2122
2005	1580	1749	1517	1794		2018	2129	2228	2940	2971
2006	1844	2194	1824	1429		2019	1354	2036	1990	2355
2007	2337	2805	2616	2786		2020	1830	1850	2221	2601
2008	2502	3052	3380	2612		-	-	-	-	-

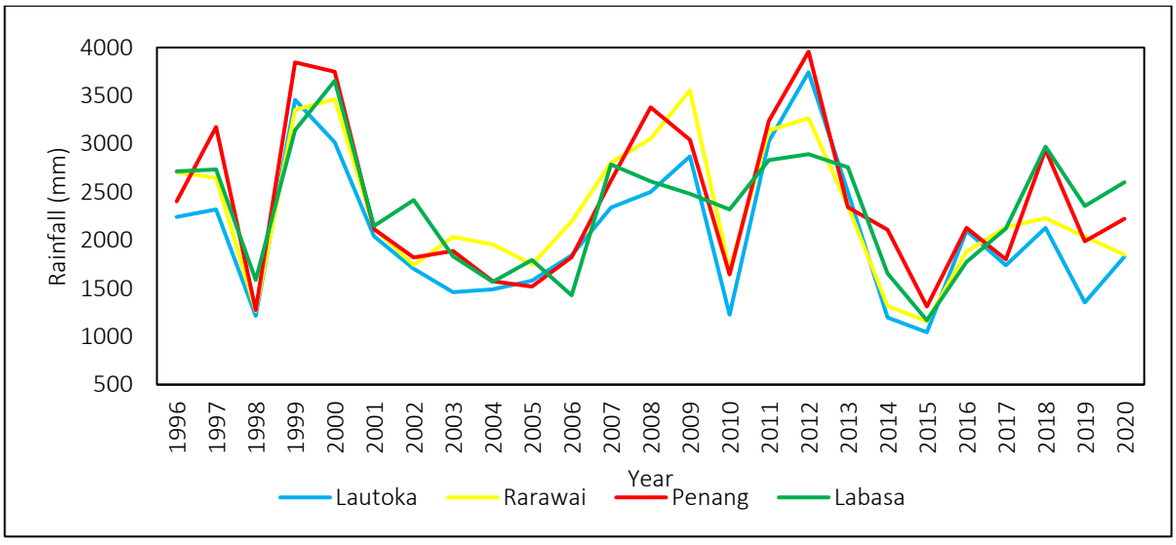


Figure 4.2: Total rainfall recorded by 4 mills in the past 25 years

SRIF WEATHER STATION – V77555

The institute has a fenced weather station at the head office that is managed and maintained by the Institute. The instruments in this station are owned and supplied by the Fiji Meteorological Services. Manual observations are taken at 9am daily. The station is equipped for measuring atmospheric conditions to provide information for weather forecasts and to study the "weather" and "climate".

The weather station has the following instruments in place:

- ✓ Thermometers
- ✓ Rain gauge
- ✓ Evaporation tank

Measurements taken include:

- ✓ Temperatures
- ✓ Humidity
- ✓ Wind direction
- ✓ Evaporation

Figure 4.3: LEFT - evaporation tank and RIGHT - weather station at SRIF-Drasa.

Table 4.11: Meteorological data for Sugar Research Institute of Fiji, Lautoka 2020													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Relative Humidity (%)	76	74	85	81	86	76	73	70	63	68	67	72	74
51 yrs avg	75	77	75	74	74	72	70	69	70	66	69	72	72
Air Temperature													
Mean Maximum	32	33	31	31	31	31	30	31	31	31	31	32	31
51 yrs avg	32	31	31	31	30	28	28	28	29	31	31	31	30
Mean minimum	23	24	24	23	22	21	19	21	21	22	23	23	22
51 yrs avg	24	24	24	24	22	20	20	20	21	26	23	23	23
Mean	28	28	27	28	26	26	25	26	26	26	27	28	27
Highest maximum	36	35	34	34	36	33	32	35	34	33	35	34	34
Lowest minimum	21	21	23	19	18	16	17	18	18	19	18	20	19
Evaporation (mm)													
Raised pan	218	166	119	123	122	125	125	140	154	150	158	177	148
Earth Thermometers (°C)													
5cm	29	30	28	28	27	26	25	26	27	28	29	29	28
51 yrs avg	27	29	29	27	26	24	24	24	26	27	29	29	27
10cm	28	29	28	28	27	25	25	26	26	27	28	28	27
51 yrs avg	29	28	26	27	24	24	23	24	28	27	28	28	26
30cm	29	30	29	29	28	27	27	27	27	28	29	29	28
5 yrs avg	30	29	29	29	28	27	27	27	27	29	29	29	28

Temperatures

The highest maximum temperature of 36℃ was recorded for the months of January and May while the lowest minimum temperature of 17℃ was recorded for the month of July.

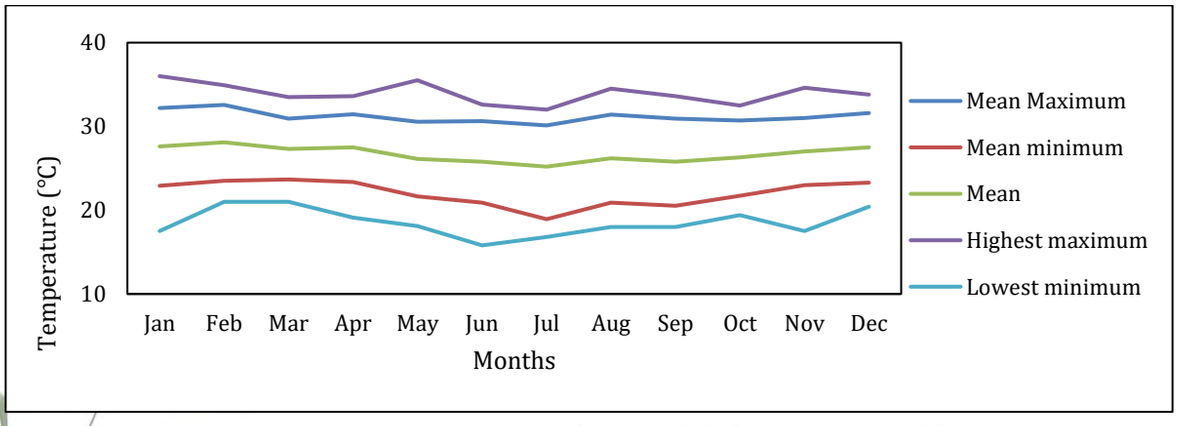


Figure 4.4: Mean maximum, mean minimum and mean with highest maximum and lowest minimum

Soil Thermometers

The soil thermometers at SRIF are placed at depths of 5cm, 10cm and 30cm. The 51 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 5 years average calculated was 28℃.

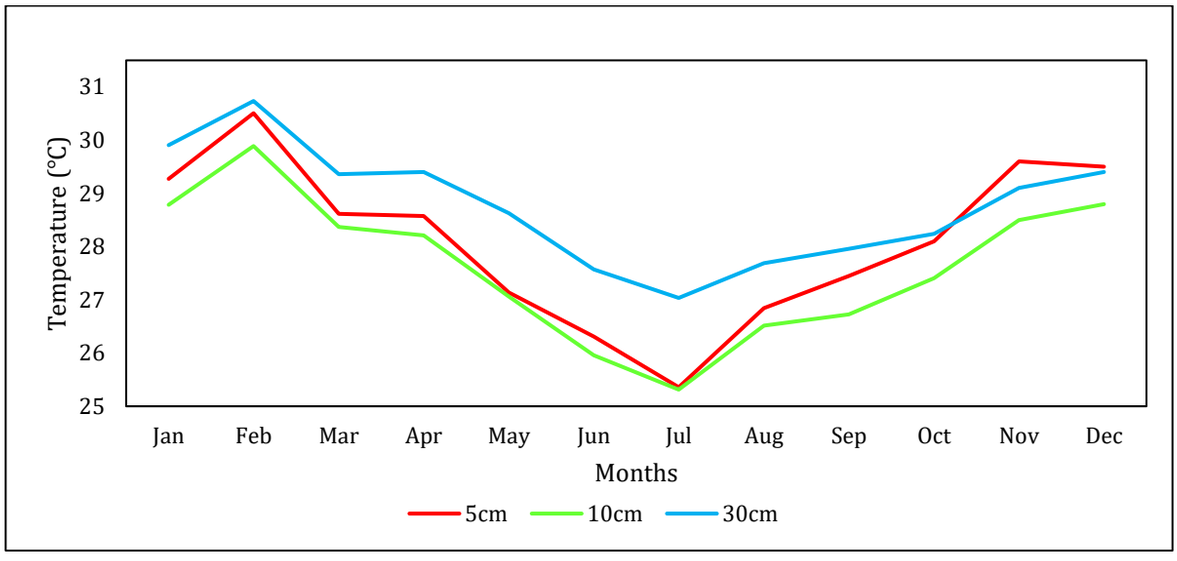


Figure 4.5: Earth thermometers at depths 5cm, 10cm and 30cm

Evaporation

The average evaporation for this year was calculated to be 148mm. The pan is constantly monitored and cleaned for dirt/debris and algae growth.

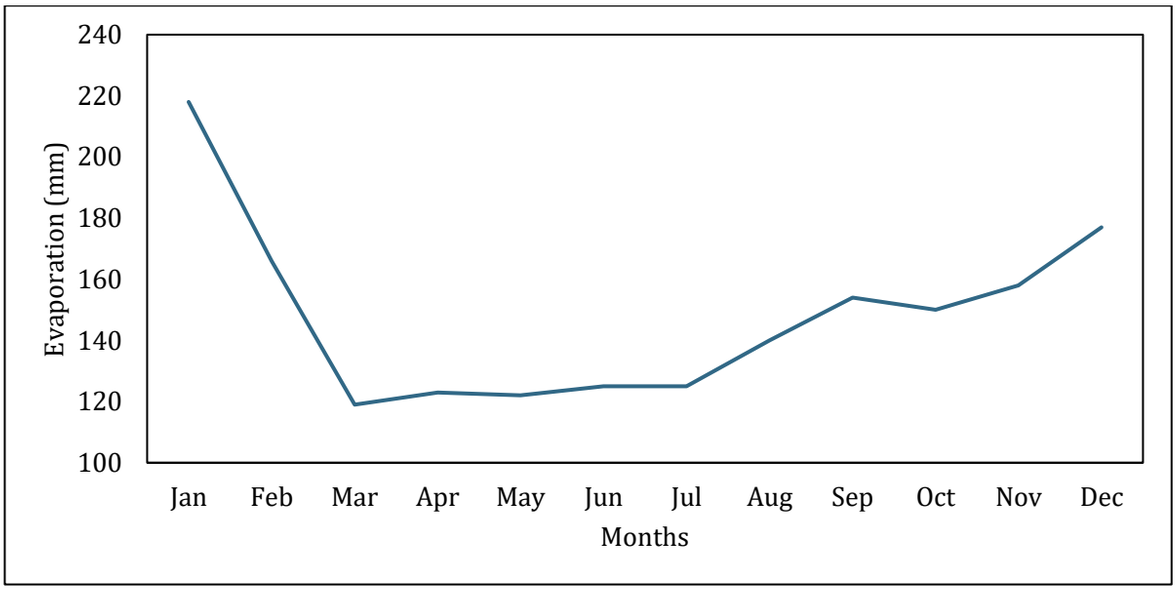


Figure 4.6: Monthly evaporation for station V77555

Relative Humidity

The average humidity for the year was calculated to be 74%. This value was 2% higher than the 51-year average.

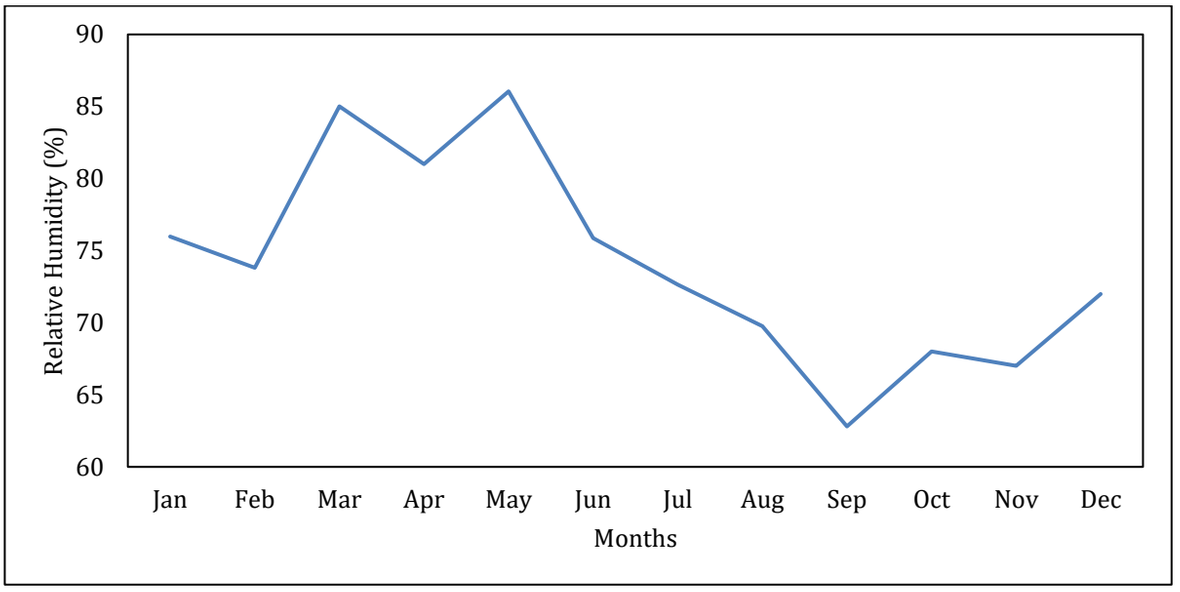


Figure 4.7: Relative Humidity for station V77555

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.

National Climate Outlook Forum

1. FMS Stakeholder Consultation to Further Develop Data Sharing Agreements with Partners

The consultation brought together key stakeholders with the FMS and decision makers from climate sensitive sectors.

Objective

The main objective of the consultation was;

- Identify the specific factors affecting user;
- Co-design tailored products to address identified decision-making needs;
- To ensure climate information are communicated, interpreted and understood by stakeholders and users;
- To discuss user views and obtain feedback for improvement of climate products, services and accessibility;
- To agree to a MoU between user and FMS.

Outcome

- It was previously stated that the FMS product, the Fiji Sugarcane Rainfall Outlook (FSCRO), was too complex for the intended user. The product needed to have more clarity with pictorials and graphs for easier understanding.
- The main input (from SRIF) that was of main highlight to the user (grower) is to be placed on the fore-front of the FSCRO product rather than on the next page.
- Key points that was to be stated in a memorandum of agreement (MoU) was discussed and taken note of by FMS.

SRIF Presentation

The institute was given an opportunity to present on the following;

- FMS products and services satisfaction
  - One specific product offered by FMS had been tailor-made for the sugar industry – the FSCRO. After numerous consultations with FMS, the product is now easier to understand and translate to the intended user
  - Sometimes, there is complexity in the FMS prediction/forecast
  - Data sharing used to be an issue before but lately, access to data and information had drastically improved
- How the weather and climate information is useful to the organisation;
  - Useful for proper, foresighted and informed planning – field works (planting), fertilization, spraying, irrigation, harvesting etc
  - Required for various decisions relating to storage and distribution of fertilizers, weedicides, materials, machinery etc.
  - Securing of farm implements, building and machinery/vehicles
  - Safety of institute staff
  - Monitor and study production trends
  - Proper advice given to farmers
- How the information is received by the institute and the preferred mode of communication;
  - The institute receives FMS products and services via, social media (Facebook), telephone, emails and through FMS website.
- Memorandum of Agreement
  - The institute and the FMS did not have any MoU in place. Key points that needed to be stated in a MoU was discussed and this was taken note of by FMS.
- Some of the challenges faced by user
  - The outreach to the target audience and the product adaptation/application.

2. Third National Climate Outlook Forum (*Theme: Ocean & Fisheries*)

. The focus of this forum was mainly on the Ocean and Fisheries sector.

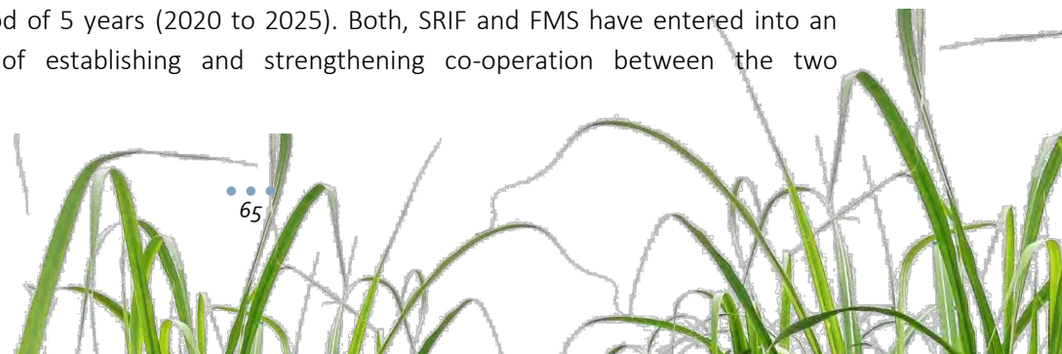
Objective

The main objective of the consultation was;

- Identify the specific factors affecting user;
- Co-design tailored products to address identified decision-making needs;
- To ensure climate information are communicated, interpreted and understood by stakeholders and users;
- To discuss user views and obtain feedback for improvement of climate products, services and accessibility;
- To agree to a MoA between user and FMS.

MoA signing between SRIF and FMS

A memorandum of agreement (MoA) was finalized between the Institute and the Fiji Meteorological Services effective for a period of 5 years (2020 to 2025). Both, SRIF and FMS have entered into an agreement with the aim of establishing and strengthening co-operation between the two



organizations. The agreement will improve the coordination, gathering and sharing of information including the installation and re-activation of hydro-meteorological stations.

Installation of Automatic Weather Station

An Automatic Weather Station (AWS) is a meteorological station where observations are made, recorded and transmitted automatically. either to save human labor or to enable measurements from remote areas or during weather extremes.

An AWS was installed by Fiji Meteorological Services at the Institute's head office in Drasa, Lautoka (figures 4.7 & 4.8). The AWS was funded by UNDP.

Some of the key parameters that are measured by the AWS are:

- Wind Speed
- Wind Direction
- Air Temperature
- Relative Humidity
- Atmospheric Pressure
- Leaf Wetness
- Earth temperature at different levels from 5cm to 100cm
- Solar Radiation
- Rainfall

Figure 4.7: Ground work in progress for AWS instruments installation at station V77555.

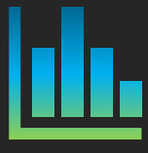
Figure 4.8: Completed AWS installation at station V77555.

Crop Production

3,500+
Tonnes seed cane produced

10,100+
Tissue culture plants produced

1.8M+
tonnes cane crushed



1.0 SEED CANE PRODUCTION

All three mill areas, Lautoka, Rarawai and Labasa have the hot water treatment plants for treatment of 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. Farmers should use clean equipment to harvest this seed cane before taking it for planting in their field. Planting is one of the most expensive farming operations when growing sugar cane. It has an enormous impact on the long-term productivity of a plot. Ignoring timing, seed cane source, and good planting methods can lead to poor germination and gaps in the field; this will reduce crop yields, reduce the number of ratoons from the plot, and increase costs by additional efforts to control weeds. Good-quality seed cane is critical to successful crop establishment. Benefits of quality seed cane include;

- Germination percentage is more than 85%
- Better successive ratoons
- Increase in yield to the extent of 10% to 15%
- Reduction in the expense on plant protection measures

1.1 LAUTOKA MILL AREA

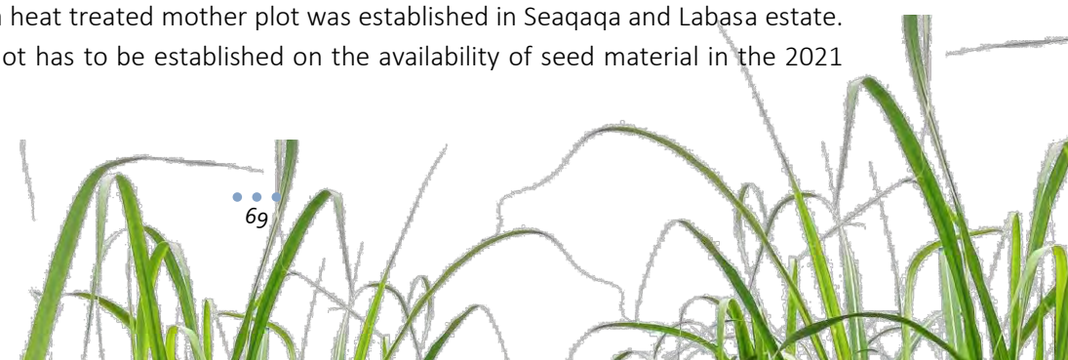
In 2020, about 150 tonnes of seed cane was distributed from Hot water treated mother plots, which was planted in FSC Lautoka Estate in 2019. Most of this seed cane was taken by nearby farmers in Drasa and Lovu sector. Also, SRIF facilitated planting 8 hectares of seed cane distribution plot in Nadi and Sigatoka District. The seed cane used to plant these plots was sourced from Hot water Mother plots. SRIF has acquired 4.6ha of land in FSC Waqadra Estate to plant Hot water treated mother plots in 2021.

1.2 RARAWAI MILL AREA

In 2019-2020, SRIF Rarawai had 1.8 ha of HWT seed cane plots namely Qamea – 0.2ha, Kaba – 0.2 ha, Viwa – 0.1 ha and Mana – 0.5 ha as plant crop and 0.8 ha Mana as 1st Ratoon. From these plots, approximately 25 tonnes of HWT treated seed cane for Mana, Qamea, Viwa and Kaba was taken by farmers and remaining (mostly from ratoons) were harvested and sent to the mill. SRIF has a greenhouse at Rarawai that has a capacity of producing more than 20, 000 seedlings of various commercials which could be supplied to farmers for gap filling. During 2020, 7616 seedlings were produced in the greenhouse for 6 commercial varieties of which some Mana seedlings were bought by a nearby farmer for gap filling but majority seedlings remained in the greenhouse with Qamea seedlings already planted whereas remaining awaiting favorable weather conditions for planting. Apart from HWT seedlings, tissue culture seedlings were also received from Drasa and planted with LF2019 Stage 1 trial as well as another 0.3 ha as separate plot. Some of the tissue culture seedcane was given to farmers in Naroko, Ba (Moto Sector) and Vuqele, Tavua (Drumasi sector).

1.3 LABASA MILL AREA

Eight hectares of hot water treated seed bed was established in Vanua Levu in May 2020. Around 15.78 hactares of distribution plot which was established in 2019 was in its first ratoon in 2020 for the farmers in the sector. Another 8.0 ha heat treated mother plot was established in Seaqaqa and Labasa estate. New heat-treated mother plot has to be established on the availability of seed material in the 2021 planting window.



2.0 TISSUE CULTURE

The Plant tissue culture laboratory at Sugar Research Institute of Fiji, Lautoka uses in vitro techniques to grow plants in a sterile, well-monitored environment with the help of meristem and shoot tip culture. The process of micropropagation is usually divided into stages as Initiation, Multiplication, Shooting, Rooting, and Acclimatization. The lab work comprises Inoculation from the very first stage to sub-culturing in intervals of 15-20 days to different stages till the Rooting stage, medium preparation (with macronutrients, micronutrients, and plant growth hormones for the explant to survive in a controlled environment), cleaning procedures includes (glassware cleaning and general lab cleaning) and sterilization practices.

Five varieties were propagated in the lab: Qamea, Viwa, Aiwa, LF91-1925, and Naidiri. With the existing varieties in the lab, there is a total of 3,332 glass jars and test tubes with 16,047 plantlets in different stages (M5, M6, and Shooting). A total of 11,218 plants for variety (Qamea) has been released in 4 batches. Upon reaching 8 months the first batch of quality seedcane material was distributed to two farmers in Ba and Tavua on a trial basis. While the other batches transferred to the field have been performing well. After a decade of small-scale production, in 2017 a new proposal was set forth to continue plant tissue culture but in micropropagation to produce quality seedcane material.

The renovation and structural set up of the laboratory suitable for tissue culture was carried out in 2018 under EU Funds. Structural changes were done after a training leading to the official opening in 2019 by the Honourable Prime Minister of Fiji and EU Ambassador in the memory of late Dr. Krishnamurthi. More than 10,000 plantlets were produced in the laboratory and a target to put out 5,000 plants in the field. Even though 2020 has been challenging, culture production was maintained with 16,047 plantlets with 3 batches dispatched to the field for this year. The technique to produce clean seedcane material through plant tissue culture has been developedbut the adoption of the tissue culture seedlings for commercial farming is still a major challenge for the farmers. On a trial basis, two farmers from Ba and Tavua were given 8-month-old seedcane that was produced from the tissue culture seedlings fromthe first batch planted in 2019.

The technique used to produce clean cultures in the laboratory

Production of clean cultures in the laboratory comprises from selection of clean explant to maintaining it through Rooting stage with multiple clones produce like the mother plant. Producing clean plant material includes the continuous hygienic protocols in place to maintain high production and less contamination. The procedure starts from the selection of a clean explant from the mother plant, the selected explant is sterilized with chemicals and culturing techniques in laminar airflow, dissecting the virus-free region known as meristem.

Meristem culture is commonly carried out to produce virus-free cultures. For meristem to successfully survive, a food source is prepared, known as MS media consisting of macro, micro and trace elements from certain chemicals in proportions. One explant multiplies into several smaller plants which are sub-cultured into a new MS media to keep increasing the production. Upon transfer to different stages, the plants are kept and monitored for 15-30 days to attain more plants which will be sub cultured into new media. The plants thrive well in the created atmosphere in the lab with the amount of light and darkness provided through LED lights with timers. To produce maximum cultures the explant passes through

several stages from Initiation (I0, I1, IM), Multiplication with six phases with and without PGH (Kinetin, IBA, IAA, GA), Shooting and Rooting stage. One of the main objectives is to maintain the production above 10,000 plantlets and in 2020 16,047 plantlets were produced from the 5 varieties Qamea, Viwa, Aiwa, LF91-1925, and Naidiri.

Plantlets hardening in the greenhouse

Upon the Rooting stage completion, the plants are ready to be transferred from a well-controlled surrounding to the open atmosphere as the hardening stage. Plants with well-developed roots are potted into the sterilized potting mixture (Mill mud and topsoil) after cleaning the plants.

The plants are maintained in the polytunnel for few weeks as primary hardening and later exposed to direct sunlight to adjust to the environment. While in the acclimatization phase, plants are trimmed 3-4 times in 2 months. Constant care is given in regards to irrigating the plants for proper establishment, foliar fertilizer application and manual weeding.

Figure 2.1: plantlets hardening in the greenhouse

Field Planting

The allocated field should be prepared to get a fine soil tilth. Different spacing has been used while planting to determine the suitable one. A row spacing of 1.5 apart ×40cm between plants has been adopted.

For early planting, germination is monitored followed up by monthly observations on the growth phase, tillers, and gaps. The field should be irrigated immediately after planting and the next irrigation should be on the third day if no rain is received. Successive irrigations are given every two weeks for the first 10 weeks depending on weather conditions. Fertilizer application and weeding are also tracked accordingly.

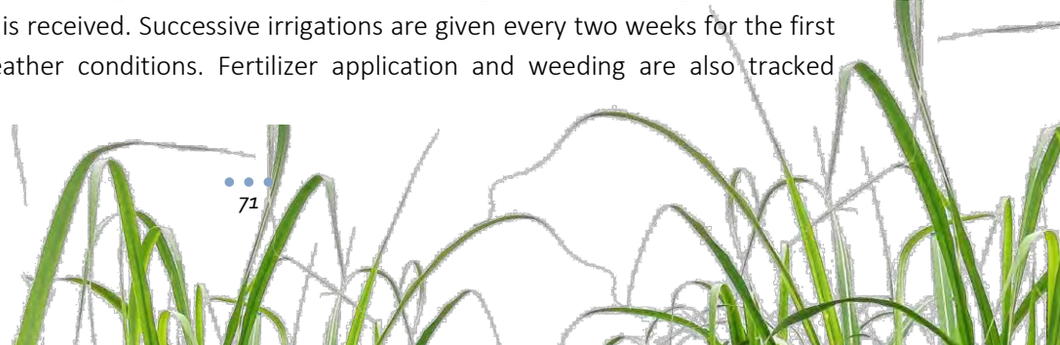


Figure 2.2: Field planting of Tissue Culture plantlets

Seedling Production in the lab

As target of producing 10,000 seedlings was set but this was exceeded as more than 16,000plants were produced.

Only 4,000 glass jars can be accommodated in the plant growth room space. These glass jars are used for media preparation and sub-culture in the Laminar Air Flow (LAF) cabinet to produce a clean culture. A total of 3,332 glass jars were maintained in the Plant Growth Room (PGR) which contains 6 Glass Rack each with 5 shelves.

Table 2.1: Estimated number of plants that can be achieved from each glass jar

Variety	Stage	No. of glass jars	Est. count of plants/jar	Forecasted No. of plants
Qamea	M5	614	5	3,070
	M6	454	5	2,270
	Shooting stage	494	7	3,458
Viwa	M6	528	4	2,112
Aiwa	M6	506	4	2,024
LF 91-1925	M5	223	7	1,561
	M6	500	3	1,500
Naidiri	M5	13	4	52
Total		3,332		16,047

Percentage germination of plants transferred from the lab to the greenhouse

The ultimate success of micropropagation on commercial scale depends on the ability to transfer plants out of culture on a large-scale, at a low cost and high survival rates. The success rate is measured upon an acclimatization process in order to ensure that sufficient number of plants survive and grow vigorously when transferred to the field.

Hardening varies from 2-3 months according to how well the plants adopt the outside environment. The table below shows the 2020 progress on releasing one variety (Qamea) from the laboratory to the greenhouse for Hardening. A total of 11,586 plants were transferred but only 9,768 plants (84%) survived the acclimatization phase.

Table 2.2: Lab to greenhouse progress of Qamea

Variety	Batches	Date Planted	No. Transferred	No. Survived	% Survived
Qamea	Batch 2	02/03/20 03/03/20	1,893	1,250	66
	Batch 3	17/04/20 01/05/20	1,981	1,334	67
	Batch 4	21/09/20 22/09/20	7,712	7,184	93
Total			11,586	9,768	84

Percentage germination of plants transferred from the greenhouse to the field

Establishment of the tissue culture raised plants in the field is above 85 per cent if proper maintenance and irrigation schedules are followed.

Table 2.3: Green house to field progress of Qamea (with number survived after 30 days)

Variety	Batches	Date Planted	No. Transferred	No. Survived	% Germination
Qamea	Batch 2	21/04/20 23/04/20	1,250	830	66
	Batch 3	03/07/20 09/07/20	1,008	1,008	75
	Batch 4	08/12/20	4,786	3,414	71
Total			7,044	5,252	

Tissue culture plant in the field after 3 months

Seed cane produced by tissue culture was distributed to two farmers in Tavua and Ba for field adaptability observations.The area planted by the Tavua farmer was 0.8hectares while the farmer at Ba planted two guard rows with 50 -60 stalks.

The feedback from field officers were that the farmer in Tavua had moderately good germination after planting whereas the germination was greatly affected in the Ba farm due to poor husbandry practices. This cane will be harvested in 2021.

Figure 2.4: Tissue culture plant in the field (3 months later)

Conclusion

Initially plant tissue culture was prioritized for cryopreservation in case of any viral outbreak. As this project focuses on micropropagation, producing clones from the mother plant in shorter duration, it has successfully achieved its target for 2020, with more than 16,000 seedlings produced in the laboratory including 3 batches that were successfully transferred from the laboratory to the greenhouse and subsequently to the field.

3.0 FACP

Table 3.1: Main features of 2020 season compared with 2019										
Mill →	Lautoka		Rarawai		Labasa		Penang		All mills	
Year →	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Total registrations (Numbers)	5474	5494	5370	7161	4151	4179	1759	N/A	16754	16834
Total farm basic allotments (tonnes)	957700	962195	966969	1250312	941352	947586	276654	N/A	3142675	3160093
Total registered area (hectares)	23119	23166	22229	30386	19780	49788	8046	N/A	73174	103340
Total area cultivated (hectares)	21156	9443	11052	14505	21156	14522	3413	N/A	56777	38470
Total area harvested (hectares)	9283	8957	10895	13950	14214	13826	3251	N/A	37643	36734
Total farm harvest quotas (tonnes)										Open
Sugar make actual (tonnes)	58439	42353	44830	46291	65435	64473	N/A	N/A	168702	153117
Tonnes 94 N.T sugar	60830	42353	46594	47669	68007	66591	N/A	N/A	175431	156613
Yield tonnes 94 N.T. sugar per hectare	5	5	4	3	5	5	N/A	N/A	4	4
Tonnes cane per tonnes sugar 94 N.T.	11	12	11	12	10	10	N/A	N/A	11	11
%POCS	10	9	10	10	11	10	N/A	N/A	11	10
Cane purity average for season	79	77	80	77	81	82	N/A	N/A	80	80
Tonnes cane harvested	474914	418149	523920	639816	661919	671316	145808	N/A	1806561	1729281
Tonnes cane crushed	657161	505652	487428	552314	661919	671316	NIL	NIL	1806507	1729281

Table 3.2: Monthly rainfall(mm) for 2020 compared with long term average														
Mills	No. of years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lautoka	2020 actual	114	204	595	244	198	60	75	20	32	74	104	111	1830
	111 yrs. avg. to 2020	304	325	324	186	97	65	51	67	72	91	125	188	1894
Rarawai	2020 actual	88	121	534	276	211	51	8	29	64	86	247	137	1850
	134 yrs. avg. to 2020	356	358	359	285	79	39	29	92	100	143	216	237	2293
Labasa	2020 actual	166	205	726	187	57	62	37	135	112	252	131	532	2601
	131 yrs. avg. to 2020	360	360	364	360	359	359	359	359	359	360	359	362	4319
Penang	2020 actual	128	170	446	166	276	58	1	39	50	192	248	449	2221
	122 yrs. avg. to 2020	429	356	401	375	122	72	52	93	85	144	153	247	2528

Table 3.3: Crop production details										
	Lautoka		Rarawai		Labasa		Penang		All mills	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Areas harvested (hectares)										
Plant	777	504	1309	1133	1812	1109	428	N/A	4326	2745
First ratoon	765	787	1716	1702	1929	1806	342	N/A	4751	4294
2nd ratoon	590	773	1174	1902	1687	1908	228	N/A	3679	4583
Other ratoons	7151	6893	6696	9214	8786	9004	2254	N/A	24888	25111
Total	9283	8957	10895	13950	14214	13826	3251	N/A	37643	36733
Cane harvested (tonnes)										
Plant	45714	29812	67825	61219	88806	61014	22164	N/A	224509	152044
First ratoon	45664	41340	87813	88045	105423	97857	16758	N/A	255658	227243
2nd ratoon	33250	40702	57904	90152	83429	95279	11186	N/A	185769	226133
Other ratoons	350286	306295	310378	400401	384261	417165	95700	N/A	1140626	1123861
Total	474914	418149	523920	639816	661919	671316	145808	N/A	1806562	1729281
Yield tonnes cane per hectare (TCH)										
Plant	58.8	59.1	52.0	54.1	49.0	55.0	51.8	N/A	51.9	55
First ratoon	59.7	52.5	51.0	51.7	54.6	54.2	49.1	N/A	53.8	53
2nd ratoon	56.4	52.7	49.0	47.4	49.5	49.9	49.1	N/A	50.5	49
Other ratoons	49.0	44.4	46.0	43.5	43.7	46.3	42.5	N/A	45.8	45
Avg. yield/ha	49.3	46.7	49.0	45.9	46.6	48.6	44.8	N/A	48.0	47
Varieties crushed (% of total cane harvested)										
Ragnar	0.6	0.3	0.5	0.1	20.7	18.9	0.0	N/A	9.1	7.5
Aiwa	0.7	0.6	0.2	0.1	0.1	0.2	0.1	N/A	0.3	0.2
Beqa	0.1	0.1	nil	nil	0.0	nil	0.0	N/A	0.0	0.0
Galoa	0.1	0.1	nil	nil	4.5	4.3	0.0	N/A	1.7	1.7
Kaba	2.0	1.6	6.4	2.5	0.2	0.2	0.1	N/A	2.5	1.6
Mali	0.1	nil	0.1	nil	7.5	6.4	0.0	N/A	2.8	2.5
Mana	91.7	92.7	90.1	95.0	0.0	nil	97.0	N/A	56.8	57.3
Naidiri	2.5	3.2	0.7	1.3	49.4	53.9	2.6	N/A	19.2	21.7
Vatu	0.0	nil	nil	nil	8.7	7.1	0.0	N/A	3.2	3.3
Waya	0.0	nil	0.3	0.3	4.6	2.9	0.0	N/A	1.7	1.2
LF91-1925	1.3	0.7	1.3	0.2	3.1	3.4	0.0	N/A	1.8	1.5
Kiuva	0.4	0.3	nil	0.1	0.5	0.7	0.0	N/A	0.3	0.4
Qamea	0.3	0.2	nil	nil	nil	nil	0.0	N/A	0.0	0.1
Viwa	0.1	0.2	nil	nil	0.2	0.1	0.0	N/A	0.1	0.1
Expt./Others	0.1	0.2	0.3	0.3	0.4	1.9	0.1	N/A	0.3	0.9
Total	100	100	100	100	100	100	100	N/A	100	100

Table 3.4: Rainfall (mm) at mill centres										
Mill	For 12 months ended 31st December					For 12 months ended 30th September				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Lautoka	2072	1721	2129	1354	1830	1666	1380	2070	1442	1541
Rarawai	1908	1993	2228	2036	1850	1768	1547	2286	2042	1380
Labasa	1773	2122	2971	2355	2601	1167	1471	2981	2099	1686
Penang	2086	1799	2940	1990	2221	1685	1711	2787	2171	1332

Table 3.5: Rainfall distribution affecting 2020 crop(mm)					
Month	Period	Lautoka	Rarawai	Labasa	Penang
Jul-19	Early	0	0	2.3	3.8
	Mid	13.5	0.3	0	22.1
	Late	47.7	48.8	27	25.8
Aug-19	Early	0	0	0	0
	Mid	0	0	0	0
	Late	10.1	12.7	40.9	16.9
Sep-19	Early	58.5	102.7	84.8	68.2
	Mid	27.5	27.9	0	0.4
	Late	0	0	0	6.2
Oct-19	Early	20.3	11	57.4	29.5
	Mid	59.6	7.6	0	11.6
	Late	6.5	66.3	127.2	0
Nov-19	Early	16.6	48.3	16.2	81.6
	Mid	52.3	54.8	34	11.4
	Late	0	5.1	6.8	3.8
Dec-19	Early	0	8.2	20.4	1.4
	Mid	4.7	33.4	45.7	7.6
	Late	153.4	148.4	348	151.4
Jan-20	Early	0	1.1	0	18.2
	Mid	58.4	52	128.9	86.3
	Late	55.7	34.4	36.8	23.2
Feb-20	Early	83	51.9	0.9	71.3
	Mid	94	60.2	196.6	50.7
	Late	26.6	8.9	7.6	47.5
Mar-20	Early	158.2	69.3	266	126
	Mid	228	292.2	296.6	173.4
	Late	208.7	172	163	147
Apr-20	Early	163	206.7	97.2	82.4
	Mid	20.9	27.2	13.1	20.2
	Late	60	42	76.7	63
May-20	Early	131.3	175	25	274.8
	Mid	0	2	14.8	1
	Late	66.6	33.5	17.1	0
Jun-20	Early	0.8	12.7	36.9	38.5
	Mid	0	0	1	3.1
	Late	58.7	38	24.5	16
Early - 1st to 10th of the month Mid - 11th to 20th of the month Late - 21st to end of the month					

Table 3.6: Hectares harvested										
Mills	Crop	Average for period of five seasons					Last four seasons individually			
		1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/2 020	2017	2018	2019	2020
Lautoka	P	2944	1042	788	775	638	637	756	777	504
	R	19701	19730	14614	10630	8583	9476	8376	8506	8453
	Total	22645	20772	15402	11405	9521	10113	9132	9283	8957
Rarawai	P	3164	1055	1127	953	1191	1309	1799	1309	1133
	R	14613	17585	14553	11367	9881	8968	8426	9586	12817
	Total	17777	18640	15680	12320	11072	10277	10225	10895	13950
Labasa	P	2597	1269	1116	1403	1526	2008	1673	1812	1109
	R	18348	15911	14039	11500	12516	12238	12800	12402	12717
	Total	20945	17180	15155	12903	14042	14246	14473	14214	13826
Penang	P	1120	542	339	368	352	226	452	428	N/A
	R	4674	4568	3991	3142	2933	3178	2823	2823	N/A
	Total	5794	5110	4330	3510	3285	3404	3275	3251	N/A
All mills	P	9825	3908	3369	3499	3636	4180	4680	4326	2746
	R	57336	57794	47197	36640	33776	33860	32425	33317	33987
	Total	67161	61702	50567	40139	37263	38040	37105	37643	36733

* Please note the figures for R in 2019 had errors thus has been changed in this.

Table 3.7: Tonnes of cane harvested									
Mills	Average for period of five seasons					Last four seasons individually			
	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2017	2018	2019	2020
Lautoka	1216597	971454	763321	516159	430480	429570	457480	474914	418149
Rarawai	957507	878509	738316	551682	464204	407861	479625	523920	639816
Labasa	1017061	840388	695728	547372	656529	675731	620328	661919	671316
Penang	309205	239044	213253	170698	116658	118231	139937	NIL	NIL
All mills	3500370	2929395	2410619	1785912	1595258	1631393	1697370	1530997	1729281

Table 3.8: Tonnes of cane per hectare harvested										
Mills	Crop	Average for period of five seasons					Last four seasons individually			
		1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2017	2018	2019	2020
Lautoka	P	64.2	63.9	67.2	57.7	56.0	54.6	58.8	58.8	59.1
	R	51.4	45.9	47.6	44.3	44.5	46.2	41.7	55.0	49.9
	Total	53.7	46.8	49.1	45.2	43.2	42.5	42.5	51.0	46.7
Rarawai	P	62.1	59.6	58.8	56.7	52.5	47.8	58.8	52.0	54.1
	R	52.9	46.4	44.8	43.8	43.2	43.0	54.0	49.0	47.5
	Total	53.9	47.1	46.5	44.8	42.8	39.7	56.4	48.0	45.9
Labasa	P	56.5	59.7	56.7	53.4	51.1	48.3	47.9	49.0	55.0
	R	47.4	47.6	43.5	41.4	46.9	47.5	44.8	49.3	50.2
	Total	48.6	48.9	45.8	42.7	47.4	47.4	46.4	47.0	48.6
Penang	P	62.6	54.2	56.3	50.6	39.3	37.2	35.7	52.0	N/A
	R	51.2	46.4	48.3	48.4	40.4	33.1	52.6	46.9	N/A
	Total	53.3	46.8	49.1	48.6	38.1	34.7	44.2	45.0	N/A
All	P	61.8	58.3	59.5	55.3	50.1	47.0	50.3	51.9	55.0
Mills	R	50.0	46.0	45.8	43.5	44.5	42.5	48.3	50.0	49.0
	Total	52.1	47.5	47.3	44.5	43.4	41.1	49.3	48.0	47.0

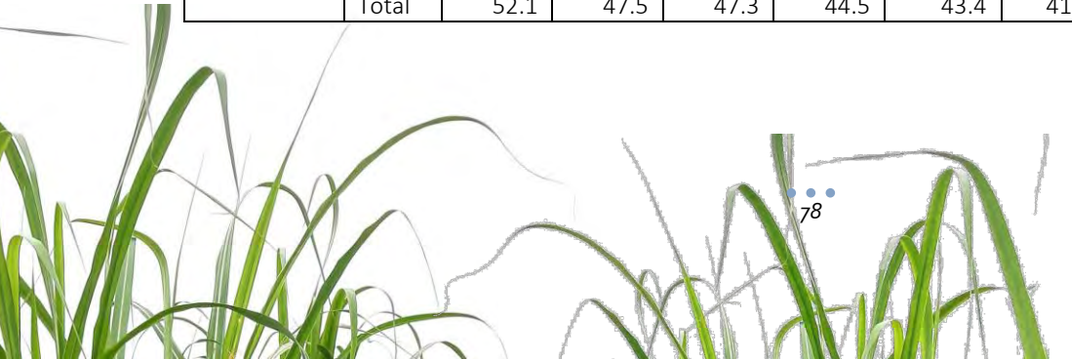


Table 3.9: Hectares harvested in relation to registered area and cultivated area (ha)					
Mills	2020 hectares (A)			Hectares harvested as % of various categories "A"	
	Registered (1)	Cultivated (2)	Harvested	(1)	(2)
Lautoka	23166	9443	8957	38.7	94.9
Rarawai	30386	14505	13950	45.9	96.2
Labasa	49788	14522	13826	27.8	95.2
Penang	N/A	N/A	N/A	N/A	N/A
Total	103340	38470	36734	35.5	95.5

Table 3.10: Plant cane harvested as percentage of total cane harvested									
Mills	Average for period of five seasons					Last four seasons individually			
	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2017	2018	2019	2020
Lautoka	13.0	5.0	5.5	8.5	8.3	8.1	9.7	10.0	7.1
Rarawai	18.0	6.0	8.2	9.7	12.6	15.3	20.1	12.9	9.6
Labasa	12.0	7.0	8.2	13.4	11.7	14.4	12.9	13.4	9.1
Penang	19.0	11.0	8.2	10.7	11.1	7.1	11.5	15.2	NIL
All mills	15.0	7.0	7.4	10.5	11.5	11.2	13.6	12.4	8.8

Table 3.11: Plant, ratoon yields and percentage of total area harvested - 2020 Crop											
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	59.1	504.4	5.6	52.5	787.1	8.8	44.4	6893.0	77.0	46.7	8957.4
Rarawai	54.1	1132.5	8.1	51.7	1701.5	12.2	43.5	9217.0	66.0	45.9	13950.4
Labasa	55.0	1108.5	8.0	54.2	1805.6	13.1	46.3	9003.9	65.1	48.6	13825.8
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	55.0	2745.4	7.5	53.0	4294.2	11.7	45.0	25110.9	68.4	47.0	36733.6

Table 3.12: Seasonal %POCS in cane									
Mills	Rough average for period of five seasons					Last four seasons individually			
	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2017	2018	2019	2020
Lautoka	11.4	11.5	10.8	11.4	10.5	11.8	10.6	9.9	9.3
Rarawai	11.4	11.9	10.9	11.3	10.3	11.4	10.0	10.4	9.8
Labasa	11.1	11.5	10.7	11.5	11.1	11.1	11.5	10.8	10.2
Penang	11.1	11.9	11.1	11.1	NIL	NIL	NIL	NIL	NIL
All Mill Avg.	11.2	11.7	11.0	11.4	10.6	11.6	10.6	10.4	9.8

Table 3.13: Weekly POCS in cane 2020 season				
Week	Lautoka	Rarawai	Labasa	Week average
1	7.3	9.0	9.4	8.6
2	7.4	9.2	9.8	8.8
3	8.8	8.4	9.7	9.0
4	9.0	9.5	10.0	9.5
5	9.8	9.6	9.9	9.8
6	10.0	9.7	10.1	9.9
7	9.5	9.9	10.2	9.9
8	9.9	10.1	10.5	10.2
9	9.7	10.0	10.1	9.9
10	10.1	10.1	10.6	10.3
11	10.0	9.5	10.9	10.1
12	9.6	9.9	10.8	10.1
13	10.0	10.5	11.0	10.5
14	8.5	10.8	10.6	10.0
15	9.2	10.5	10.7	10.1
16	9.1	10.0	11.0	10.0
17	9.2	10.2	10.9	10.1
18	8.3	10.0	9.7	9.3
19	8.6	9.8	9.9	9.4
20	7.9	9.7	10.5	9.4
21	-	9.9	10.2	10.1
22	-	8.9	9.9	9.4
23	-	-	9.9	9.9
24	-	-	9.3	9.3
25	-	-	-	-
26	-	-	-	-
27	-	-	-	-
Average	9.1	9.8	10.2	9.0

Table 3.14: Sugar produced (tonnes 94 N.T. equivalent)									
Mills	Tonnes sugar 94 N.T equivalent								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lautoka	48129	41874	76456	63784	40595	52021	60256	60825	42353
Rarawai	45732	60039	68277	61083	25979	57167	42708	46594	47669
Labasa	45398	63423	69647	82744	76466	67010	64332	68007	66591
Penang	19908	19258	21684	18731	N/A	N/A	N/A	N/A	N/A
All mills	159166	184594	236065	226342	143040	176198	167296	175431	156613

Table 3.15: Sugar tonnes 94 N.T equivalent per hectare (TSH)										
Mills	Average for period of five seasons					Last five seasons individually				
	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2016	2017	2018	2019	2020
Lautoka	5.6	4.9	4.4	4.9	9.2	4.0	8.4	10.5	11.0	11.9
Rarawai	5.6	5.4	4.0	4.9	8.8	2.6	8.7	11.2	10.0	11.6
Labasa	5.0	5.0	4.0	5.1	8.9	5.7	9.3	9.3	10.0	10.1
Penang	5.4	4.7	5.4	5.5	5.7	NIL	5.7	NIL	NIL	NIL
Average	5.4	5.1	4.3	5.1	8.7	3.9	8.0	10.3	10.0	11.2

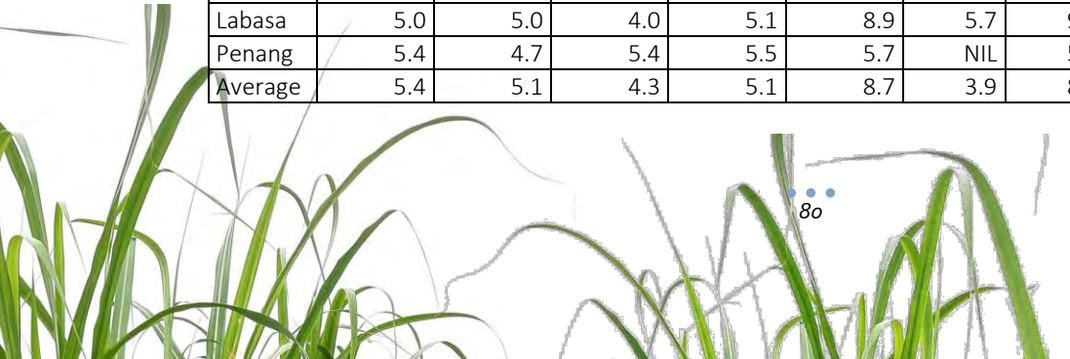


Table 3.16: Length of season (weeks) - Start and finish of crushing (date)									
Mills	Average length of season (5 yearly)					Last four seasons individually			
	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2016/ 2020	2017	2018	2019	2020
Lautoka	29.7	27.6	27.0	22.3	22.6	19.1 06/06/17 To 17/10/17	24 09/07/18 To 17/10/18	26 13/06/2019 To 15/12/2019	23 24/06/2020 To 29/11/2020
Rarawai	26.5	24.2	28.0	22.1	21.7	20.5 07/06/17 To 28/10/17	22.9 17/07/18 To 24/12/18	22 08/07/2019 To 09/12/2019	24 23/06/2020 To 30/11/2020
Labasa	30.7	24.1	25.9	18.7	24.2	24.4 01/06/17 To 19/11/17	26 19/06/18 To 12/12/18	25 12/06/2019 To 05/12/2019	25 10/06/2020 To 28/11/2020
Penang	26.2	20.4	22.5	18.1	NIL	No crushing	No crushing	No crushing	No crushing
All mills	28.2	24.1	25.9		22.9	21.3	24.3	25	24

Table 3.17: Varieties Percent of hectares harvested										
Varieties	Lautoka		Rarawai		Labasa		Penang		All Mills	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Ragnar	0.6	0.3	0.5	0.1	20.7	18.	0.0	nil	9.1	7.5
Waya	0.0	0.0	0.3	0.3	4.6	2.9	0.0	nil	1.7	1.2
Mali	0.0	0.0	0.1	0.0	7.5	6.4	0.0	nil	2.8	2.5
Galoa	0.1	0.1	0.0	0.0	4.5	4.3	0.0	nil	1.7	1.7
Aiwa	0.7	0.6	0.2	0.1	0.1	0.2	0.1	nil	0.3	0.2
Mana	91.7	92.7	90.1	95.0	0.0	0.0	97.0	nil	56.8	57.3
LF91-1925	1.3	0.7	1.3	0.2	3.1	3.4	0.0	nil	1.8	1.5
Kaba	2.0	1.6	6.4	2.5	0.2	0.2	0.1	nil	2.5	1.6
Vatu	0.0	0.0	0.0	0.0	8.7	7.1	0.0	nil	3.2	3.3
Beqa	0.1	0.1	0.0	0.0	0.0	0.0	0.0	nil	0.0	0.0
Naidiri	2.5	3.2	0.7	1.3	49.4	53.9	2.6	nil	19.2	21.7
Kiuva	0.4	0.3	0.0	0.1	0.5	0.7	0.0	nil	0.3	0.4
Qamea	0.3	0.2	0.0	0.0	0.0	0.0	0.0	nil	0.0	0.0
Viwa	0.1	0.2	0.0	0.0	0.2	0.1	0.0	nil	0.1	0.1
Exp.	0.1	0.0	0.0	0.0	0.0	0.1	0.0	nil	0.0	0.0
Others	0.1	0.2	0.3	0.3	0.4	1.8	0.1	nil	0.3	0.9

Table 3.18: 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		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Lautoka	860.9	560.8	545.4	3.7	2.4	2.4	7.8	6.0	6.1
Rarawai	1705.8	921.8	916.0	7.7	4.1	3.0	15.6	8.3	6.3
Labasa	2035.2	1186.4	1099.2	10.2	6.0	2.2	13.3	8.3	7.6
Penang	476.2	386.9	0.0	5.9	4.8	0.0	13.6	11.3	0.0
Total	5077.1	3055.9	2568.6	6.9	4.2	2.5	12.5	7.6	6.7

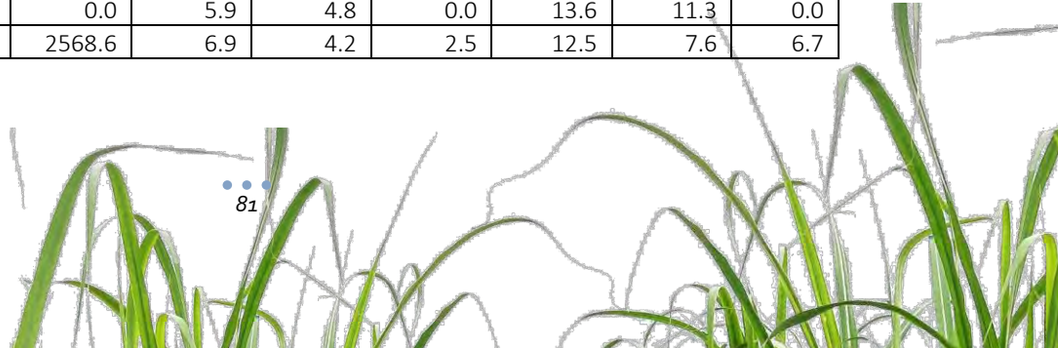


Table 3.19: Percentage of total area planted by different varieties over three years											
		Lautoka		Rarawai		Labasa		Penang		All mills	
Year	Varieties	%	Area ha	%	Area ha	%	Area ha	%	Area ha	%	Area ha
2018	Ragnar	0.2	2.1	-	-	8.3	169.4	-	-	3.4	171.5
2019		-	-	0.0	0.4	10.1	119.4	-	-	3.9	119.8
2020		0.2	0.9	-	-	9.3	101.7	-	-	4.0	102.6
2018	Waya	-	-	0.2	2.6	2.0	40.8	-	-	-	-
2019		-	-	0.3	2.9	1.5	17.9	-	-	-	-
2020		-	-	0.1	0.5	-	-	-	-	0.0	0.5
2018	Mana	96.3	829.4	97.7	1666.5	-	-	94.4	449.3	58.0	2945.2
2019		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
2018	Galoa	-	-	-	-	2.8	57.8	-	-	1.1	57.8
2019		-	-	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
2018	Vatu	-	-	-	-	4.8	97.8	-	-	1.9	97.8
2019		-	-	-	-	3.0	36.0	-	-	1.2	36.0
2020		-	-	-	-	3.0	33.2	-	-	1.3	33.2
2018	Mali	-	-	-	-	3.0	60.8	-	-	1.2	60.8
2019		-	-	-	-	2.2	25.7	-	-	0.8	25.7
2020		-	-	-	-	3.3	36.3	-	-	1.4	36.3
2018	Aiwa	0.3	2.4	0.2	3.2	-	0.2	-	-	0.1	5.8
2019		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
2018	Beqa	0.1	0.7	-	-	-	-	-	-	0.0	0.7
2019		-	-	-	-	-	-	-	-	-	-
2020		-	-	-	-	-	-	-	-	-	-
2018	Kaba	0.5	4.1	1.8	30	0.2	4.4	-	-	0.8	38.5
2019		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
2018	Naidiri	0.8	7.1	0.0	0.6	72.7	1478.8	5.6	26.9	29.8	1513.4
2019		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
2018	Kiuva	0.0	0.3	-	-	0.4	8.1	-	-	0.2	8.4
2019		-	-	-	-	0.6	7.2	-	-	0.2	7.2
2020		-	-	-	-	0.1	0.8	-	-	0.0	0.8
2018	LF91-1925	0.7	6.2	0.1	1.3	4.8	98.1	-	-	2.1	105.6
2019		-	-	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
2018	Qamea	-	-	0.1	1.6	0.5	11.1	0.0	0.4	0.3	13.8
2019		0.2	1.4	0.3	2.5	1.7	19.6	0.1	0.4	0.8	23.9
2020		-	-	0.3	2.9	0.9	9.4	-	-	0.5	12.3
2018	Experiment	-	-	-	-	-	-	-	-	-	-
2019		-	-	-	-	-	-	-	-	1.4	43.4
2020		-	-	-	-	-	-	-	-	-	-
2018	Others	-	-	-	-	-	-	-	-	-	-
2019		-	-	-	-	-	-	-	-	-	-
2020		-	-	-	-	1.1	11.5	-	-	1.1	27.8

Table 3.20: Cane transport in Fiji (tonnes of cane harvested and actual method of delivery)									
Mills	Year	Delivered portable line		Winch trailer or lorry to mainline		Lorry direct to mill carrier		Total	
		Tonnes	% of Total	Tonnes	% of Total	Tonnes	% of Total	Tonnes	% of Total
Lautoka	2011	9491	1.5	144569	22.2	498273	76.4	652333	100
	2012	2065	0.4	113819	23.6	365599	75.9	481483	100
	2013	12464	1.7	168852	23.3	544730	75.0	726046	100
	2014	1436	0.3	116328	22.4	402500	77.4	520264	100
	2015	nil	nil	111036	21.3	410029	78.7	521065	100
	2016	50	.01	85410	22.9	286831	77.0	372291	100
	2017	168	0.0	73141	17.0	356261	82.9	429570	100
	2018	nil	nil	70995	15.5	386486	84.5	457481	100
	2019	1308	0.3	129966	27.4	343641	72.4	474915	100
	2020	nil	nil	123532	29.5	294617	70.5	418149	100
Rarawai	2011	23586	3.6	332792	50.1	307396	46.3	663774	100
	2012	14772	3.6	106393	24.9	387485	71.4	508650	100
	2013	22054	6.3	104779	30.2	220584	64.0	347417	100
	2014	14006	2.2	113691	18.0	468653	79.8	596350	100
	2015	12032	2.5	93635	19.1	385098	78.5	490765	100
	2016	8189	3.0	45598	16.6	221077	80.4	274864	100
	2017	5577	1.4	52370	12.8	349914	85.8	407861	100
	2018	1132	0.2	67303	14.0	411190	85.7	479625	100
	2019	760	0.1	62239	11.9	460921	88.0	523920	100
	2020	nil	nil	137167	21	502650	79	639816	100
Labasa	2011	nil	nil	162856	29.0	407610	71.0	570466	100
	2012	840	0.2	117543	28.4	294902	71.4	413285	100
	2013	nil	nil	137018	25.1	409138	75.0	546156	100
	2014	nil	nil	149353	27.4	395000	72.6	544353	100
	2015	nil	nil	181420	27.4	481180	72.6	662600	100
	2016	nil	nil	178355	26.0	508736	74.0	687091	100
	2017	12012	1.8	130502	19.3	533217	78.9	675731	100
	2018	nil	nil	164846	26.6	455482	73.4	620328	100
	2019	23930	3.6	127294	19.2	510695	77.2	661919	100
	2020	1275	0.2	109847	16	560194	83	671316	100
Penang	2011	nil	nil	55422	26.5	153438	73.5	208860	100
	2012	nil	nil	38712	27.0	104856	73.0	143568	100
	2013	nil	nil	40797	26.0	118923	75.0	159720	100
	2014	nil	nil	36454	21.3	134760	78.7	171214	100
	2015	nil	nil	31707	18.6	138422	81.4	170129	100
	2016	nil	nil	nil	nil	91806	100.0	91806	100
	2017	nil	nil	nil	nil	118231	100.0	118231	100
	2018	nil	nil	nil	nil	139938	100.0	139938	100
	2019	nil	nil	nil	nil	145809	100.0	145809	100
	2020	nil	nil	nil	nil	nil	nil	nil	nil
All mills	2011	33077	1.6	695639	33.2	1366717	65.2	2095433	100
	2012	17677	1.1	376467	24.3	1152842	74.5	1546986	100
	2013	8630	2.0	451446	26.2	1293375	74.1	1779339	100
	2014	15442	0.8	415826	22.7	1400913	76.5	1832181	100
	2015	12032	0.7	417798	22.7	1414729	76.6	1844559	100
	2016	8239	0.5	309363	21.7	1108450	77.7	1426052	100
	2017	1775.7	1.1	256013	15.7	1357623	83.7	1631393	100
	2018	1132	0.07	303144	17.86	1393096	82.1	1697372	100
	2019	25998	1.4	319499	17.7	1461066	80.9	1806564	100
	2020	1275	0.1	370546	21.4	1357460	78.5	1729281	100

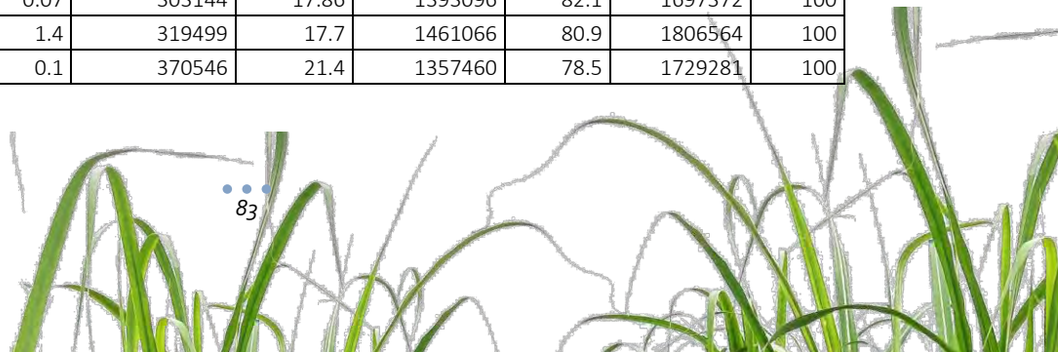


Table 3.21: Percentage burnt cane of total tonnes crushed

Year	Lautoka		Rarawai		Labasa		Penang		Average	
	%	Total	%	Total	%	Total	%	Total	%	Total
1981	17.6	1444504	21.2	1248910	19.4	930265	17.0	307753	18.8	3,931,432
1982	23.2	1507831	24.8	1100133	13.6	1140552	13.2	326348	18.7	4,074,864
1983	18.3	639823	18.4	561774	18.0	761454	12.0	239482	16.7	2,202,533
1984	25.1	1731580	8.2	1146140	12.9	1136737	10.0	382030	14.1	4,396,487
1985	28.6	947593	25.2	864264	22.4	934166	16.2	296418	23.1	3,042,441
1986	29.5	1526648	15.1	1204661	15.1	1017372	11.3	360284	17.8	4,108,965
1987	23.8	1090111	34.2	685994	20.9	877652	19.0	306706	24.5	2,960,463
1988	37.7	1116916	15.2	742128	16.0	1034788	19.2	291440	22.0	3,185,272
1989	20.6	1537337	13.6	1250977	12.7	974201	10.0	336418	14.2	4,098,933
1990	24.3	1347531	30.4	1148070	13.7	1171817	14.6	348110	20.8	4,015,528
1991	42.5	1112957	46.4	961961	32.0	1029223	27.6	276261	37.1	3,380,402
1992	52.5	1109778	52.1	962936	44.4	1162108	41.1	297818	47.5	3,532,640
1993	35.6	1341537	33.4	1013627	29.2	1124357	19.4	224383	29.4	3,703,904
1994	39.0	1337977	36.0	1104246	27.0	1298285	19.8	323743	30.5	4,064,251
1995	43.4	1515880	42.5	1044098	37.6	1216290	28.7	333790	38.1	4,110,058
1996	54.8	1561446	48.1	1229978	39.9	1238443	33.2	349348	44.0	4,379,215
1997	50.7	1160879	49.1	906495	33.5	910137	34.8	302095	42.0	3,279,606
1998	67.0	625763	67.7	406811	54.5	832622	44.6	232825	58.5	2,098,021
1999	41.6	1433143	39.8	992968	17.0	1192735	26.3	339292	32.4	3,958,138
2000	56.1	1301752	54.6	1251282	37.8	911370	49.0	322475	50.6	3,786,879
2001	56.7	906743	50.3	844411	18.9	845444	49.5	208183	42.9	2,804,781
2002	46.8	1137123	41.8	1071579	21.4	938450	33.9	275431	37.1	3,422,583
2003	40.1	890499	32.8	836728	29.3	638851	22.0	243602	33.4	2,609,680
2004	42.7	1032127	39.5	878121	18.3	848533	35.5	242408	34.3	3,001,189
2005	44.4	890779	38.4	761704	25.0	910663	34.9	225594	35.7	2,788,740
2006	60.5	1051097	58.5	1039474	34.4	871031	46.5	264498	51.7	3,226,100
2007	39.0	741231	40.5	738478	39.1	769138	53.5	229844	40.8	2,478,691
2008	50.9	770569	53.6	732165	49.1	604314	48.5	214572	51.1	2,321,620
2009	43.5	726046	33.3	659351	18.6	679584	28.8	181650	31.8	2,246,631
2010	30.4	527663	33.6	522114	18.6	554575	16.3	175701	25.0	1,780,053
2011	28.5	652333	28.2	663774	17.9	570468	26.6	208860	25.3	2,095,435
2012	43.8	481483	44.7	508638	18.7	413285	28.3	143568	35.9	1,546,974
2013	77.8	726046	31.9	347417	14.2	546156	27.0	159720	37.7	1,779,339
2014	50.7	520264	49.9	596350	22.0	544353	28.0	171214	39.9	1,832,181
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	0	0	50.7	877301

TECHNOLOGY TRANSFER

10
Demo plots

7
Hectares mother plot

5
Lime trials

67
Farms (27 ha) under green manure

1.0 LAUTOKA MILL AREA

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; training of FSC extension personnel, training farmers, meeting with key stakeholders, establishing demonstration plots, organizing field days, designing audiovisual aids, media publication, and establishing seed cane nurseries.

Grower demonstration trials

A demonstration trial provides an interactive platform to directly demonstrate the effectiveness and benefits of adopting best management practices to combat declining sugar cane production in Fiji. As the saying goes "seeing is believing," farmers are invited to the demonstration sites to attend field days and see for themselves the results of effectively using our recommendations and its impact on enhancing crop yield and quality. Demonstration trials also provide an ideal opportunity to transfer knowledge to growers about implementing sustainable farming practices and educate them on mitigation strategies to overcome the negative impact of climate change on sugarcane production in Fiji. A total of 11 grower demonstration trials were planted in 8 sectors under Lautoka mill area. The demonstration plots were planted to educate growers on importance of varietal spread.

The table 1.1 below shows the cane production from grower demonstration trials planted in 2019. The results from these farms demonstrated the yield potential of the varieties are much higher than the average cane production yield from farmers' fields.

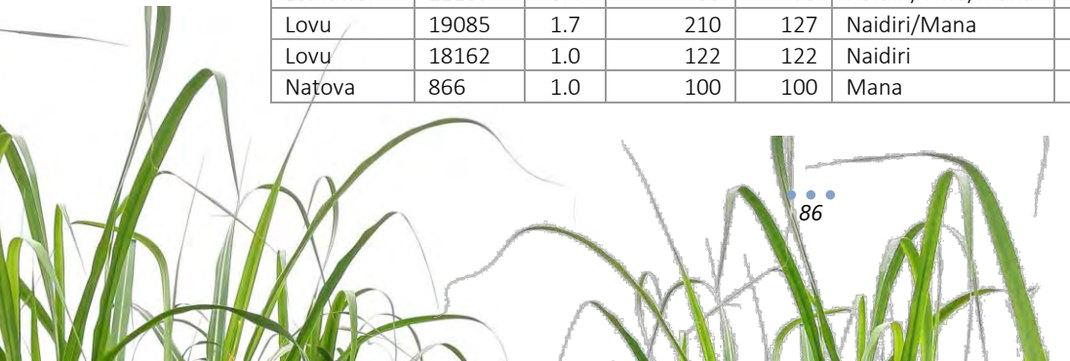
Table 1.1: Cane production from grower demonstration plots (Plant) that were planted in 2019

Sector	Farm #	Area (ha)	Tonnes harvested	TCH	Variety
Lovu	167	1.1	141	128	Mana
Lovu	135	0.4	42	105	Naidiri
Meigunyah	2270	1.3	83	63	Naidiri
Malolo	12903	1.7	283	167	Naidiri

The table 1.2 below shows the cane production in the first ratoon crop from the grower demonstration plots. One of the farmers in Olosara farm nuber 5533 did not harvest his crop in 2020. The yield in first ratoon crop in all the plots except one farm in Olosara was higher than the average cane production in Fiji. This demonstration plot shows that by following recommended practices, it is possible to increase the yield on individual farms.

Table 1.2: Cane production in first ratoon crop from grower demonstration plots

Sector	Farm #	Area (Ha)	Plant 2019			1st Ratoon 2020	
			Harvested (tons)	TCH	Variety	Harvested (tons)	TCH
Drasa	8087	0.6	72	120	Viwa/Mana	67	112
Meigunyah	2140	0.5	45	90	Naidiri/Viwa	30	60
Qeleloa	2426	0.7	86	118	Mana/Viwa	74	102
Nawaicoba	10726	1.0	110	110	Mana/Viwa/Qamea	70	70
Olosara	5695	0.7	78	112	Viwa/Naidiri	35	50
Olosara	5533	0.4	30	75	Kaba	0	0
Lomawai	11237	0.4	30	75	Naidiri/Viwa/Mana	26	65
Lovu	19085	1.7	210	127	Naidiri/Mana	90	55
Lovu	18162	1.0	122	122	Naidiri	90	90
Natova	866	1.0	100	100	Mana	93	93



Results from Tokatoka Sautorotoro Trust Farm

The FSC approached the Sugar Research Institute of Fiji (SRIF) to assist with developing this farm in 2019. The SRIF and the FSC facilitated the planting of sugar cane on this farm using SRIF's mechanical planter and using good quality hot water treated seed cane. SRIF also provided technical advice on timely weed control, fertilizer application, gap filling, drainage, and soil conservation with Vertiver planting. SRIF/FSC continued monitoring this project in 2019 and 2020 and provided guidance on all crop development and harvesting stages. The table 1.3 shows the details and results of this project.

Table 1.3: Cane production and yield of commercial varieties

Plot no	Area (ha)	Variety	Production (tons)	TCH
1	1.7	Naidiri	283	166
2	1.2	Qamea	100	83
3	0.8	Naidiri	119	149
4	0.8	Naidiri	65	81
5	0.9	Naidiri	89	99
6	3.6	Naidiri	431	120
7	3.1	Mana	476	154
8	2.1	Viwa	239	114
9	0.8	Mana	89	111
Total	15.0		1891	126

Source: Fiji Sugar Corporation.

In addition to above production, an estimated 23 tonnes of sugarcane was sold as seed cane to nearby farms from an area of 0.3ha.

Grower information Days

The traditional role of field days and exchange visits has been to introduce growers and agricultural professionals to new technologies and techniques so that the audience could see how these technologies or techniques could be practically used and applied. Based on this concept, field days are conducted to demonstrate new technologies in front of a large manageable group of interested farmers. Through this activity, technical experts, extension workers, and farmers are involved and learn from each other. In 2020, only 4 mini-field days and one major field day were organized in the Lautoka Mill area due to the Covid-19 restrictions that was in place.

Figure 1.1: Farmers participate in actual planting of a demonstration plot in Olosara Sector

Workshop with FSC extension team

In August, SRIF facilitated a joint farm advisory service workshop with the Lautoka Mill area's FSC extension team. The workshop was also attended by newly appointed FSC sector farm advisors and SRIF technical staff. The objective was to review FSC's 2020/2021 extension targets and align SRIF Technology transfer initiatives with FSC's extension plan. The participants also visited two demo plots and SRIF Drasa estate as part of the training for new farm advisors.

Figure 1.2: Germination count explanation to the workshop participants who visited the SRIF demo plot

Green manuring

In August, the Government of Fiji allocated some grant under cane planting program 2020/2021 to plant Green Manure crops (urd) during short fallow between November 2020 and February 2021. Green Manuring is a process whereby leguminous plants such as Pulses, Lentils, Peas, Peanuts and Mucuna that are capable of trapping Nitrogen from the atmosphere are incorporated within the soil. To date, about 13 hectares on 32 farms have been planted in Lautoka Mill Area across 3 districts in Lautoka, Nadi, and Sigatoka. The early onset of rain affected the progress of this project. Depending on the weather, the remaining farms will be planted in early 2021. Planting green manure is the cheapest and easier method to rehabilitate our depleting soil health due to continuous mono-cropping. SRIF is thankful to the Government of Fiji for allocating funding for such important initiatives.

2.0 RARAWAI MILL AREA

Rarawai mill area covers 14 sectors from three districts; Rarawai, Tavua and Penang. SRIF through its Technology Transfer programs has been engaged in improvement of the knowledge, skills, practices and attitudes of the sugarcane farming community. Technology transfer on various aspects of sugarcane production system in collaboration with field division of Fiji Sugar Corporation (FSC) is executed through;

- Field demonstrations in farmers' fields
- Field days and interactive Grower information days
- Publications including pamphlets
- Programmes in public media like Radio talks & newspaper articles
- SRIF's website and Facebook page

The priority areas under the Technology Transfer programs include;

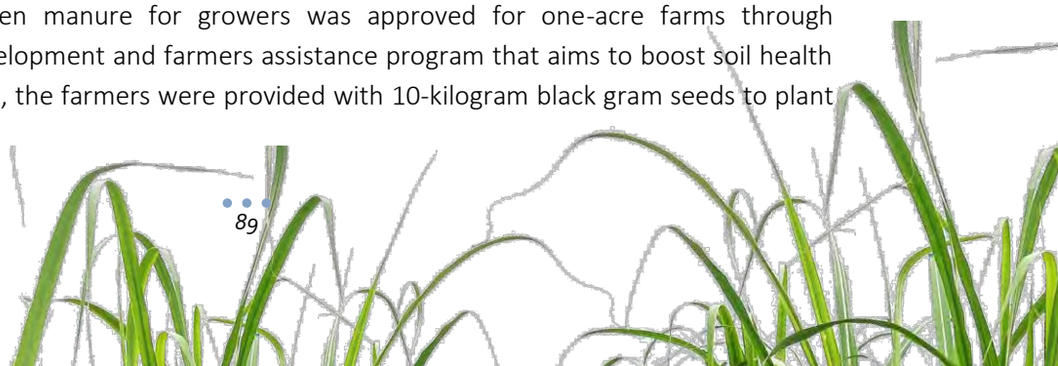
- Promotion of early to mid-maturing varieties
- Knowledge of improvement on soil fertility management through mill by products and green manuring
- Improvement and adoption of good agronomic practices

Green manuring

Continuous and conventional cultivation leads to a decline in soil organic matter content, affects soil nutrients status, resulting in a loss of soil sustainability. One of the ways to maintain sustainability in agriculture by restoring soil quality and reclaiming degraded soil is to increase soil organic matter content. Green manure plants are grown for improving the organic matter and nutrient contents of soils. Green manuring also improves soil physical, chemical and biological activity in soil, reduces soil compaction, increases soil porosity, water infiltration and rooting depth. Choice of green manure plants is important. Legume plants are preferred for green manuring as they have nitrogen fixing properties. Plants with large biomass, ability to form a cover over the land, easy to incorporate and fast decomposing are preferred. Among the legumes, Black gram (*Vigna mungo* (L)) is preferred for green manuring due to its characteristics. Growers were provided with black gram seeds that were mechanically and manually planted. Demonstration plots planted in promotion of green manure through mechanical planter had 15 kilogram per hectare of seed requirement. Planting period for green manure is from November to December as this coincides with the rainy season, allowing fast growth for the green manure plants. Upon reaching its flowering stage the plants are incorporated into the soil using three-disc plough. Once the plants are decomposed, fields are harrowed, and sugarcane planted. Six demonstration plots with green manure were established in November 2019 in Rarawai, Tavua and Penang district. Field information days were held to demonstrate incorporation of black gram and share knowledge on benefits of green manure to sugarcane. After incorporation of the green manure, sugarcane was planted in these fields during 2020 planting season.

Figure 2.1: Picture showing sugarcane plants growing well which was planted after green manure incorporation at Drumasi sector

In 2020, assistance for green manure for growers was approved for one-acre farms through government's sugarcane development and farmers assistance program that aims to boost soil health and increase cane yield. Thus, the farmers were provided with 10-kilogram black gram seeds to plant



one-acre farms. SRIF with FSC conducted awareness on radio and group meetings with farmers prior to implementation of the program. Legume planter through SRIF was made available to farmers to ease planting of black gram. 35 farms in Tavua and Rarawai district were planted with the green manure using legume planter.

Grower information days

Grower information days is found to be an effective tool for sharing knowledge on best farming practices with the growers and stakeholders. Nutrition and weed management are important for good production of cane. It is important that timely fertilizer application as per recommended rates are applied to the crop. It is seen that less of Phosphorous fertilizer is applied to the cane at the time of planting. Inadequate knowledge on fertilizers and poor farm planning are causes of low Phosphorous fertilizer use. Sugarcane growing areas receive enough rainfall throughout the sugarcane cropping system thus presenting challenges for effective weed management in the farms. Weeds are fast growing that compete with the growing sugarcane plants. If not controlled on time, weeds tend to decline sugarcane yield and make harvesting difficult. Through effective grower information days and field days, knowledge of nutrient and weed management, importance of early to mid-maturing varieties are shared with growers. Fields with good management practices and early to mid-maturing varieties are visited. Information such as accurate time for fertilizer and weedicide application, recommended rates, characteristics of varieties are shown to the farmers.

Table 2.1: List of grower information days

Sector	Topic	Participants
Drumasi	Land preparation, best management practices, pest and disease management	20
Ellington 2	Weed management, varieties, pest and disease management	16
Drumasi	Best management practices, diseases, pests, varieties, timely fertilizer application & crop planning	9
Drumasi	Trash management, timely weedicide & fertilizer application, varieties, soil health and farming as a business	6
Drumasi	Pest and disease management & trash management	6

Figure 2.2: Demonstration plot with good weed management in Drumasi sector

3.0 LABASA MILL AREA

The major focus during technology transfer in the year 2020 was improving soil health, quality seed cane, liming, intercropping, ratoon management and weed control. The major concern in today's era is depleting soil health, weed management, planting of recommended varieties, adaptation to new machineries and their operations. 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 in the Fiji Sugar Industry.

The following topics were covered in the grower demonstration trials and field information days;

- ✓ Importance of improving Soil Health through Green Manuring
- ✓ Sugarcane Varieties & Quality Seed cane.
- ✓ Mechanical spraying (pre-emergence and Post emergence).
- ✓ Importance of Blend A and Blend B application
- ✓ Benefits of using Mill mud.
- ✓ Integrated weed Management
- ✓ Timeliness of operations
- ✓ Benefits of intercropping
- ✓ Ratoon management
- ✓ Importance of Liming

Integrated weed management trial

Weeds affect sugarcane crop in a number of ways. A significant reduction in yield occurs if weeds are not controlled, as they compete with the sugarcane crop for nutrients, sunlight and moisture. Weeds such as vines causes harvesting difficulty whereby farmers turn to burn the sugarcane which reduces the quality of sugar. Weed management is very important cultivation aspect towards yield. Timely application of herbicides and weeding is very vital towards sugarcane growth. Pre and post emergence should be done on time and manual weeding is required if the weeds are of similar type as sugar cane and is not killed by the post emergent herbicide used in Fiji. To make aware of the importance of integrated weed management, one field day on the demonstration plot planted in Bucaisau sector was conducted. The pictures below show the demonstration done in the field.

Figure 3.1: Result of integrated weed management.

Improving Soil Health - Intercropping

Sugarcane is mono cropped for decades in same particular piece of land. It is known that sugarcane is a heavy feeder of nutrients and it exhausts the soil if it is not rested or given other source of organic amendment. Soil is a living entity which needs time to replenish itself. This can be done by fallowing the land, adding organic amendment, green manuring and cultivating inter-crop together with sugarcane crop.

Figure 3.2: Intercropping legume with plant cane.

Sugar cane varieties

Varieties play vital role in the production of quality sugar by the mills. SRIF is dedicated to continue breeding high sugar, disease resistance, drought tolerant and early maturing varieties. The two new varieties released (Viwa and Qamea) has these characteristics. Viwa is mid to late maturing and is highly suited for mechanical harvesting where as Qamea is early maturing and fast growing. Five field days were conducted in Bucaisau, Salove and Natua sector. These two new varieties were introduced to the farmers and their characteristics were demonstrated on the farmer fields. Farmers were advised to plant these varieties and also Naidiri as these are high sugar yielding and suitable for poor soil types.

Soil Amendment - Liming

Most of the farms in Vanua Levu are becoming acidic due to continuous mono cropping and usage chemical fertilizer in the sugarcane crop. As we know that sugar cane is a heavy feeder of nutrients therefor the soil needs amendments such as lime to rectify the pH value so that the nutrient is available for the plants to uptake. Five demo plots are being carried out in Vanua Levu sectors. The lime

recommendation is being generated in the lab and used for applying lime in the field. Lime was broadcasted in the field and incorporated in soil. The soil sampling has been carried out for six months and continuing to see the change in the pH.

Figure 3.3: Top: Spreader used to broadcast lime. Bottom: Lime broadcasted in the field

After the lime was broadcasted the field was planted with sugar cane crop. To study the effect of lime on soil chemical properties samples from the fields were taken every month to see the change in soil pH. Table 3.1 shows the rate of lime applied in individual farms and the graphs (figure 3.5 & 3.6) that follows shows the change in pH over time.

Table 3.1: Rate of lime applied to farms	
Farm No.	Lime-tonnes/ha
22261	2.51
3104	2.92
8580	1.80
9126	1.71

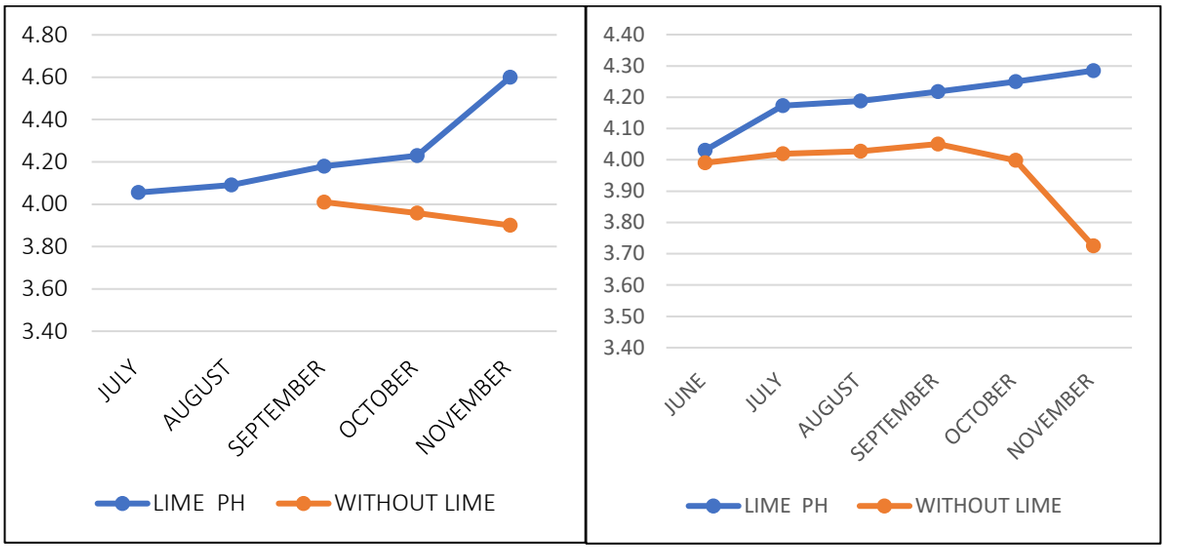


Figure 3.5: Effect of lime on pH of soil in (left) Farm No. 22261 of Bucaisau sector (right) Farm No. 3104 of Waiqele sector

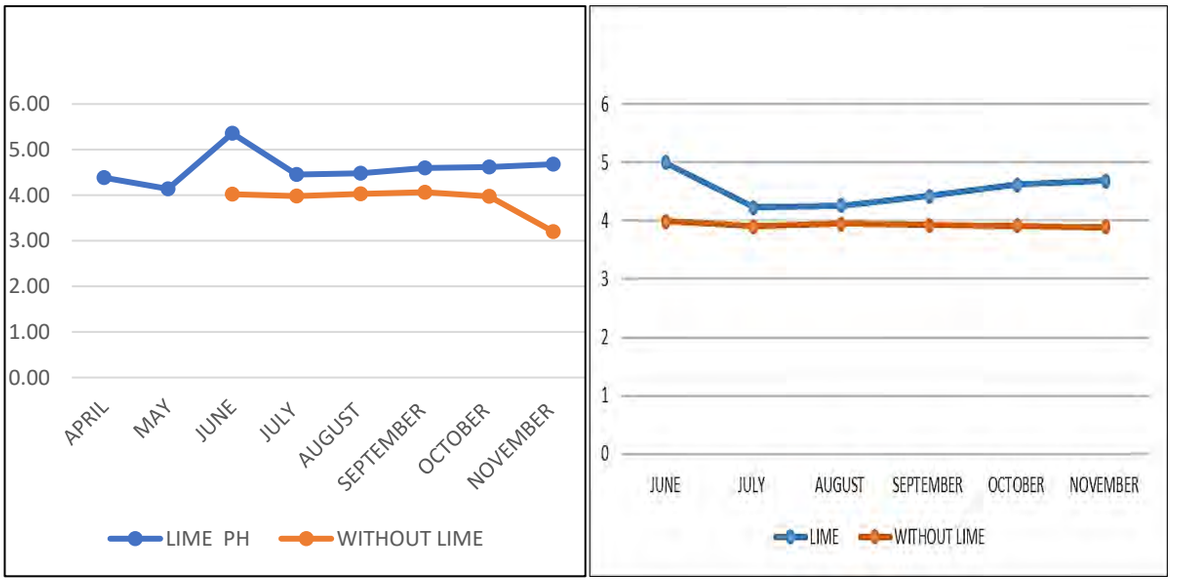


Figure 3.6: Effect of lime on pH of soil in (left) Farm No. 9126 of Waiqele sector (right) Farm No. 8580 of Bulivou sector

Lime application was made on the lab recommendation after soil. The soil was acidic but after liming the pH started to change slowly as shown in the result. At the first month the pH improved nearly by 1, keeping in mind the reaction from lime is slow and will take time. The sampling will continue to see the further results.

SRIF ESTATES

4,000+
Tonnes cane produced

~74
Tonnes per hectare

1.0 DRASA ESTATE

A total of 1888 tonnes of sugarcane was harvested from SRIF Drasa estate in the 2020 season. Around 15% (287 tonnes) was harvested as burnt cane due to arson. 762 tonnes of cane was transported using cage bins and the remaining 1126 tonnes were transported using lorries. The overall yield for 2020 season was 88 TCH. About 8 hectares of the field were ploughed out after the 2019 harvesting season to accommodate planting research trials and seed cane nurseries in 2020.

This had contributed to a drop-in production by 1000 tonnes compared to 2019 harvest season. An area of 2ha was allocated for Large Mill trial of a promising variety while a further 0.8ha was allocated for Stage 2 trial to the Crop Improvement team. A total of 4.6ha have been reserved in 2020 for seed cane mother plot and will be planted in the 2021 planting season.

Out-turn 2020

Table 1.1: Lautoka Estate 2020 production record

Field	Plot	Area (ha)	Variety	Tons	TCH
8	1	3.4	Naidiri, Beqa, Aiwa, Kaba, Mana	283.8	84
11	1	1.5	Viwa	120.0	80
25	2	0.6	Aiwa	60.0	100
24	1	3.6	Viwa, LF91-1925, Qamea, Naidiri	351.2	98
	2	1.9	Naidiri, Research trial	186.8	98
	3	5.8	Research trial	482.6	83
	4	5.4	Qamea + research trial	403.5	75
Total		22.2		1,887.8	88

2.0 RARAWAI ESTATE

In 2020, a total of 18.4ha were under cane (17.8ha harvested and sent to mill, 0.6ha used for seed cane and remaining 1.9ha were short fallow). The total cane production for 2020 was 1248.46 tonnes (1198.46 tonnes was harvested and sent to the mill and approximately 50 tonnes were used as seed cane). The total cane yield achieved was 61.5 TCH (67.3 TCH for cane harvested and delivered). The research cane occupied 12.6 ha producing 831.92 tonnes of cane giving yield of 66 TCH whereas commercial cane was 5.2ha producing 366.4 tonnes of cane giving yield 70.1 TCH.

Table 2.1: Rarawai Estate 2020 production record

Field	Area (ha)	Varieties	Tons	TCH
Commercial & Research	12.6	Ragnar, Mana, Kaba, Aiwa, Naidiri, LF91-1925	832.0	66
Seed cane	5.2		367.0	70
Total	17.8		1,199.2	67

As seen in above table, approximately 65% or 12.2ha of the total land was used for research trials and 5.8ha for seed cane and commercial cane plots. The remaining 1.9ha was under short fallow of which 1.6ha was planted with large mill trial plots of new variety LF11-233 and Ragnar variety while 0.3ha will be planted with LF91-1925 (Hot Water Treated). Weed control continues to be a challenge and a costly exercise because of heavy infestation of iTCH grass in almost all the fields and Johnson grass mostly in Field 6 and Field 7 due to seeds brought in by flood and nearby fields. The harvesting started on 22 June 2020 and was completed on 18.11.2020.

The 2020 season overall was good with 12% more crop harvested from forecasted crop of 1050 tonnes. Some research plots and commercial cane left behind by mechanical harvesters were harvested manually (1.4 ha = 91.3 tonnes) whereas the remaining were harvested mechanically (16.4 ha = 1107.19 tonnes). 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.

3.0 LABASA ESTATE

A total of 694 tonnes of sugarcane were harvested from SRIF Labasa estate farm during 2020 season. 694 tonnes of cane was sent to mill and 36 tonnes were used to establish mother plot in Seaqaqa. Also 14 tonnes were used in establishing 2.0 ha mother plot in estate. Another 6 tonnes of Qamea and 3 tonnes of Naidiri was used to establish a variety demonstration plot in Daku sector. 42.36 % (294 tonnes) of sugarcane was harvested as burnt cane and 57.64% (400 tonnes) was harvested as green cane.

Sugarcane harvested mechanically was 42.36 % whereas manually was 57.64 %. The mechanically and manually harvested cane was transported using Lorry at the cost of $28.00 per tonne. Total crop increased by almost 40% compared to 2019 season. Favorable weather conditions, Good fallow management with green manure crops, use of Quality seed cane, timely weed control and fertilizer application contributed to this increase in production.

Table 3.1: Labasa Estate 2020 Production Record

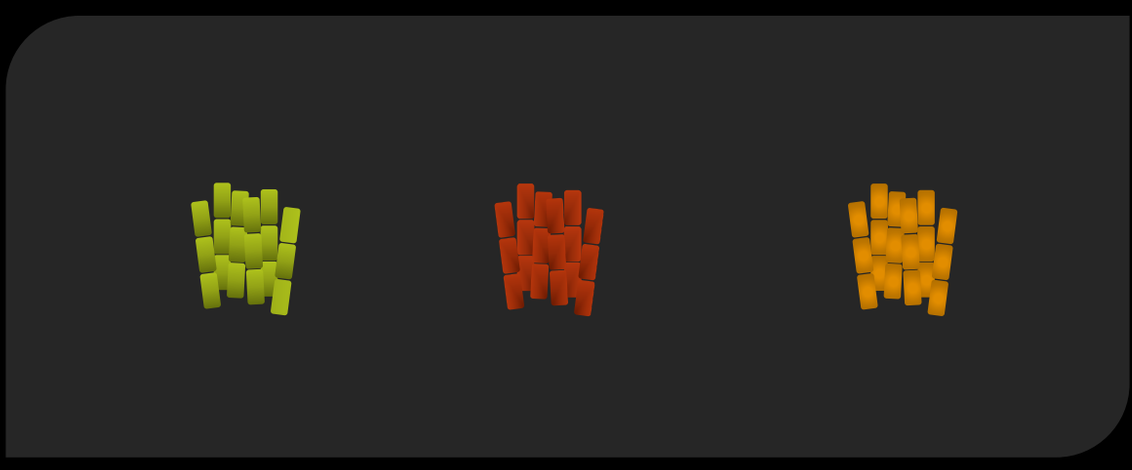
Field	Plot	Area (Ha)	Variety	Tonnes	TCH
1	1,2,3,4	5.0	Naidiri	402	80
2	5,6	2.0	Naidiri, Viwa, Mali, Kuiva	156	78
3	7,8	0.8	Qamea, Ragnar	64	80
4	9,10	1.0	Stage 04, Ragnar, Qamea, Kuiva	72	72
Total		8.8		694	79

Constraints and challenges

There was a loss of cane due to the harvester not being operated properly. The blades are not sharpened, therefore some portion of the cane is shredded and blown out with the leaves. Also, in some place within a field, cane is not harvested from the base therefore some portion is left with the stump. The lorries don't follow the controlled traffic rule in the field which cause soil compaction.

Since the phasing out of Glyphosate weedicide, which was a systemic herbicide, farmers are claiming that the substitute (Glufosinate Ammonium) weedicide is not as effective as Glyphosate. There is not much option for selecting herbicide which leads to plant resistance to the weedicide. Therefore, more options of herbicide should be available and a systemic herbicide like Glyphosate to be brought in for the head lands and broad spraying of fields.

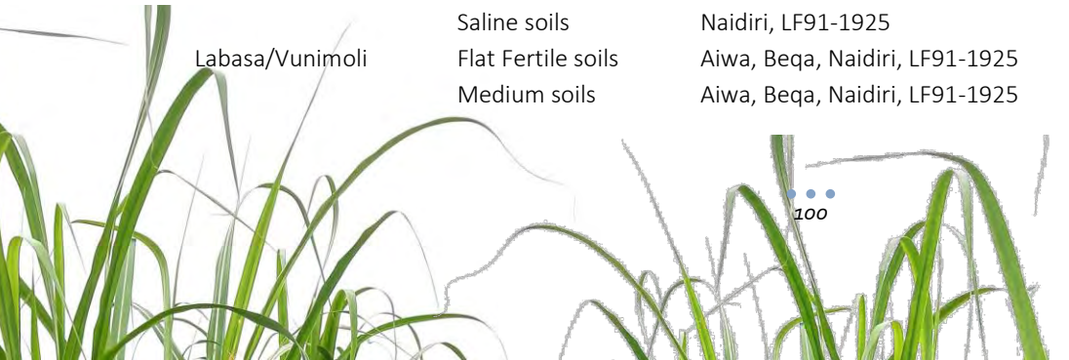
APPROVED VARIETIES



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

Mill/Sectors	Soil types	Varieties recommended on maturity trends	
		Early – mid maturing	Mid – late maturing
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



Mill/Sectors	Soil types	Varieties recommended on maturity trends	
		Early – mid maturing	Mid – late maturing
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

ABBREVIATION

ASPAC	-	Australian Soil and Plant Analysis Council
AVG./Avg.	-	Average
AWS	-	Automatic Weather Station
CBA	-	Cost Benefit Analysis
COSPPac	-	Climate and Ocean Support Program for the Pacific
CQD	-	Cane Quality Department
ENSO	-	El Niño Southern Oscillation
EU	-	European Union
FFE	-	Farmer Feel Effect
FMS	-	Fiji Meteorological Services
FSC	-	Fiji Sugar Corporation Ltd
FSI	-	Fijian Sugar Industry
FTIR	-	Frontier Transform Infra-Red
G x E	-	Genetic by Environment
IMG	-	Industry Management Group
K	-	Potassium
LBC	-	Lime Buffering Capacity
LF[YEAR]	-	Lautoka Fiji [year in which the fuzz was planted], e.g. LF2014
MoS	-	Ministry of Sugar
N	-	Nitrogen
NIR	-	Near Infra-Red
P	-	Phosphorus
POCS	-	Pure obtainable cane sugar
QBPS	-	Quality Based Payment Scheme
RCBD	-	Randomized Complete Block Design
Rep	-	Replication
RMSECV	-	Root Mean Square Error of Cross validation
SCGC	-	Sugar Cane Growers Council
SCGF	-	Sugar Cane Growers Fund
SIT	-	Sugar Industry Tribunal
SOI	-	Southern Oscillation Index
SPF	-	South Pacific Fertilizers
SRIF	-	Sugar Research Institute of Fiji
STC	-	Smut Technical Committee
Suc	-	Sucrose
NPK	-	Nitrogen, Phosphorus, Potassium
TCH	-	Tonnes cane per hectare
Trt or Trts	-	Treatment(s)
TSH	-	Tonnes sugar per hectare
UV-VIS	-	Ultra violet visible light spectrum

GLOSSARY

%brix	Total soluble solutes in cane juice
%fibre	Percent of fibre present in sugarcane
%pol	Percent total sucrose in cane juice
Breeding Plots / Flowering Beds	Small areas planted with sugarcane for the purpose of harvesting flowers from.
Brix	Measure of dissolved solids in sugar juice, liquor or syrup using a refractometer.
Clones / Varieties	The distinct individual sugarcane type that can be identified by numerous attributes or a combination of it, such as stalk color, stalk shape, leaf type, etc.
CQD	The body within the Fiji Sugar Industry Tribunal charged with implementing the QBPS procedures.
Farmorganix/Stand Up SummaGrow	Brand names of new organic fertilizers being tested at SRIF.
Fibre	The dry fibrous insoluble structure of the cane plant. Generally taken to mean all insoluble material in the cane delivered to a mill, and therefore includes soil or other extraneous insoluble matter in cane.
Fuzz	Sugarcane seeds, not to be confused with seeds commonly referred to in the sugar industry as the stalks of sugarcane used for planting. Seeds in this case are all different varieties, much like seeds of beans, cucumbers or chilies.
G X E trials	Genetic by Environment trials to test the interaction of the genetic attributes of varieties against environmental conditions.
Gene Pool	Basically, referring to the Germplasm from a genetics point of view.
Germplasm	A collection of clones that has recorded desirable traits such as high fibre, disease tolerant, etc.
IMG	A group set up within each mill area, comprising representatives of the mill owner, the cane growers and the Tribunal to act as a point of contact between the CQD and the local industry.
LBC	Lime Buffering Capacity. It is modified from the original method which is used for the purpose of agricultural crops. It is a potentiometric method used for determining the amount of lime required for the soil to raise the pH based on the buffering capacity of the soil. LBC is a more efficient routine determination as compared to pH buffering capacity method in regards to result throughput.
Nematology	The scientific study of nematode worms.
Pathology	The science of the causes and effects of diseases
Phytotoxic	Poisonous to plants.

POCS	Pure Obtainable Cane Sugar. A measure of total recoverable sugar in the cane. A formula based on assumption that sugarcane contains pure sugar, impurities, water and fibre only. It assumes that only pure sugar is made, and that for every kilogram of impurities which goes to the factory, half a kilogram of sugar accompanies it.
Polarization (or Pol)	The apparent sucrose content expressed as a mass percent measured by the optical rotation of polarized light passing through a sugar solution.
Purity	The true purity is the sucrose content as a percent of the dry substances or dissolved solids content. The solids consist of sugar plus non-sucrose components such as invert, ash and colorants. Apparent purity is expressed as polarization dived by refractometer Brix multiplied by 100.
Ratoon	Commonly referred to the sugarcane crop that established or grew after the initial plant crop was harvested.
RMSECV	RMSECV: errors are calculated on test/train splits using a cross validation scheme for the splitting. If the splitting of the data is done correctly, this gives a good estimate on how the model built on the data set at hand performs for unknown cases. However, due to the resampling nature of the approach, it actually measures performance for unknown cases that were obtained among the calibration cases. In simple, it is a formula used to build a model from a data set, as a validation of two data set. Thus, confirms data set from a new approach against the data set of the original method validating the performance of the origin of the new data set as similar to the existing method.
Series	When used in the context of plant breeding, it refers to a set of clones or varieties distinguished by the year in which those clones or varieties were initially planted from fuzz (seed) stage.
Spectra-Cane	High-speed fully automated sugarcane analyzer that uses Near-Infrared (NIR) to monitor the sugar content upon analyzing disintegrated cane. The instrument requires minimal intervention from the operator once the sample has been fed into the disintegrator at the start of the process.
Standards	Sugarcane varieties that have already been released to growers to plant for commercial use.
Supply	The term is normally used when “supplying” seed cane referring to sugarcane field that have
UV-VIS spectrophotometer	Ultra violet visible light spectrum instrument. Is used to determine analyte concentrations by the absorption of light across the ultraviolet and visible light wavelengths through sugar cane juice, sugar and sugar by-products.

FINANCIALS

Sugar Research Institute of Fiji

Financial Statements

For the Year Ended 31 December 2020

Building a better working world

SUGAR RESEARCH INSTITUTE OF FIJI

FINANCIAL STATEMENTS
FOR THE YEAR ENDED 31 DECEMBER 2020

Contents

SUGAR RESEARCH INSTITUTE OF FIJI
DIRECTOR'S REPORT
FOR THE YEAR ENDED 31 DECEMBER 2020

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 2020, 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:

- Professor Rajesh Chandra - Chairman (Expired - February 2020)
- Mr Prakash Chand - Chairman - (Effective - February 2020
- Dr Sanjay Anand - (Expired - December 2020)
- Mr Graham Clark
- Ms Reshmi Kumari
- Professor Ravendra Naidu
- Mr Ashween Nischal Ram
- Mr Raj Sharma
- Mr Vimal Dutt - (Effective - November 2020)

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 2020 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.

SUGAR RESEARCH INSTITUTE OF FIJI
DIRECTOR'S REPORT (CONTINUED)
FOR THE YEAR ENDED 31 DECEMBER 2020

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 negative cash flows from operations of $169,969 during the year ended 31 December 2020 and positive working capital of $1,077,556 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

Subsequent to the end of the financial year, on 19 April 2021, in response to the COVID-19 pandemic, the Government announced a number of measures including lockdown of certain containment areas within Viti Levu. Under the lockdown restrictions, all non-essential businesses are required to be closed unless the workplace was deemed part of a permitted industry as set out by the Government. The introduction of these restrictions have not had a material effect on the Institute's Financial Statements at 31 December 2020.

Apart from the exception above, no other matters or circumstances have arisen since the end of the financial year which significantly affected or may significantly affect the operations of the Institute, the results or cash flows of those operations, or the state of affairs of the Institute in future financial years.

Impact of COVID-19 pandemic on the Institute

During the year, the COVID-19 outbreak was declared a pandemic by the World Health Organization in March 2020. We have not seen a significant impact on our business to date. The outbreak and the response of Government in dealing with the pandemic is interfering with general activity levels within the community, the economy and the operations of our business. The scale and duration of these developments remain uncertain as at the date of this report however they will have an impact on our earnings, cash flow and financial condition.

It is not possible to estimate the impact of the outbreak's near-term and longer effects or Governments' varying efforts to combat the outbreak and support businesses. This being the case, we do not consider it practicable to provide a quantitative or qualitative estimate of the potential impact of this outbreak on the Institute at this time.

Apart from the exception above, no other matter or circumstance has arisen that has significantly affected, or may significantly affect the Institute's operations, the results of those operations, or the Institute's state of affairs in future financial years.

SUGAR RESEARCH INSTITUTE OF FIJI
DIRECTOR'S REPORT (CONTINUED)
FOR THE YEAR ENDED 31 DECEMBER 2020

For and on behalf of the Board of Directors in accordance with a resolution of the Directors this 10th day of June 2021.

Board Member

Board Member

EY
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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 2020, 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 2020, 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.

Material Uncertainty Related to Going Concern

We draw attention to Note 1.2(b) in the financial statements, which refers to the preparation of the Institute's financial statements on a going concern basis. The Institute incurred negative cash flows from operations of $169,969 during the year ended 31 December 2020. The Institute has operating expenditure commitments of approximately $3.5 million for the financial year ending 31 December 2021 and is most likely to require further funding to meet its working capital requirements and fund its operating activities.

The appropriateness of the going concern assumption on which the financial statements are prepared is critically dependent on Government and the stakeholders support to the Institute, as disclosed in Note 1.2(b), to enable the Institute to continue operations for the foreseeable future.

The events or conditions outlined above indicate that a material uncertainty exists that may cast significant doubt on the Institute's ability to continue as a going concern. The financial statements do not include any adjustments relating to the recoverability and classification of recorded asset amounts or to the amounts and classification of liabilities that might be necessary should the Institute not continue as a going concern. Our opinion is not modified in respect of this matter.

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.

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Independent Auditor's Report (continued)

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.

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Independent Auditor's Report (continued)

Auditor's Responsibilities for the Audit of the Financial Statements (continued)

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.

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
Ernst & Young
Chartered Accountants

Shaneel Nandan
Partner
Nadi, Fiji
10th June 2021

SUGAR RESEARCH INSTITUTE OF FIJI
STATEMENT OF ACTIVITIES
FOR THE YEAR ENDED 31 DECEMBER 2020

	Notes	2020	2019
		$	$
Contributions and grants	2.1	2,682,198	2,662,462
Estate income		183,551	357,299
Other income	2.2	55,088	89,113
Total income		2,920,837	3,108,874
Cost of operations	2.3	(1,638,407)	(1,752,999)
Administrative expenses	2.4	(1,286,780)	(1,363,200)
Deficit from operations		(4,350)	(7,325)
Finance income	2.6	4,735	8,148
Finance expense		(385)	(823)
Deficit before tax		-	-
Income tax expense		-	-
Balance at the beginning of the year		-	-
Deficit 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 2020

	Notes	2020 $	2019 $
Assets			
Current assets			
Cash and cash equivalents	3	764,453	421,541
Receivables and prepayments	4	35,473	194,352
Receivables from related parties	10(b)	1,400,688	1,400,688
		2,200,614	2,016,581
Non-current assets			
Property, plant and equipment	5	5,936,684	5,958,082
Intangible assets	6	18,437	23,046
Receivables from related parties	10(b)	6,225,255	6,520,169
		12,180,376	12,501,297
Total assets		14,380,990	14,517,878
Current liabilities			
Deferred income	8	764,453	421,541
Trade and other payables	7	326,709	89,813
Employee benefits	9	31,896	41,697
		1,123,058	553,051
Non-current liabilities			
Deferred income	8	10,992,247	11,699,142
Payable to related parties	10(c)	2,265,685	2,265,685
		13,257,932	13,964,827
Total liabilities		14,380,990	14,517,878
Net assets		-	-
Funds employed			
Funds employed		-	-
Total funds employed		-	-

Signed on behalf of the Board.

Board Member

Board Member

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 2020

	Note	2020	2019
		$	$
Cash flows from Operating Activities			
Receipts from stakeholders and donors		1,909,887	2,174,456
Payments to suppliers and employees		(2,084,206)	(2,656,698)
Interest and bank charges paid		(385)	(823)
Interest received		4,735	8,148
Net cash (used in) by operating activities		(169,969)	(474,917)
Cash flows used in Investing Activities			
Acquisition of property, plant and equipment		(429,000)	(438,330)
Payment of intangible assets		-	(26,361)
Proceeds from disposal of property, plant and equipment		41,881	21,208
Net cash flows (used in) investing activities		(387,119)	(443,483)
Net increase / (decrease) in cash and cash equivalents		342,912	(918,400)
Cash and cash equivalents at 1 January		421,541	1,339,941
Cash and cash equivalent at 31 December	3	764,453	421,541

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

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 31 DECEMBER 2020

1. Reporting entity

The financial statements of Sugar Research Institute of Fiji for the year ended 31 December 2020 were authorised for issue in accordance with a resolution of the Directors on 10th June 2021. 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 negative cash flows from operations of $169,969 during the year ended 31 December 2020 and positive working capital of $1,077,556 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.

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

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.

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

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 5 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.

(ii) Non- derivative financial liability

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.

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

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.

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

2. Revenue and expenses	2020 $	2019 $
2.1 Contributions and grants		
Contribution from the Fiji Government	698,965	713,161
European Union	585,303	522,979
Fiji Sugar Corporation (FSC)	698,965	713,161
Sugar Cane Growers	698,965	713,161
	2,682,198	2,662,462
2.2 Other income	$	$
Gain on sale of motor vehicles	41,881	21,208
Outsource income	13,207	65,743
Others	-	2,162
	55,088	89,113
2.3 Cost of operations	$	$
Advertising	2,876	4,626
Amortisation	4,609	5,272
Bank charges	2,251	3,413
Consultancy fees	7,073	26,731
Depreciation	450,485	459,502
Electricity	52,580	49,641
EU cost	211,223	102,405
Communication expenses	34,289	37,449
Material costs	98,904	78,584
Motor vehicle running expenses	129,524	124,809
Repairs and maintenances	20,289	138,984
Subcontract expenses	162,778	264,392
Wages and salaries	461,526	457,191
	1,638,407	1,752,999
2.4 Administrative expenses	$	$
Audit fees	9,000	9,000
Audit fees - EU Project	1,231	33,079
Accommodation and meals	1,772	6,360
Annual leave expense	-	9,532
Board allowance	35,807	34,508
Cleaning and landscaping	8,018	3,478
Office security	116,682	109,333
Office supplies	7,091	11,288
Director's fees	52,090	62,464
Fiji National Provident Fund contributions	79,300	122,665
Freight	9,884	24,218
Fringe benefit tax	9,562	13,547
General expenses	44,513	42,330
ICT consumables	7,733	12,627

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

2. Revenue and expenses (continued)	2020	2019
2.4 Administrative expenses (continued)	$	$
Insurance	66,755	53,955
Legal fees	2,125	1,742
Land rent	8,160	7,817
Medical expense	5,969	6,394
Media and publication	13,605	9,656
Office rent	8,400	-
Postage	28	1,153
Repair and maintenance	10,365	6,081
Rent expense	20,250	35,385
Staff expenses	24,122	17,381
Stationery	5,882	5,642
Training and Productivity Authority of Fiji	26,379	11,854
Travel	9,651	17,846
Utilities	10,118	8,078
Wages and salaries	692,288	685,787
	1,286,780	1,363,200
2.5 Personnel expenses	$	$
Fiji National Provident Fund (FNPF) contributions	79,300	122,665
Training and Productivity Authority of Fiji	26,379	11,854
Key management compensation - short term benefit	98,980	98,980
Wages and salaries	1,054,834	1,043,998
	1,259,493	1,277,497
2.6 Finance income	$	$
Interest received	4,735	8,148

3. Cash and cash equivalents	$	$
Cash at bank	763,953	421,041
Cash on hand	500	500
Cash and cash equivalents in the cash flow statements	764,453	421,541

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	764,453	421,541
	764,453	421,541

4. Receivables	$	$
Trade receivable	21,504	20,322
Staff advance	-	378
Deposits	5,884	4,506
VAT receivable	-	140,116
Interest receivable	-	6,609
Prepayments	8,085	5,500
Withholding tax receivable	-	16,921
	35,473	194,352

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

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 2019	2,856,987	162,319	2,933,178	1,584,487	427,897	1,234,915	9,199,783
Additions	152,674	18,459	18,308	229,742	19,147	-	438,330
Transfers	1,234,915	-	-	-	-	(1,234,915)	-
Disposals	-	-	-	(96,569)	-	-	(96,569)
At 31 December 2019	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
Accumulated depreciation							
As at 1 January 2019	227,917	65,688	1,423,091	1,165,597	338,237	-	3,220,530
Depreciation charge for the year	32,296	15,630	270,121	108,060	33,394	-	459,501
Disposals	-	-	-	(96,569)	-	-	(96,569)
At 31 December 2019	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
Net book value							
At 31 December 2020	3,935,143	98,441	1,022,098	753,965	58,648	68,389	5,936,684
At 31 December 2019	3,984,363	99,460	1,258,274	540,572	75,413	-	5,958,082

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

6. Intangible assets	Software	Total
Cost	$	$
As at 1 January 2019	2,480	2,480
Additions	26,361	26,361
Disposals	-	-
At 31 December 2019	28,841	28,841
Additions	-	-
Disposals	-	-
At 31 December 2020	28,841	28,841
Accumulated depreciation		
As at 1 January 2019	523	523
Amortisation	5,272	5,272
At 31 December 2019	5,795	5,795
Amortisation	4,609	4,609
At 31 December 2020	10,404	10,404
Net book value		
At 31 December 2020	18,437	18,437
At 31 December 2019	23,046	23,046

7. Trade and other payables	2020 $	2019 $
Trade creditors	22,770	13,377
Payables and accruals	289,547	76,436
VAT payable	14,392	-
	326,709	89,813

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	12,120,683	12,458,893
Funds received or receivable during the year	2,561,590	2,778,811
Utilised during the year	(2,925,573)	(3,117,021)
Balance at 31 December	11,756,700	12,120,683

This is comprised as follows:	$	$
Fiji Government	101,243	39,031
Fiji Sugar Corporation (FSC)	6,725,943	7,020,857
Sugar Cane Growers	2,700,000	2,700,000
European Union grant	1,829,359	2,202,291
Estate income	199,212	160,895
Other income	200,943	(2,391)
Total	11,756,700	12,120,683

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

8. Deferred income (continued)

	2020	2019
Disclosed as:	$	$
Current	764,453	421,541
Non-current	10,992,247	11,699,142
Total	11,756,700	12,120,683

9. Employee benefits	$	$
Balance at 1 January	41,697	32,165
Provision created / utilised during the year	(9,801)	9,532
Balance at 31 December	31,896	41,697

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:

- Professor Rajesh Chandra - Chairman (Expired - February 2020)
- Mr Prakash Chand - Chairman - (Effective - February 2020
- Dr Sanjay Anand - (Expired - December 2020)
- Mr Graham Clark
- Ms Reshmi Kumari
- Professor Ravendra Naidu
- Mr Ashween Nischal Ram
- Mr Raj Sharma
- Mr Vimal Dutt - (Effective - November 2020)

(b) Amounts receivable from related parties	$	$
Fiji Sugar Corporation Limited- grant income	7,605,085	6,999,999
- other income	20,858	20,858
Allowance for uncollectability - Fiji Sugar Corporation Limited	(900,000)	-
Sugar Cane Growers	2,700,000	2,700,000
Allowance for uncollectability - Sugar Cane Growers	(1,800,000)	(1,800,000)
	7,625,943	7,920,857

Disclosed as:	$	$
Current	1,400,688	1,400,688
Non-current	6,225,255	6,520,169
Total	7,625,943	7,920,857

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

10. Related parties (continued)

(b) Amounts receivable from related parties (continued)

Reconciliation of Allowance for Uncollectability	2020	2019
	$	$
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.

(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 $4,439,400 as at 31 December 2020. 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.

The amount stipulated in the agreement is $4,009,314 which is the amount as at 31 October 2018. The net receivable amount as at 31 December 2020 is $4,439,400 and is reconciled as follows:

	$	$
Balance at the beginning of the year	4,734,314	4,159,314
Contributions during the year	900,000	900,000
Payments made in 2020	(1,194,914)	(325,000)
Balance at the end of the year	4,439,400	4,734,314

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.

(e) Transactions with related parties	$	$
Deferred income		
Grant income - Fiji Sugar Corporation Limited	1,100,800	298,165
Grant income - Fiji Government	640,974	716,287
Grant income - Sugar Cane Growers	825,688	825,688
Estate income- Fiji Sugar Corporation Limited	221,868	269,679
	2,789,330	2,109,819

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

10. Related parties (continued)

(f) Key management personnel

Key management personnel include the Chief Executive Officer and Finance Administration Manager 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	2020	2019
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	589,347	597,843
	640,319	648,815
(b) Contingent liability	-	-
(c) Capital expenditure commitments	-	-
(d) Finance lease commitments	-	-

12. Subsequent events

Subsequent to the end of the financial year, on 19 April 2021, in response to the COVID-19 pandemic, the Government announced a number of measures including lockdown of certain containment areas within Viti Levu. Under the lockdown restrictions, all non-essential businesses are required to be closed unless the workplace was deemed part of a permitted industry as set out by the Government. The introduction of these restrictions have not had a material effect on the Institute's Financial Statements at 31 December 2020.

Apart from the exception above, no other matters or circumstances have arisen since the end of the financial year which significantly affected or may significantly affect the operations of the Institute, the results or cash flows of those operations, or the state of affairs of the Institute in future financial years.

13. Impact of COVID-19 pandemic on the Institute

During the year, the COVID-19 outbreak was declared a pandemic by the World Health Organization in March 2020. We have not seen a significant impact on our business to date. The outbreak and the response of Government in dealing with the pandemic is interfering with general activity levels within the community, the economy and the operations of our business. The scale and duration of these developments remain uncertain as at the date of this report however they will have an impact on our earnings, cash flow and financial condition.

It is not possible to estimate the impact of the outbreak's near-term and longer effects or Governments' varying efforts to combat the outbreak and support businesses. This being the case, we do not consider it practicable to provide a quantitative or qualitative estimate of the potential impact of this outbreak on the Institute at this time.

Apart from the exception above, no other matter or circumstance has arisen that has significantly affected, or may significantly affect the Institute's operations, the results of those operations, or the Institute's state of affairs in future financial years.

SUGAR RESEARCH INSTITUTE OF FIJI
NOTES TO THE FINANCIAL STATEMENTS (continued)
FOR THE YEAR ENDED 31 DECEMBER 2020

14. Segment Information

Industry segment

The Institute operates predominantly in the sugar industry.

Geographical segment

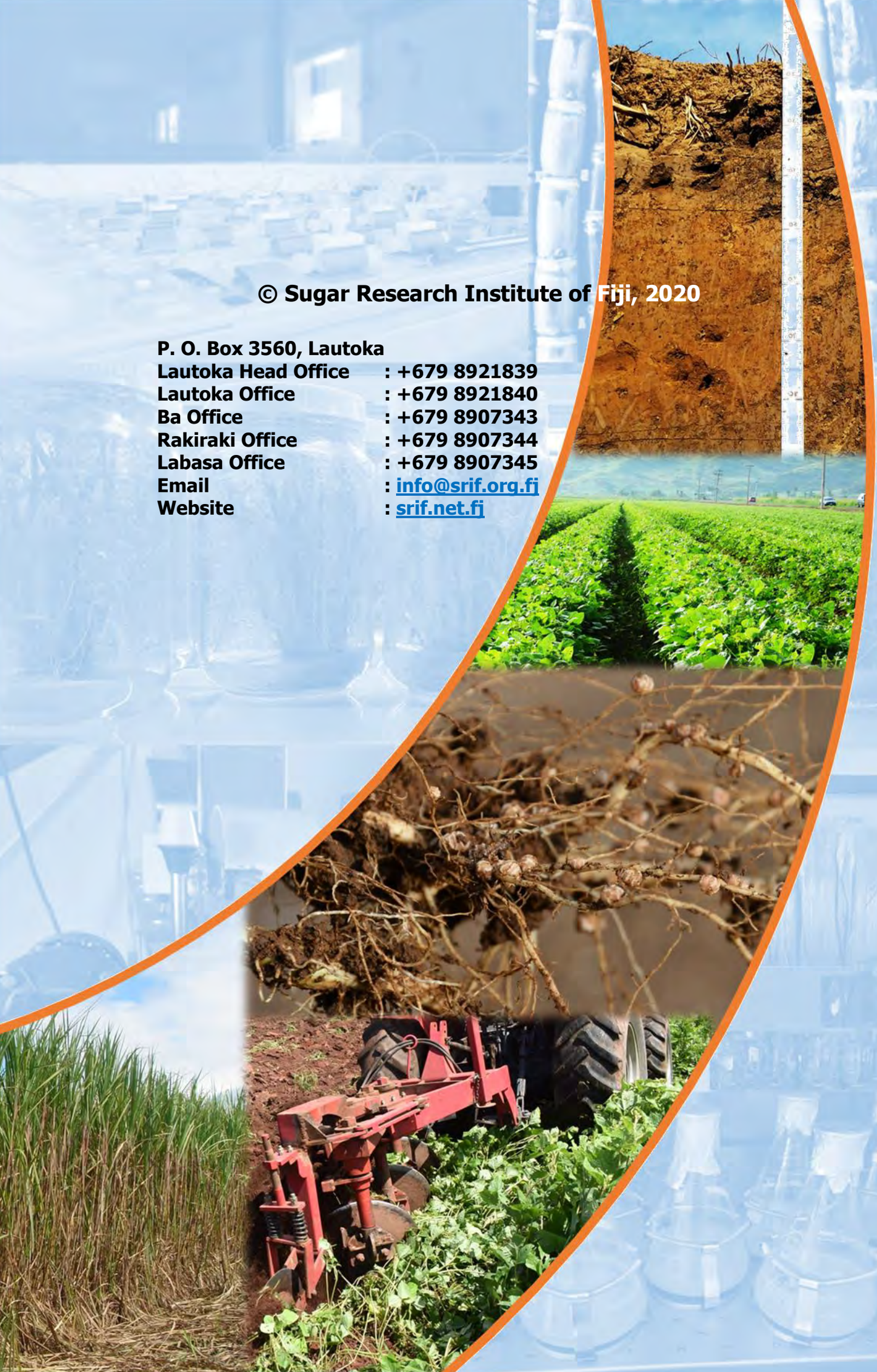
The Institute operates predominantly in Fiji and is therefore one geographical area for reporting purposes.

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 79 employees (2019: 82).



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