2018

Annual Report

PARLIAMENT OF FIJI
PARLIAMENTARY PAPER NO. 171 OF 2019

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FOREWORD

Three tropical cyclones in successive months (February, March and April) with heavy rainfalls affected cane growth. There was a slight increase in 2018 cane production compared to 2017. Drier conditions prevailed from June to December and the month of December was exceptionally hot. The breeding program suffered a setback in 2018 due to the after effects of the cyclones that caused heavy lodging of the cane in the flowering beds thus reducing the availability of parent materials. In 2018, 135 poly crosses were made using 50 female and 55 male parents. The low number of crosses made was due to severe lodging of the varieties in the flowering beds. Fuzz sowing was delayed as there was no packets of fuzz in stock from previous years. 135 packets of fuzz from 2018 crossing season were sown that had good germination producing 2,750 seedlings. 408 varieties were selected from stage 2 and advanced to stage 3, and 15 varieties were selected from stage 3 and progressed to stage 4. In an effort to develop better improved cane varieties, the germplasm collection of 640 varieties was evaluated to identify promising parent varieties. A total of one thousand seventy-six soil and three hundred fifteen foliar samples were analysed for fertilizer recommendations and research trials. A project was initiated to study the nutrient status of the sugarcane crop and another project was conducted to develop a nutrient budget for the sugar industry. Post-harvest cane deterioration studies were carried out to ascertain losses in sugarcane due to field practices.

Under the SRIF Act, one of the functions of the institute is to protect the industry against diseases and pest incursions. Routine screening of Fiji leaf gall (FLG) disease continued during the year. A study was carried out to classify sugarcane cultivars of Fiji to their host response to plant parasitic nematodes in treated and untreated soil. Fifteen farms affected by the Asian Subterranean Termites infestation was monitored during the year and Termidore powder was applied to these farms. As part of the integrated pest management of the major pest Cane Weevil Borer (CWB), split bait traps were placed in 10 farms to monitor CWB population density. The Disease Control unit inspected 1606 farms covering an area of 5770 hectares and removed 1524 diseased FLG stools. Fiji is the only country in the world that has not been affected by SMUT disease. An incursion plan in collaboration with the Biosecurity has been put in place to encounter this disease. Smut spore traps were placed at points of entry and no spores were trapped. A nitrogen fixing bacteria was successfully isolated, then mass propagated and added to a sterile compost to conduct pot trials. The bacteria were also used for inoculating black gram seeds for green manuring project. The production of hot water treatment seed cane continued during the year and 25 hectares was planted. Single eye bud nursery was also established at some sectors and few farmers tried using these seedlings to fill the gaps in ratoon crops on their farms. A major achievement for the institute was the revival of the tissue culture laboratory. This lab is now operational, and production of seedlings is under way. The Institute remains the centre for disseminating information through the technology transfer program. Under this program on field demonstrations on key issues that will improve production are conducted. In 2018, 17 grower demonstration trials were conducted. Improving soil health was part of the technology transfer program and in 2018 three green manuring trials were established. The crop used in these trials was black gram. After vegetative growth of the green manure, it is ploughed into the soil and allowed to decompose. The decomposing plants help to improve the organic matter content of the soil that later helps in improving fertilizer uptake. My sincere appreciation to all the staff for their valuable contribution towards the progress of the Institute and I also thank the Chairman and board members for their guidance and support.

Acting Chief Executive Officer
Prem N Naidu

Cover Page: Aftermath of Cyclone Josie

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.

BOARD MEMBERS

Professor Rajesh Chandra - Chairman (re-appointed 2 March 2018)
Dr K.S Shanmugha Sundaram (term expired on 1 March 2018)
Mr Daniel Elisha (term expired on 1 March 2018)
Mr Sundresh Chetty (term expired on 1 March 2018)
Mr Graham Clark
Ms Reshmi Kumari
Dr Sanjay Anand
Mr Raj Sharma (appointed on 12 June 2018)
Mr Ashween Nischal Ram (appointed on 18 June 2018)
Professor Ravendra Naidu (appointed on 13 March 2018)

SCIENCE AUDIT COMMITTEE MEMBERS

Professor Ravendra Naidu - Chairman
Dr K.S Shanmugha Sundaram
Dr Sanjay Anand
Mr Ashween Nischal Ram
Mr Graham Clark
Mr Sundresh Chetty

1.0 RESEARCH & DEVELOPMENT

1.1 METEOROLOGY

HIGHLIGHTS

1. February – category 4 severe Tropical Cyclone Gita affected the westward Fiji group. Heavy rainfall was experienced and recorded average to well above average rainfall.
2. March – Tropical Cyclone Josie developed and resulted in heavy rain bands with strong and gusty winds. This resulted in flooding with the western side of Fiji recording generally average to above average rainfall during the month.
3. April – Tropical Cyclone Keni affected Fiji from the 8th to the 11th of the month. Hurricane force winds and damaging gale force winds were experienced over the Fiji Group with heavy rain, contributing to heavy flooding in various parts of the country, damaging sugarcane, agricultural crops and infrastructures.
4. June – Exceptionally drier than normal conditions were experienced in the Western Division with all sites from Sigatoka to Rakiraki areas recording well below normal rainfall.
5. August – it was significantly a dry month with Lautoka Mill to Yaqara corridor recording well below average rainfall. According to a bulletin released by FMS, due to the very low rainfall, majority of the stations across the country entered into some form of meteorological drought alert affecting grasslands, shallow rooted plants and small water bodies (e.g. small water tanks, creeks and streams) by the end of August 2018.
6. December – majority of the Western Division experienced drier than normal rainfall conditions. Significantly hot condition was experienced in the Western Division on the Christmas Day.

SUMMARY

- Daily meteorological readings recorded at 9am and sent to Fiji Meteorological Service (FMS).

RESULTS AND DISCUSSION

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 centres. Climatological station is 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 30cm, 24 hours rainfall, amount of cloud, visibility, wind force and wind direction at 9am daily. At the end of each month, data is compiled in a designated F211 form and forwarded to The Regional Specialized Meteorological Centre Nadi. Similarly, rainfall figures from each sector from the eight districts are compiled and kept for our records. The climatic data is used to produce climate summary and prediction of weather forecasts for the country. The Research Institute provides a summary statement towards the Fiji Sugar Cane Rainfall Outlook (FSCRO) which becomes an advice to farmers on possible farm activities such as land preparation, cultivation, fertilizer application, weedicide application and harvesting from sugarcane belt areas.

El Niño Southern Oscillation (ENSO)

ENSO is an irregular cycle of persistent warming and cooling of Sea surface temperatures in the tropical Pacific Ocean. The warm extreme is known is El Niño and the cold extreme, La Niña. Scientists now refer to an El Niño event as sustained warming over a large part of central and eastern equatorial Pacific Ocean. This warming is usually accompanied by persistent negative values of Southern Oscillation Index (SOI), a decrease in the strength or reversal of the trade winds, increase in cloudiness in the Pacific and a reduction 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 to 3000mm. From the table below, it can be seen that the total rainfall for all mills was in the annual average rainfall range.

Table 1.1.1: Rainfall (mm) figures for All Mills

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
January	370	18	489	13	319	13	394	26
February	350	23	308	21	663	20	321	27
March	502	16	402	19	475	24	507	26
April	329	12	463	4	898	13	475	18
May	84	5	105	4	92	12	60	16
June	67	4	55	5	26	5	459	8
July	1	1	0	0	25	4	9	11
August	0	0	0	0	0	0	199	15
September	26	1	17	1	74	8	35	10
October	209	10	171	14	283	17	340	24
November	80	4	83	6	31	2	70	8
December	112	8	135	7	86	11	72	15
Total	2129	102	2228	94	2971	129	2940	204
Average	177	9	186	8	248	11	245	17

Table 1.1.2: Monthly Rainfall figures for Lautoka mill with the Long-Term Averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Avg
Monthly rainfall	370	350	502	329	84	67	1	0	26	209	80	112	2130	178
No. of rain days	18	23	16	12	5	4	1	0	1	10	4	8	102	9
48 yrs. avg (1970-2017)	363	330	323	194	88	69	50	70	74	101	135	194	1990	280
% of avg	102	106	155	170	95	98	2	0	35	207	59	57	107	63

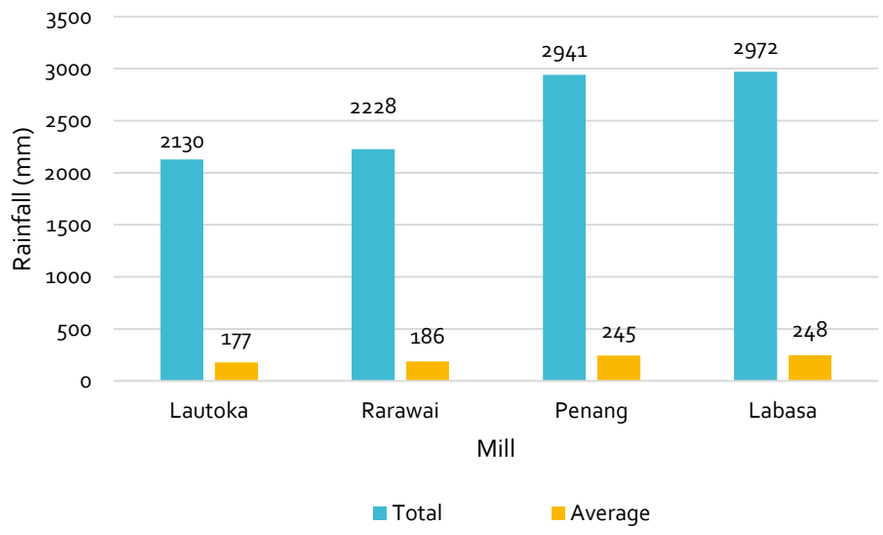
Table 1.1.3: Monthly Rainfall figures for Rarawai mill with the Long-Term Averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Avg
Monthly rainfall	489	308	402	463	105	55	0	0	17	171	83	135	2228	186
No. of rain days	13	21	19	4	4	5	0	0	1	14	6	7	94	8
48 yrs. avg (1970-2017)	381	357	359	202	92	77	39	64	72	106	150	238	2137	304
% of avg	128	86	112	229	114	71	0	0	23	162	55	57	104	61

Table 1.1.4 - Monthly Rainfall figures for Penang mill with the Long-Term Averages														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Avg
Monthly rainfall	394	321	507	475	60	459	9	199	35	340	70	72	2941	245
No. of rain days	26	27	26	18	16	8	11	15	10	24	8	15	204	17
48 yrs. avg (1970-2017)	413	359	365	257	149	101	49	70	84	113	150	260	2370	198
% of avg	95	89	139	185	40	455	18	283	42	301	46	28	124	124

Table 1.1.5 - Monthly Rainfall figures for Labasa mill with the Long-Term Averages														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Avg
Monthly rainfall	319	663	475	898	92	26	25	0	74	283	31	86	2972	248
No. of rain days	13	20	24	13	12	5	4	0	8	17	2	11	129	11
48 yrs. avg (1970-2017)	387	371	366	251	106	74	49	53	76	123	180	254	2289	325
% of avg	82	179	130	358	86	35	52	0	98	231	17	34	130	76

Figure 1.1.1: Total and monthly average rainfall for each mill



The tables and graph above represent the total and the monthly average rainfall figures for all the sugar mills across the sugarcane belt areas. All mills recorded above average rainfall, with Labasa recording the highest and Lautoka recording the lowest. The highest rainfall of 898mm was recorded for the month of April at Labasa mill while the least rainfall was recorded for the months of July and August at Lautoka, Rarawai and Labasa mill.

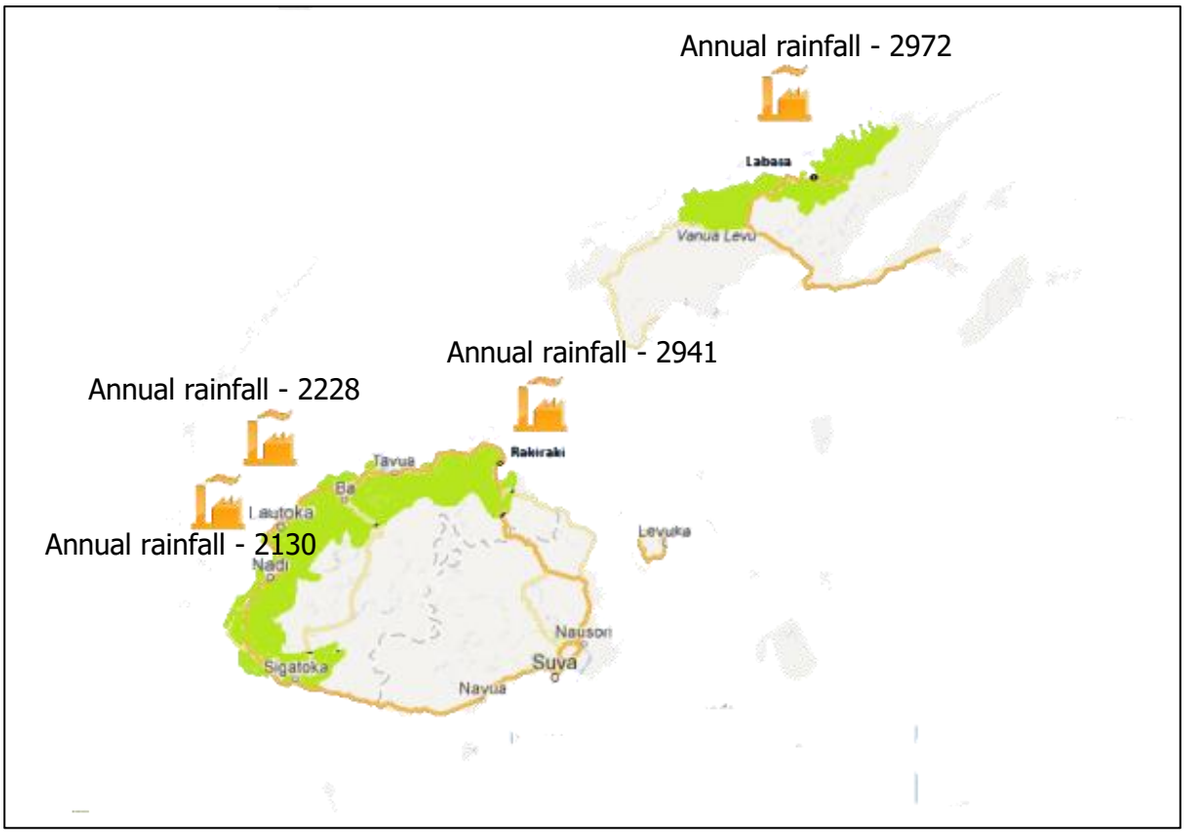


Figure 1.1.2: Annual rainfall received per mill

Lautoka Mill

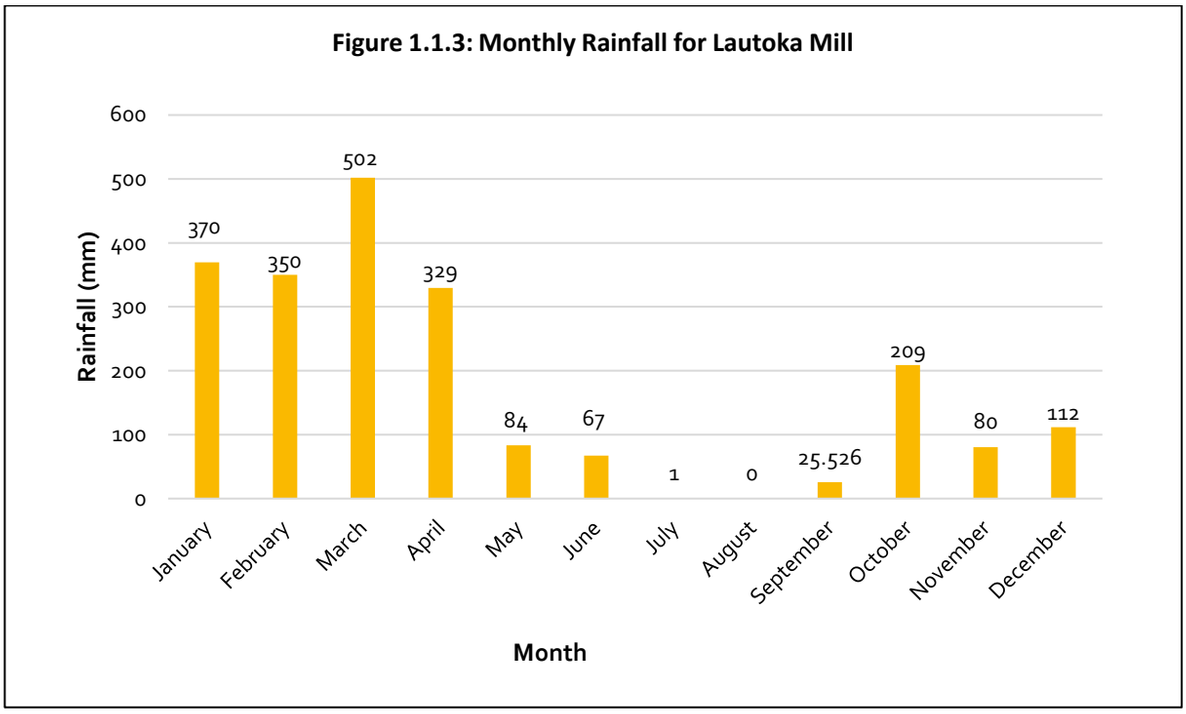


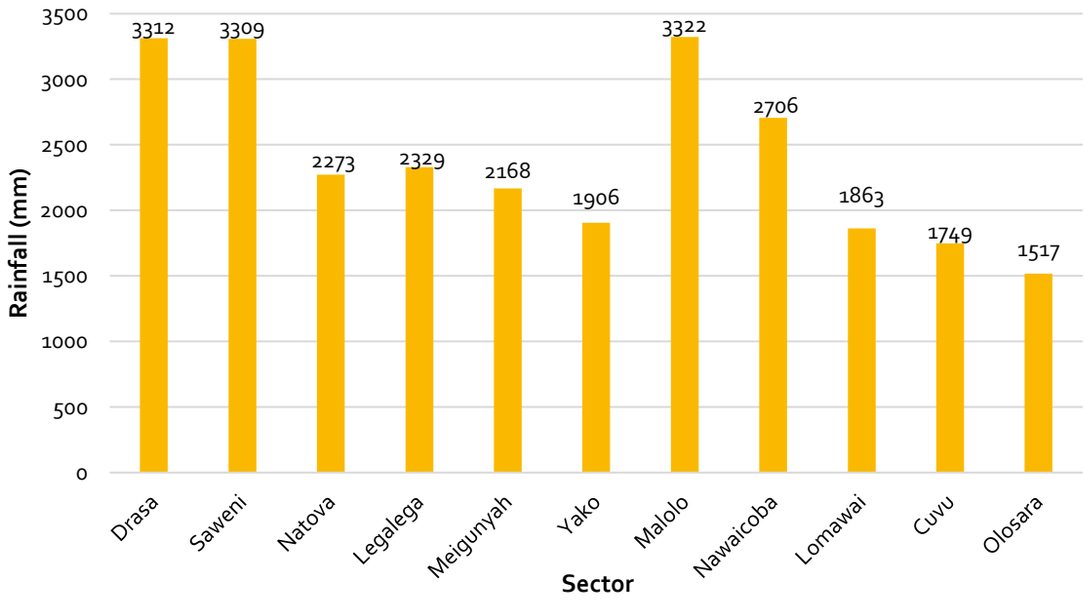
Table 1.1.6: Rainfall (mm) figures for each Sector of the Lautoka Mill

Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Drasa	518	545	781	719	153	117	0	0
Saweni	351	769	826	742	145	89	0	0
Natova	329	494	427	409	97	67	0	0
Legalega	445	508	382	356	100	64	0	0
Meigunyah	340	476	423	372	114	71	0	0
Yako	369	490	400	287	41	32	0	15
Malolo	544	818	739	450	148	85	0	10
Nawaicoba	332	616	568	446	104	26	15	20
Lomawai	237	471	340	305	163	38	18	13
Cuvu	57	343	298	207	186	28	8	2
Olosara	76	384	234	227	139	14	15	0

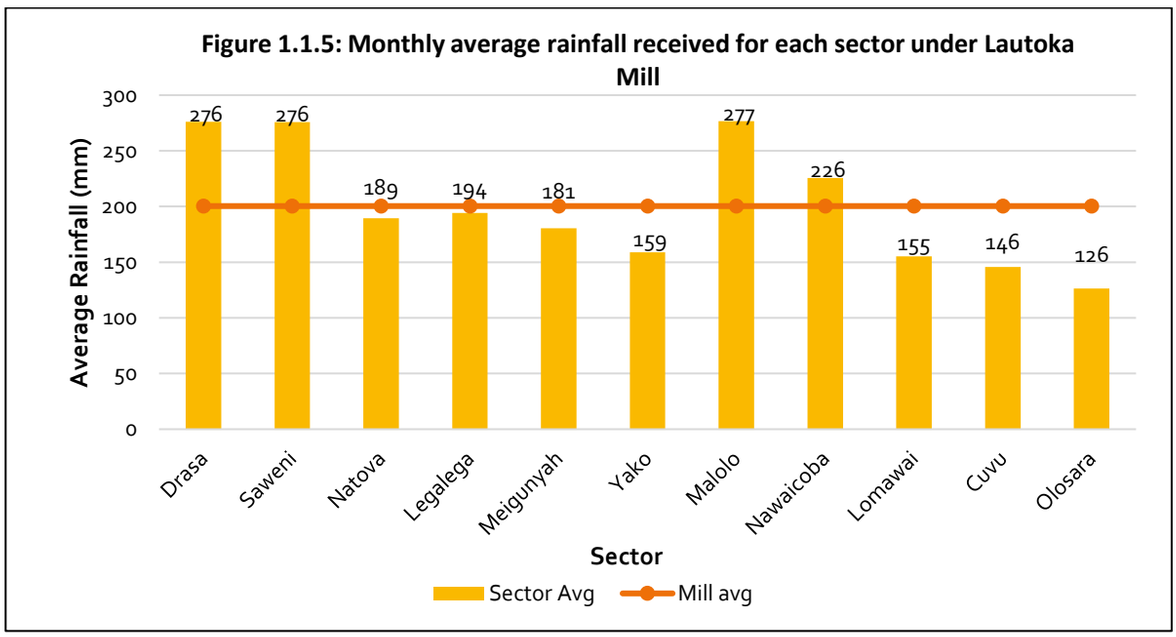
Table 1.1.6: Cont'd

Sector	Sep	Oct	Nov	Dec	Total	Sector avg	Mill avg
Drasa	13	215	87	163	3312	276	
Saweni	24	215	67	81	3309	276	
Natova	41	208	123	79	2273	189	
Legalega	48	204	101	121	2329	194	
Meigunyah	38	181	84	69	2168	181	
Yako	25	204	16	29	1906	159	200
Malolo	72	232	67	159	3322	277	
Nawaicoba	14	368	30	167	2706	226	
Lomawai	30	98	44	107	1863	155	
Cuvu	80	249	97	195	1749	146	
Olosara	38	215	69	107	1517	126	

Figure 1.1.4: Total Rainfall received for each sector under Lautoka Mill



The graph above shows that Malolo recorded the highest rainfall of 3322mm of rainfall followed by Drasa with 3312mm while Olosara recorded the least amount of rainfall of 1517mm.



The graph above shows that only 4 sectors, i.e. Drasa, Saweni, Malolo and Nawaicoba exceeded the mill average of 200mm of rainfall while all the other sectors recorded below mill average rainfall.

Rarawai Mill

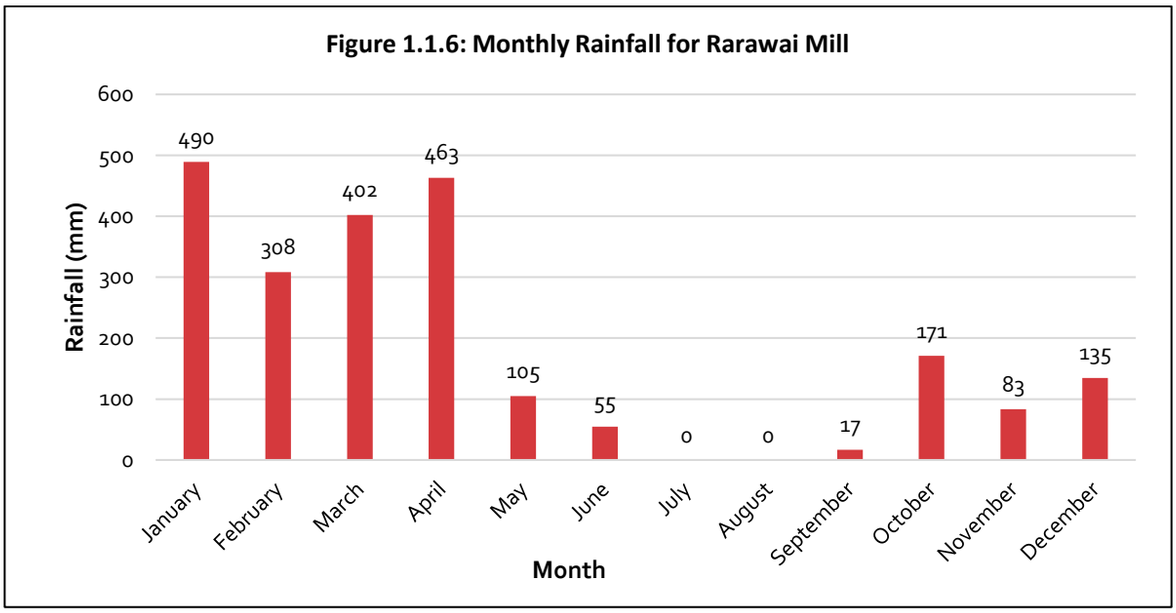
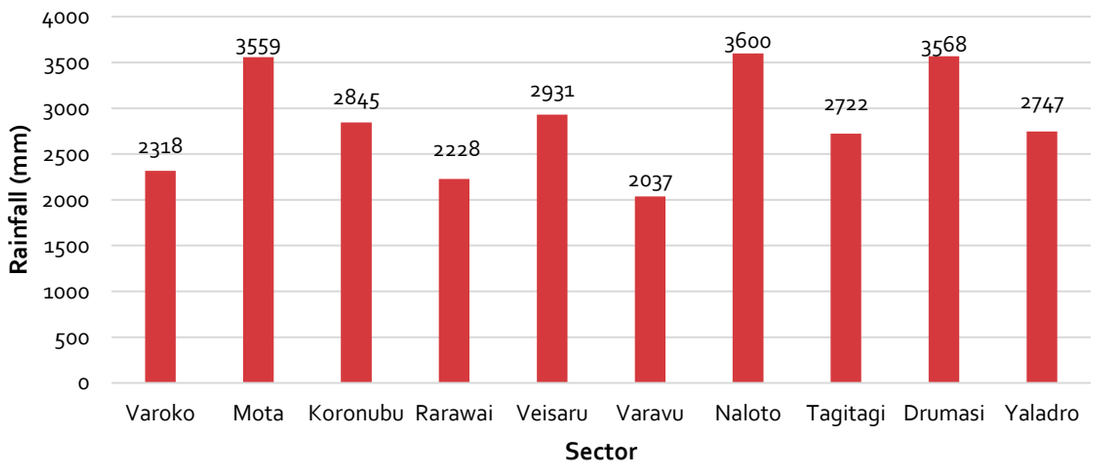


Table 1.1.7: Rainfall (mm) figures for each sector of the Rarawai Mill

Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Sec. Avg	Mill avg
Varoko	448	369	520	495	35	26	0	0	14	171	99	141	2318	193	238
Mota	661	633	747	675	114	63	0	0	46	271	119	230	3559	297	
Koronubu	513	483	309	970	67	37	0	0	4	251	71	140	2845	237	
Rarawai	489	308	402	463	105	55	0	0	17	171	83	135	2228	186	
Veisaru	678	432	492	713	98	73	0	0	5	240	87	113	2931	244	
Varavu	501	326	434	369	36	114	0	0	0	133	68	56	2037	170	

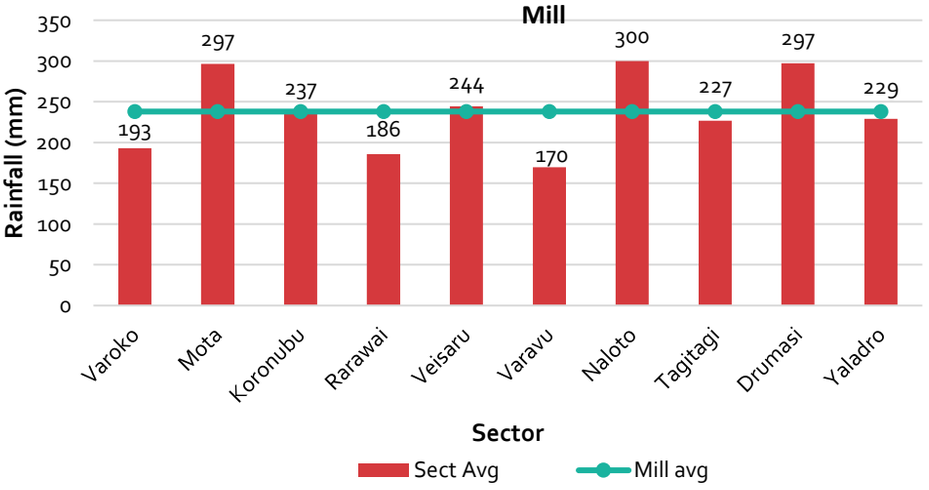
Table 1.1.7: Cont'd															
Sector	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**	**Sec. Avg**	**Mill avg**
Naloto	670	677	839	743	85	83	0	0	1	257	75	170	3600	300	238
Tagitagi	513	394	368	775	79	84	4	0	2	255	168	80	2722	227	
Drumasi	682	829	337	1064	101	50	3	0	1	285	140	76	3568	297	
Yaladro	656	562	345	628	100	48	4	0	1	224	112	67	2747	229	

Figure 1.1.7: Total Rainfall received for each sector under Rarawai Mill



The graph above shows that Naloto recorded the highest rainfall of 3600mm of rainfall followed by Drumasi of 3568mm and Mota of 3559mm while Varavu recorded the least amount of rainfall of 2037mm.

Figure 1.1.8: Monthly average rainfall received for each sector under Rarawai Mill



The graph above shows that only 3 sectors, i.e. Mota, Naloto and Drumasi exceeded the mill average of 238mm of rainfall while all the other sectors recorded below mill average rainfall.

Penang Mill

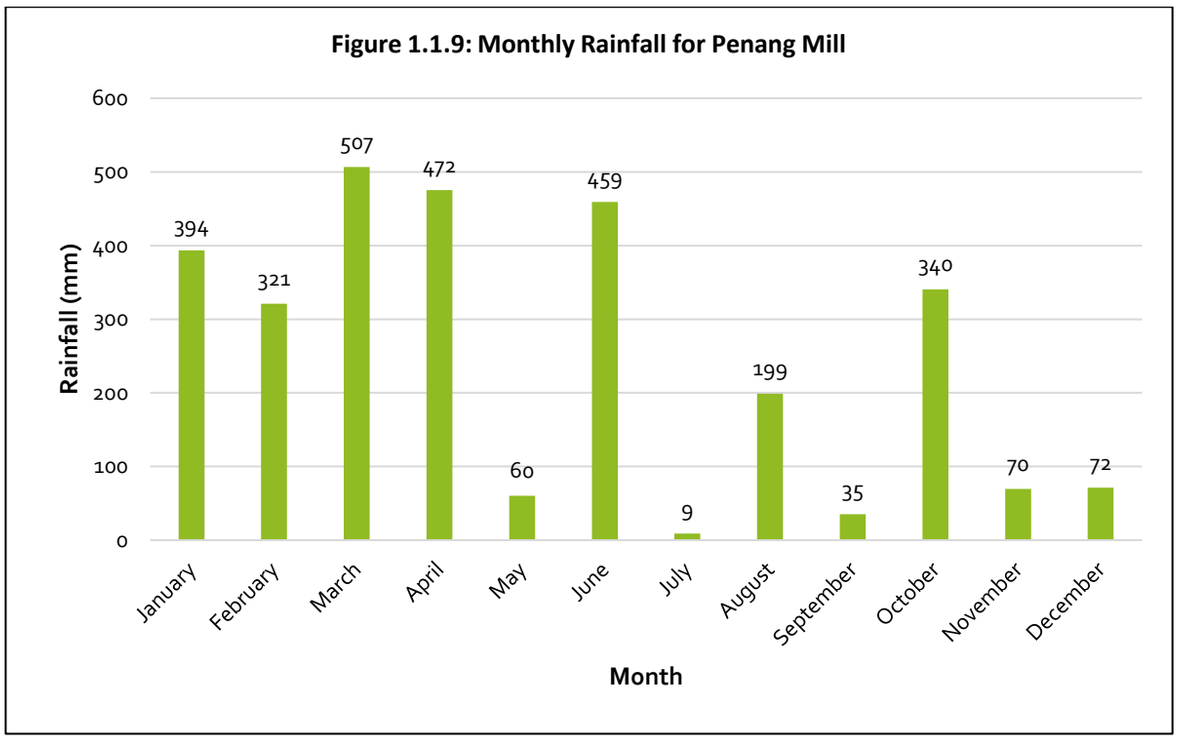
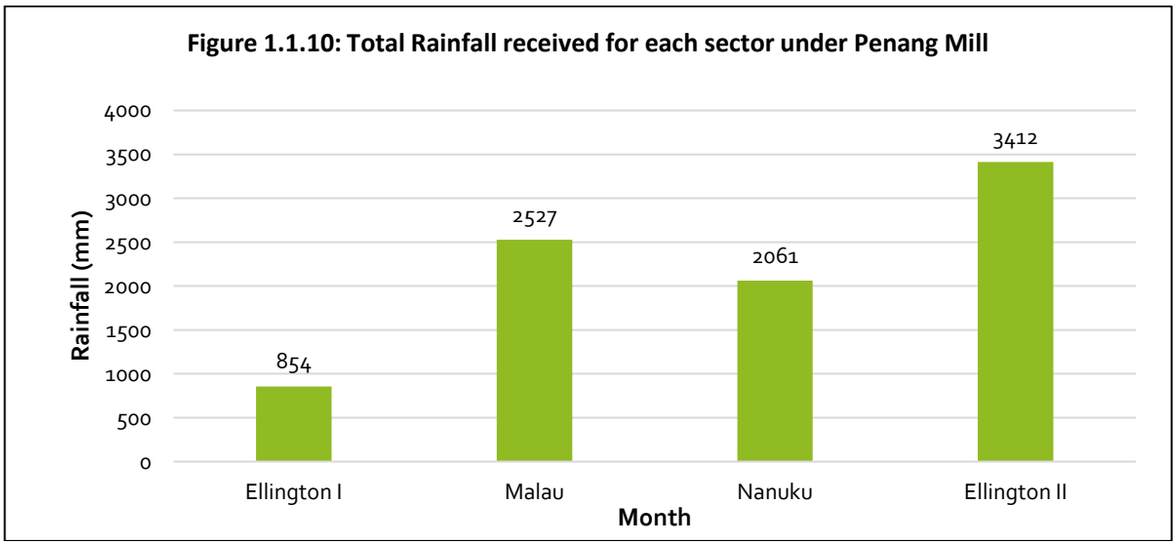


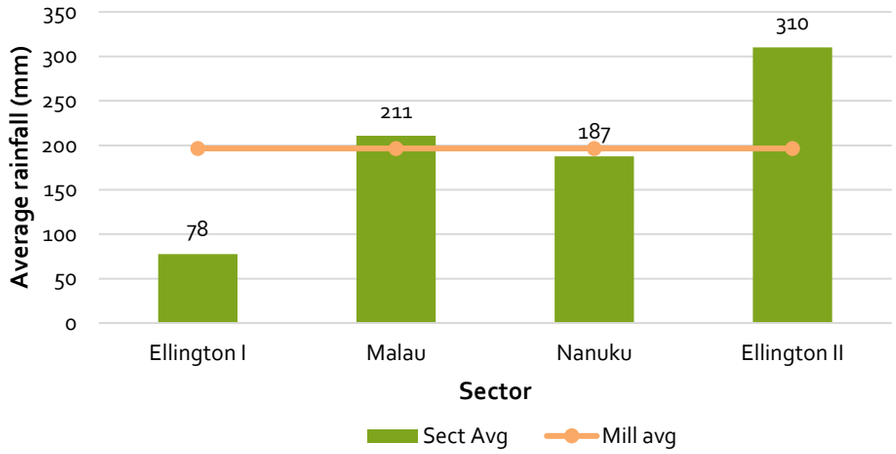
Table 1.1.8: Rainfall (mm) figures for each sector of the Penang Mill

Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Sec. Avg	Mill Avg
Ellington I	28	89	171	182	47	63	3	69	38	158	ND	7	854	78	196
Malau	394	321	507	475	60	46	9	199	35	340	70	72	2527	211	
Nanuku	375	445	330	394	34	32	0	197	20	181	ND	53	2061	187	
Ellington II	296	465	605	696	108	58	24	377	76	452	ND	255	3412	310	



The graph above shows that Ellington II recorded the highest rainfall of 3412mm of rainfall while Ellington I recorded the least amount of rainfall of 854mm.

Figure 1.1.11: Monthly average rainfall received for each sector under Penang Mill



The graph above shows that only 2 sectors, i.e. Malau and Ellington II exceeded the mill average of 196mm of rainfall while the other 2 sectors recorded below mill average rainfall.

Labasa Mill

Figure 1.1.12: Monthly Rainfall for Labasa Mill

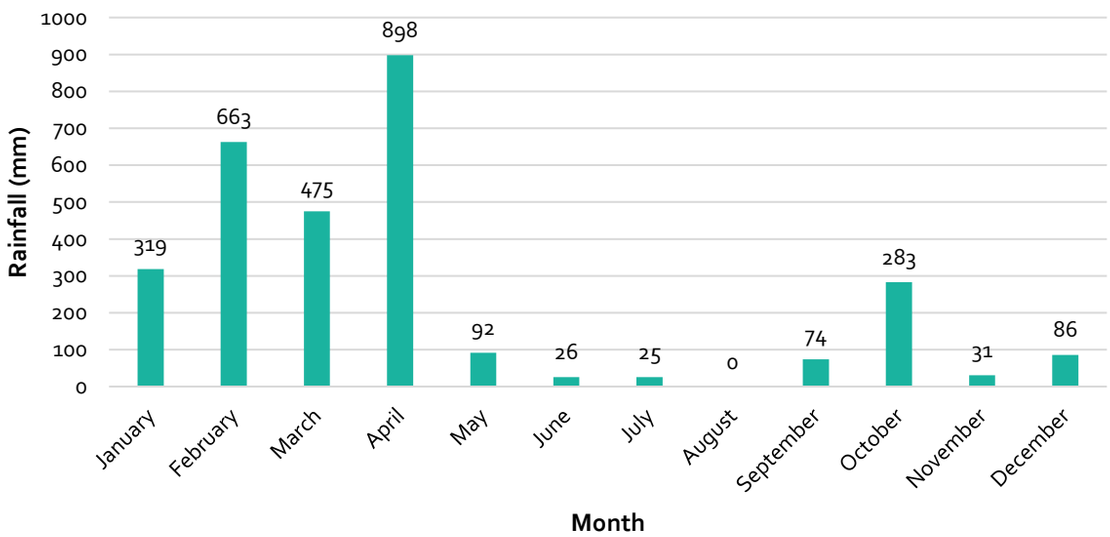
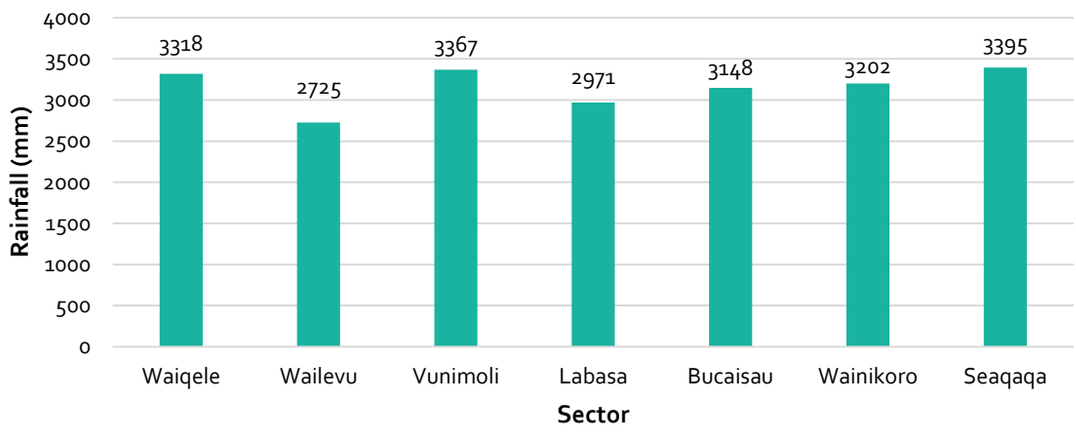


Table 1.1.9: Rainfall (mm) figures for each sector of the Labasa Mill

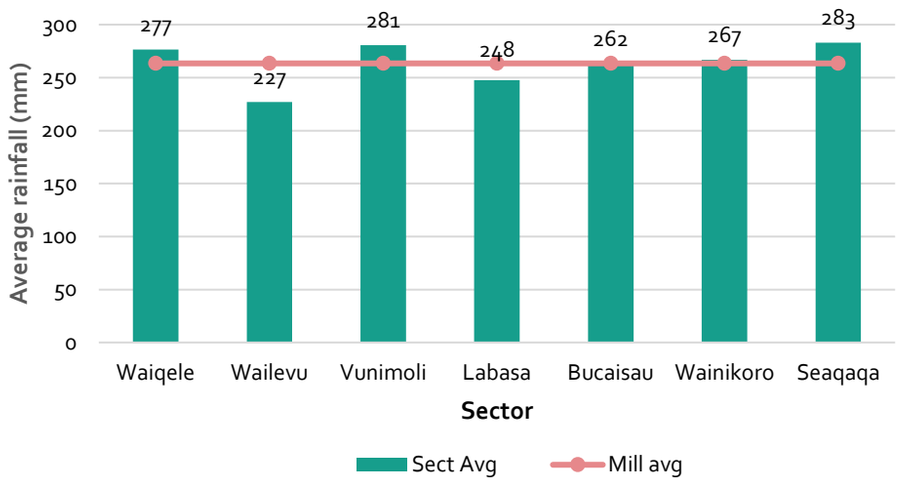
Sector	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Sec. Avg	Mill avg
Waiqele	333	656	513	886	77	29	36	0	191	391	108	98	3318	277	263
Wailevu	264	607	513	631	121	38	8	0	126	252	60	105	2725	227	
Vunimoli	290	677	472	821	178	47	6	0	110	565	78	123	3367	281	
Labasa	319	663	475	898	92	26	25	0	74	283	31	86	2971	248	
Bucaisau	339	635	533	782	90	12	3	0	91	475	27	161	3148	262	
Wainikoro	343	660	420	622	98	19	7	0	85	490	107	351	3202	267	
Seaqaqa	344	827	710	602	73	61	2	0	57	356	114	249	3395	283	

Figure 1.1.13: Total Rainfall received for each sector under Labasa Mill



The graph above shows that Seaqaqa recorded the highest rainfall of 3395mm of rainfall while Wailevu recorded the least amount of rainfall of 2725mm.

Figure 1.1.14: Monthly average rainfall received for each sector under Labasa Mill



The graph above shows that only 3 sectors, i.e. Waiqele, Vunimoli and Seaqaqa exceeded the mill average of 263mm of rainfall while all the other sectors recorded below mill average rainfall with Wailevu recording least.

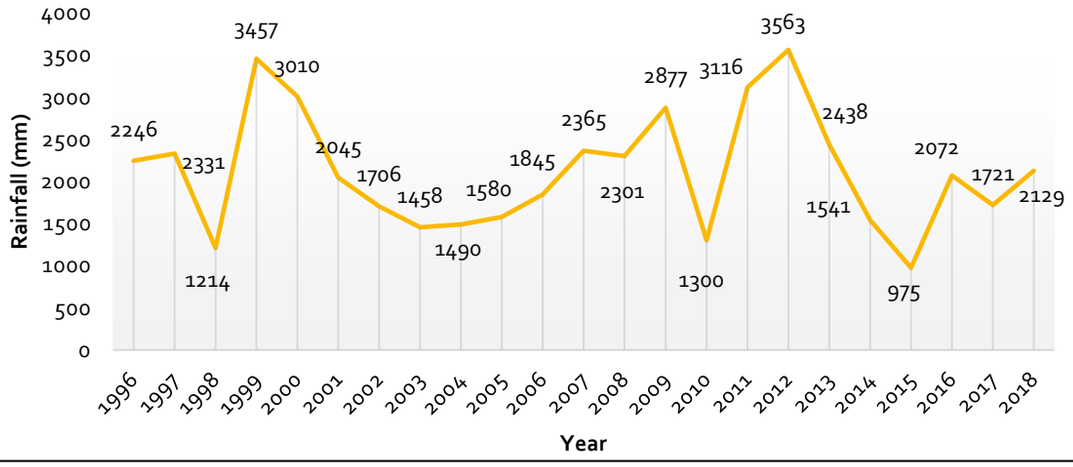
Lautoka Mill

Table 1.1.10: Past 23 years met data for the Lautoka Mill

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	417	194	453	118	234	213	90	20	60	11	102	334	2246
1997	967	218	323	271	86	25	34	233	59	40	3	72	2331
1998	164	117	63	82	37	5	7	1	23	38	481	196	1214
1999	1018	517	139	388	26	50	115	136	92	149	354	473	3457
2000	408	250	421	124	367	40	180	147	97	142	167	667	3010
2001	236	356	405	170	62	22	106	123	19	259	96	191	2045

Table 1.1.10: Cont'd													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2002	317	339	223	247	132	33	64	43	164	39	54	51	1706
2003	136	91	507	123	53	82	13	134	6	76	52	185	1458
2004	34	366	245	180	22	60	98	277	84	6	38	80	1490
2005	244	96	104	437	4	98	52	91	31	103	142	178	1580
2006	718	223	140	119	105	40	28	77	52	115	113	115	1845
2007	61	439	674	224	42	1	49	22	202	111	268	272	2365
2008	672	554	232	118	112	122	26	1	26	103	216	119	2301
2009	1280	262	384	110	116	72	34	65	223	42	52	237	2877
2010	95	93	138	144	24	3	55	7	10	206	299	226	1300
2011	560	425	407	288	275	123	122	131	92	112	275	306	3116
2012	854	579	894	406	78	210	14	53	296	120	35	24	3563
2013	106	544	531	84	127	82	17	33	46	75	354	439	2438
2014	310	300	196	194	203	10	7	0	30	53	37	201	1541
2015	212	342	130	64	10	9	27	35	43	19	2	82	975
2016	169	436	279	434	7	19	6	210	3	153	87	269	2072
2017	166	697	370	11	66	31	10	27	2	25	130	187	1721
2018	370	350	502	329	84	67	1	0	26	209	80	112	2129

Figure 1.1.15: 23 years total rainfall for Lautoka mill

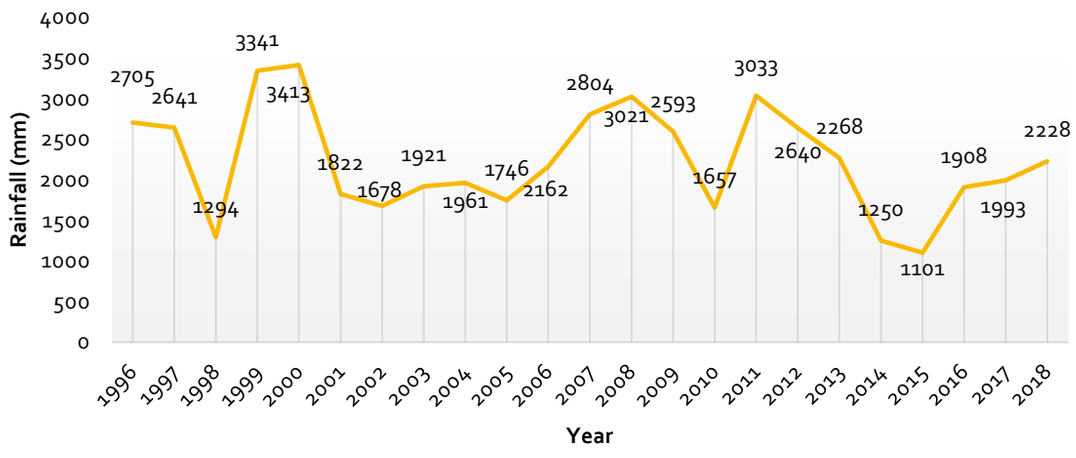


The graph shows the total rainfall received in the past 23 years by Lautoka Mill. The all-time low of 975mm was recorded in the year 2015 with the all-time high of 3563mm recorded in year 2012. This year also marked the occurrence of Cyclone Evan.

Table 1.1.11: Past 23 years met data for the Rarawai mill													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
1996	678	424	452	81	346	233	75	24	43	8	110	231	2705
1997	1029	280	442	311	116	4	26	202	55	82	9	85	2641
1998	155	55	49	54	13	4	1	1	82	46	498	336	1294
1999	1033	558	302	360	25	56	95	108	67	138	226	373	3341
2000	712	324	478	134	278	124	211	84	92	177	153	646	3413
2001	306	242	212	332	35	26	59	79	22	224	85	200	1822
2002	242	347	439	83	122	45	77	44	145	49	38	47	1678
2003	103	207	590	218	128	41	6	72	2	63	64	427	1921
2004	52	481	427	157	54	100	128	378	63	21	3	97	1961
2005	368	66	140	381	1	96	53	63	40	72	237	229	1746
2006	607	270	213	169	95	53	19	91	57	120	143	325	2162

Table 1.1.11: Cont'd													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007	110	583	904	161	14	7	42	14	239	140	305	285	2804
2008	827	605	372	271	173	55	52	9	21	81	375	180	3021
2009	944	358	353	91	150	77	28	27	237	57	48	223	2593
2010	123	141	166	167	57	1	53	24	32	141	485	267	1657
2011	738	393	421	218	149	124	92	114	41	268	299	176	3033
2012	825	710	275	4	80	173	0	46	238	173	100	16	2640
2013	218	355	468	111	159	88	9	30	31	96	277	426	2268
2014	322	256	186	85	145	4	5	0	6	46	57	138	1250
2015	196	246	143	82	13	8	5	22	53	43	7	283	1101
2016	196	412	134	487	14	29	6	148	10	128	17	327	1908
2017	347	631	374	89	43	14	0	40	9	17	186	244	1993
2018	489	308	402	463	105	55	0	0	17	171	83	135	2228

Figure 1.1.16: 23 Years Total Rainfall for Rarawai Mill



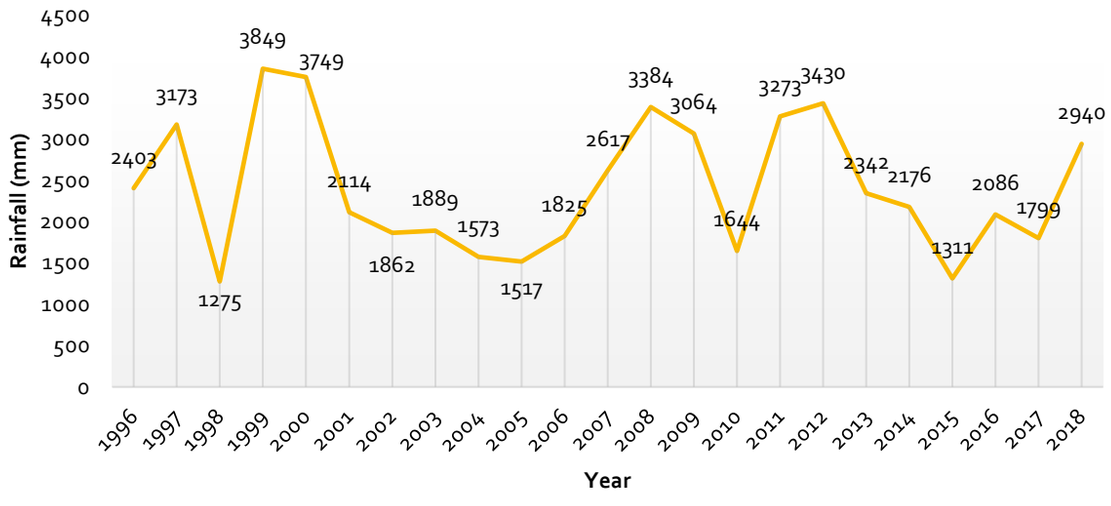
The graph shows the total rainfall received in the past 23 years by Rarawai Mill. The all-time low of 1101mm was recorded in the year 2015 with the all-time high of 6795mm recorded in year 1996.

Penang Mill

Table 1.1.12: Past 23 years met data for the Penang Mill													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	340	343	450	144	224	237	85	40	78	53	216	193	2403
1997	911	382	695	345	440	22	37	135	59	71	9	67	3173
1998	179	112	199	121	46	37	12	13	170	22	125	239	1275
1999	730	409	274	318	437	72	102	55	324	379	287	462	3849
2000	447	307	565	303	582	263	148	67	71	203	187	606	3749
2001	315	295	233	182	111	51	82	109	38	323	119	256	2114
2002	378	396	301	130	164	17	163	70	100	50	27	66	1862
2003	163	63	537	471	129	29	25	41	6	46	82	297	1889
2004	54	371	292	254	11	149	95	196	79	1	30	41	1573
2005	264	78	72	556	8	101	31	36	113	54	96	108	1517
2006	481	405	149	172	65	59	24	83	81	108	34	164	1825

Table 1.1.12: Cont'd													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2007	64	343	716	186	80	25	36	30	204	45	330	558	2617
2008	1241	570	200	222	271	104	19	75	38	21	381	242	3384
2009	1255	305	184	188	276	79	68	52	114	22	28	493	3064
2010	59	307	84	154	62	40	23	14	57	249	430	165	1644
2011	695	592	322	278	385	75	39	99	44	185	388	171	3273
2012	990	477	235	576	41	165	19	75	215	147	60	430	3430
2013	311	462	414	290	140	103	62	31	37	122	116	254	2342
2014	354	483	242	124	207	42	24	16	0	99	65	520	2176
2015	150	364	143	102	72	15	5	53	59	124	28	196	1311
2016	84	634	120	370	58	57	13	-	1	73	126	550	2086
2017	171	540	440	32	167	11	1	49	61	8	187	133	1799
2018	394	321	507	475	60	459	9	199	35	340	70	72	2940

Figure 1.1.17: 23 Years Total Rainfall for Penang Mill



Labasa Mill

Table 1.1.12: Past 23 years met data for the Labasa Mill													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
1996	500	356	557	82	185	258	86	4	72	186	140	288	2714
1997	686	367	512	443	306	4	38	100	50	140	34	55	2735
1998	422	13	91	32	31	67	1	3	85	84	182	545	1556
1999	897	452	154	182	125	99	119	81	89	271	435	239	3143
2000	670	451	617	643	223	51	122	10	73	100	176	519	3655
2001	337	339	246	336	54	59	68	55	21	162	140	331	2148
2002	438	814	292	223	77	16	103	62	74	109	118	94	2420
2003	484	92	351	334	134	16	19	16	15	25	86	261	1833
2004	40	312	392	167	31	163	92	113	48	47	53	109	1567
2005	287	113	213	275	20	107	111	18	51	85	262	254	1796
2006	550	677	91	310	46	47	17	50	64	69	46	186	2153
2007	100	458	619	167	101	56	30	49	327	131	310	439	2787
2008	655	333	305	256	232	97	10	3	45	47	168	299	2450
2009	805	454	259	211	94	111	93	16	153	14	106	163	2479

Table 1.1.12: Cont'd													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2010	213	73	314	325	108	104	88	42	17	165	425	401	2275
2011	698	476	362	84	198	89	100	81	60	161	314	244	2867
2012	567	754	411	229	37	99	12	38	175	189	167	276	2954
2013	329	334	937	40	83	96	27	115	105	216	227	246	2755
2014	293	405	183	125	88	14	18	2	6	275	116	154	1679
2015	185	404	175	105	59	2	0	82	36	7	27	86	1168
2016	4	0	257	560	1	22	1	203	0	104	111	510	1773
2017	122	779	361	16	125	83	2	93	130	29	261	120	2122
2018	319	663	475	898	92	26	25	0	74	283	31	86	2971

Figure 1.1.18: 23 Years Total Rainfall for Labasa Mill

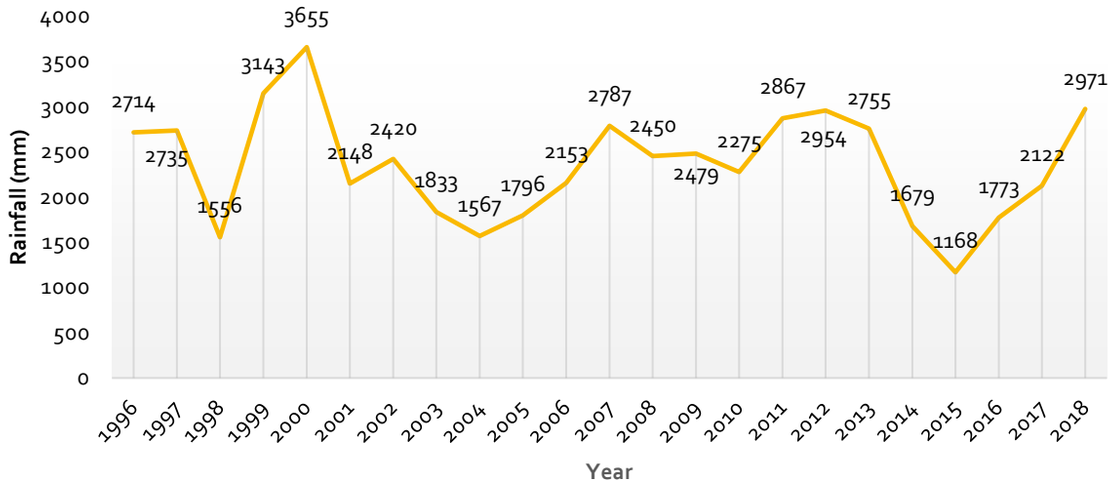


Table 1.1.13: Total Rainfall Figures for all the Four Mills for the past 23 years				
Years	**Lautoka**	**Rarawai**	**Penang**	**Labasa**
1996	2246	2705	2403	2714
1997	2331	2641	3173	2735
1998	1214	1294	1275	1556
1999	3457	3341	3849	3143
2000	3010	3413	3749	3655
2001	2045	1822	2114	2148
2002	1706	1678	1862	2420
2003	1458	1921	1889	1833
2004	1490	1961	1573	1567
2005	1580	1746	1517	1796
2006	1845	2162	1825	2153
2007	2365	2804	2617	2787
2008	2301	3021	3384	2450
2009	2877	2593	3064	2479
2010	1300	1657	1644	2275
2011	3116	3033	3273	2867
2012	3563	2640	3430	2954
2013	2438	2268	2342	2755
2014	1541	1250	2176	1679
2015	975	1101	1311	1168

Table 1.1.13: Cont'd				
Years	**Lautoka**	**Rarawai**	**Penang**	**Labasa**
2016	2072	1908	2086	1773
2017	1721	1993	1799	2122
2018	2129	2228	2940	2971

Figure 1.1.19: Past 23 Years Total Rainfall Figures for All Mills

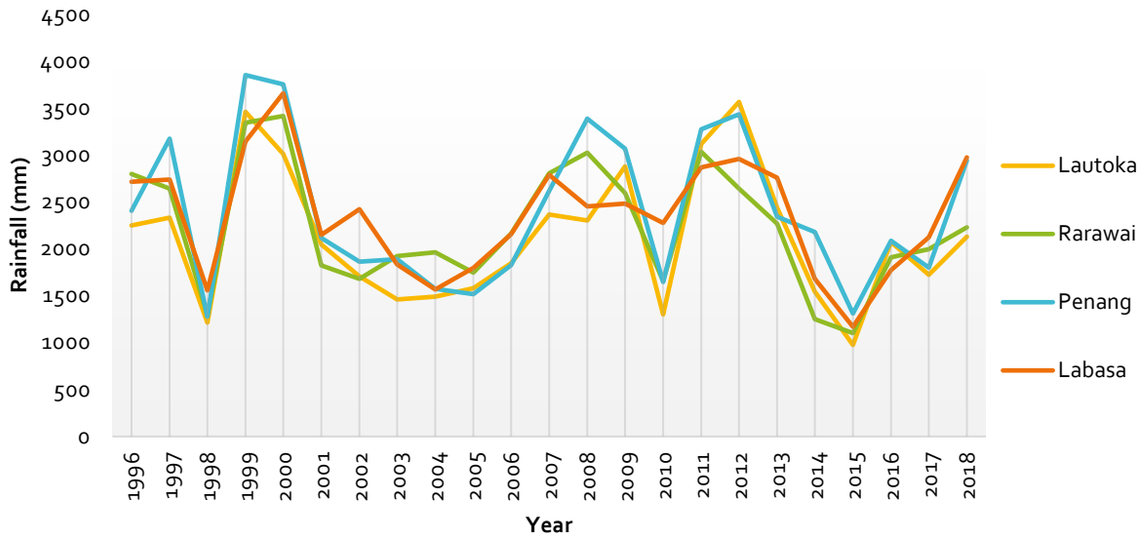


Table 1.1.14: Meteorological data for Sugar Research Institute of Fiji, Lautoka 2018													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avg**
Relative Humidity (%)	71	78	76	75	81	77	74	79	61	72	66	69	73
49 yrs. avg	75	77	75	74	74	72	69	68	69	66	69	72	72
Air Temperature													
Mean Maximum	32	31	31	31	30	30	30	31	32	31	32	33	31
49 yrs. avg	32	31	31	31	30	28	28	28	29	31	31	31	30
Mean minimum	23	24	23	22	21	21	19	19	21	23	22	23	22
49 yrs. avg	24	24	24	24	22	20	20	20	21	26	23	23	23
Mean	28	27	27	27	26	26	24	25	27	27	27	28	27
Highest maximum	35	32	34	33	33	33	33	34	34	35	35	36	34
Lowest minimum	23	19	22	18	17	17	14	15	17	18	16	20	18
Evaporation													
Raised pan	1590	980	2850	1620	1230	NR	610	1147	1456	1650	2016	2307	1587
Earth thermometers													
5cm	29	28	28	29	27	26	25	25	28	31	29	29	28
49 yrs. avg	28	29	29	27	26	24	24	24	26	27	29	29	27
10cm	28	27	28	28	26	25	25	25	28	29	28	28	27
49 yrs. avg	29	28	27	27	24	24	23	24	28	27	28	28	26
30cm	29	28	29	29	28	27	27	27	29	30	29	29	28
3 yrs. avg	30	29	29	20	19	18	27	18	28	29	29	19	25

Note: NR – not recorded

Earth Thermometers

The earth thermometers at SRIF are at depths of 5cm, 10cm and 30cm. The 49 years average of thermometers at depths 5cm and 10cm were calculated to be 26.8°C and 26.4°C respectively. The 30cm thermometer was newly installed in 2016, thus, the 3 years average calculated was 21cm.

FIGURE 1.1.20: 49 YEARS AVERAGE EARTH TEMP AT 5CM DEPTH FOR EACH MONTH

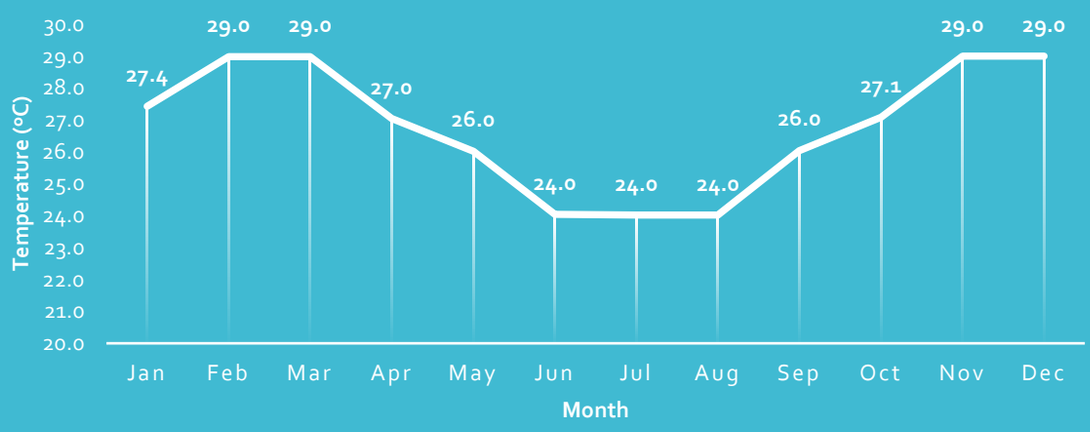
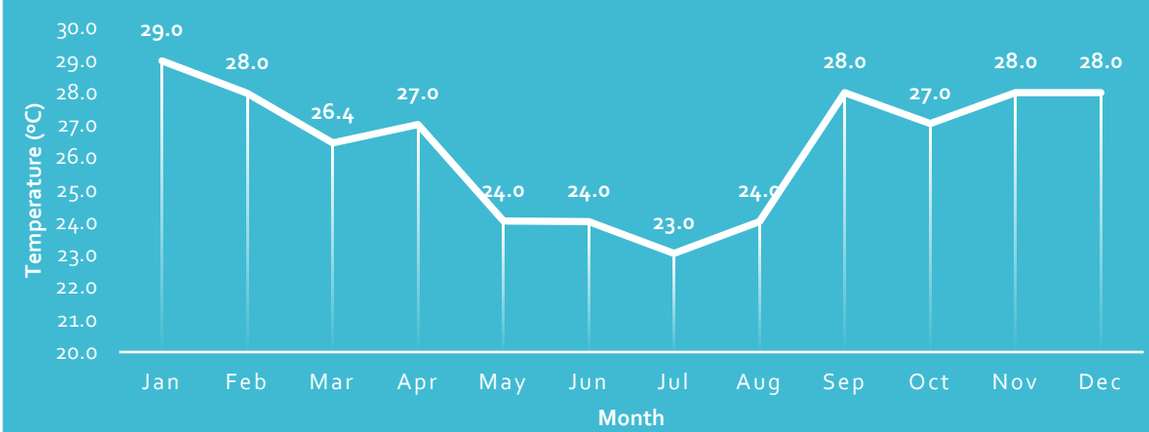


FIGURE 1.1.21: 49 YEARS AVERAGE EARTH TEMP AT 10CM DEPTH FOR EACH MONTH

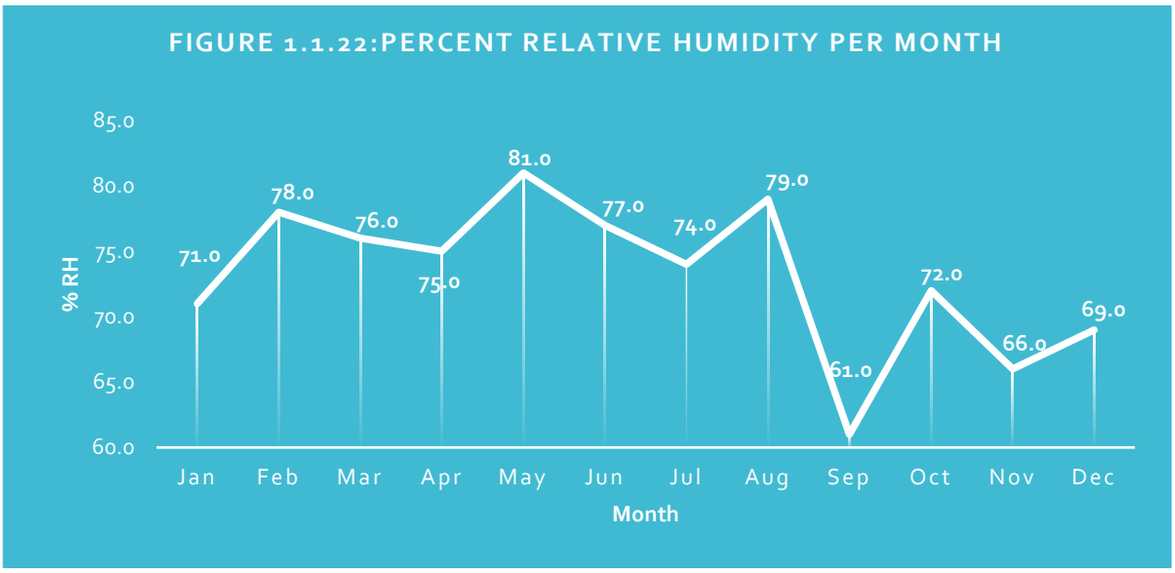


Evaporation

The 49 years average was calculated to be 1685mm.

Relative Humidity

This year's average humidity is calculated to be 73.3% but the 49 years average has been calculated to be 71.7%; thus, making this year's reading as above average.



Sunshine

There is no sunshine recorder installed at the Drasa station (V77555).

Figure 1.1.23: Climate Outlook Forum (left) & evaporation reading (right) at SRIF Lautoka

Figure 1.1.24: SRIF Lautoka meteorological station (left) & temperature reading (right)

1.2 CROP IMPROVEMENT

1.2.1 PLANT BREEDING & EARLY STAGE SELECTION

HIGHLIGHTS

1. Second year of crossing without crossing shed and all crosses set were poly crosses.
2. Evaluation of new germplasm have begun.

SUMMARY

- Two new arrowing bed was established during the year to provide a broader base for crossing in the next few years. Four old beds were maintained and one abandoned.
- 135 crosses were set (all poly crosses).
- 2750 seedlings of LF2017 series were transplanted as single stool stage 1 at Rarawai estate field 6.
- 292 cultivars of LF2016 series were advanced to stage 2 but it was ploughed out due poor germination.
- 408 varieties of LF2014 series selected from stage 2 and advanced to stage 3.
- 15 varieties of LF2015 series selected from stage 3 trial and advanced to stage 4 seedbed.
- The table below presents the number of clones of the different series and respective stages.

Table 1.2.1: Summary of series by stages

Stage	Series			
	LF2014	LF2015	LF2016	LF2017
I	11500	10000	4800	2750
II	408	599	292	-
III	65	92	-	-
IV	-	15	-	-

Germplasm Collection

The number of varieties in our new germplasm collection is approximately 640. These were the results of replanting of clones from the old germplasm that was located in Drasa estate. Total of 320 varieties planted in Drasa estate and 320 varieties in Rarawai estate which were planted in replicate in 2017. Verification is a major exercise that was initiated three years ago however it has been found out that multiples of volunteer canes are within the plots which mainly due to the harvesting techniques. Therefore, a new project is in progress which is to characterize every clone in the germplasm to have individual data which can be used for breeding purposes. Samples from the plant crop have been send to small mill for biochemical analysis and the plots are harvested and weighed for yield assessment. The first ratoon crop will be evaluated again in 2019 and data will be used for comparison with plant crop data before selection will be made for varieties to be introduced to the flowering bed.

Table 1.2.2: Summary of Germplasm samples sent for evaluation

Number of cultivars	Number of samples send	Discrepancy	Number of plots without cane	Number of samples data received
1280	1264	60	16	1204

Total of 1280 cultivars from the two stations were expected to be harvested and sent to the small mill for analysis. A total of 1204 samples were sent for biochemical analysis at small mill that included 640 varieties present in germplasm. The data were analysed based on factors such as brix %, POCS %, pol %, purity % and fibre %.

Exchange of Germplasm

Correspondence was made with CIRAD Agriculture Research for Development in France to ascertain the possibility of acquiring some parent materials for crossing. Total of 21 varieties were received. The cultivars were treated with fungicides then planted into three buckets per variety and laced in the quarantine facilities in Rarawai. This was done in the presence of bio-security officers from Biosecurity Authority of Fiji (BAF).

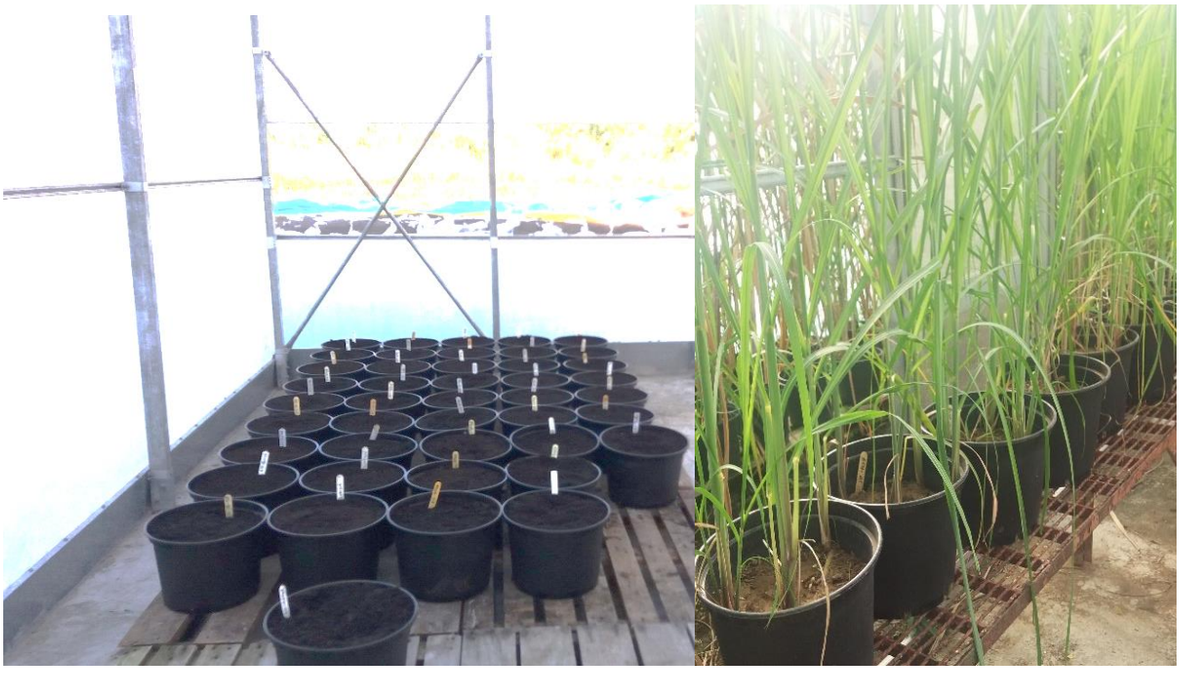


Figure 1.2.1: Twenty varieties germinate out of 21

Flowering Beds

Flowers from 10 flowering beds in Dobuilevu with 577 clones were well maintained and used in crossing. The flowering beds were severely lodged after torrential rainfall that caused massive flooding in the month of April. Due to lodging a lot of the flowered stalks were crooked, in spite of this set back, the flowers were still used in crossing. A total of six flowering beds with 577 varieties were used for crossing.

The varieties planted were from stage 4 (LF00series), stage 3 (LF01 series) and stage 2 (LF02series). Poor germination was observed in stage 3 & 4 due to seed quality. Single eye bud potted in plastic bags were used for gap-filling in this trial.

Crossing

The 2018-crossing season commenced on 22nd May and ended on 11 July. 135 crosses were set-up (All 135 were poly crosses) using 50 female and 55 male parents. The varieties at

Dobuilevu were lodged and there were difficulties in cutting the varieties and setting the crosses.

Figure 1.2.2: LEFT: Female flower (under the makeshift crossing tent) were identified and marked in their respective fields and beds for pollination. RIGHT: Pollen collected & strained.

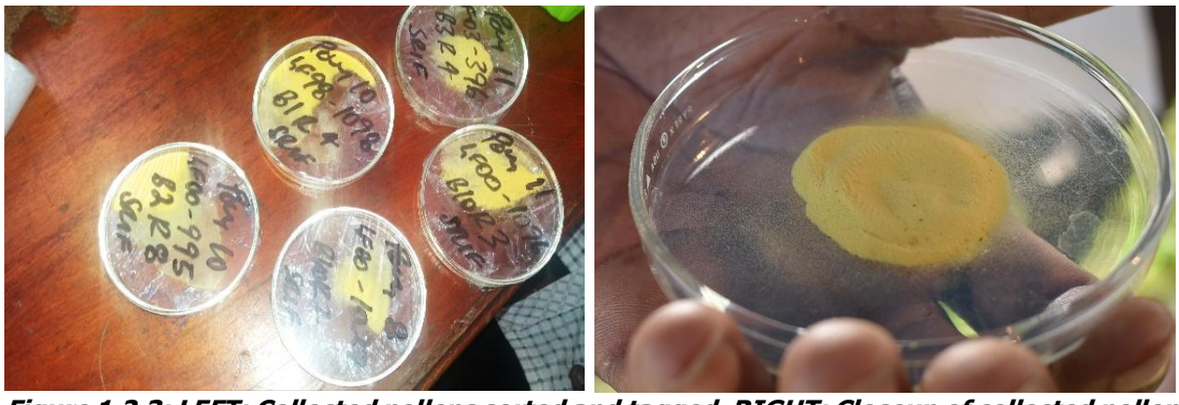


Figure 1.2.3: LEFT: Collected pollens sorted and tagged. RIGHT: Closeup of collected pollen

Figure 1.2.4: Pollinating female flowers directly in the field using collected pollens

Fuzz Sowing and Raising Seedlings

Fuzz sowing was scheduled to start in mid-June but was delayed due to lack of fuzz in stock. The soil used for fuzz sowing is sterilized using soil sterilizer. Fuzz sowing commenced on 19th July and ended on 15th August 2018.

A total of 135 packets of fuzz was sown from 2018 crossing. The germination of fuzz was good 127 packets germinated (94 %) and produced 5300 seedlings. Fuzz germination has tremendous improvement compared to previous years. Fuzz used this year was from poly crosses which has an impact in obtaining such a high germination percentage.

Figure 1.2.5: LEFT: Fuzz sowing for 2018 crosses at Rarawai. RIGHT: Germinating fuzz

Stage 1 Trial Planting

Plant breeding program consist of four different stages from fuzz sowing to varietal release. In the stage one trials, 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 based on the brix which is a measure of total soluble solids in cane juice.

Physical appeal is also taken into consideration during selection. The LF2017 series was planted in May, 2018. 2,750 varieties that are 95% of the total potted (2,800) were transplanted in an area of 0.68 acres as single stools. Due to the dry weather conditions this field was irrigated before and after planting. Evaluation will be carried out in February 2019.

Stage 1 trial selection - LF2016 single stools to stage 2 single lines

A total of 292 cultivars of LF 2016 series were advanced and planted as stage 2 single lines. This was 16.4% of the total planted (4800). The selection was done 18 months after planting and was based on brix, vigour and disease incidence. The selection was carried out in July 2018.

Table 1.2.4: Brix range for selected varieties and standards.

Standard Varieties	Standards Average Brix	Selection Range (Brix)	No of varieties Selected
Kaba	24.0	≥ 24.0	10
Naidiri	23.0	23.0 – 23.9	32
Qamea	22.0	22.0 – 22.9	47
Viwa	20.5	20.5 – 21.9	192
		18.0 - 20.5	11
Total			**292**

Note: standard brix range 17.1 – 25.0 and selected varieties' brix range 18.0 – 24.8

The cane was in the poor status during selection and the brix values of most of the clones was comparatively lower as compared to past years. There was heavy lodging in the trial and this could have also affected and contributed to the low brix. The quality of the seed cane was very poor.

Stage 2 trial selection - LF2014 and LF2015 single lines to stage 3 observation plot trial

Stage 2 is the second stage of the 4 stages of evaluation of promising varieties that may have the potential to become commercial varieties for the Fiji Sugar Industry. The plant-breeding program has undergone changes in the past decade and improvements have been made to strengthen the selection criterion that is significant to the success of the program. In the past four years, selection of clones for advancement to stage 3 was based mainly on the biochemical data but this year an **integrated approach** focusing on recurrent selection has been applied. In the integrated approach, data (preliminary brix and bio-chemical) and field visit observations are used in making the final selection.

Field visit observations – recording of information about each clone that would help in deciding to advance or reject clones.

Small Mill Evaluation – total of 408 varieties were evaluated by sending samples to small mill for biochemical analysis.
Final selection – this is the most important phase of selection and it incorporates the small mill biochemical analysis data and field observations. Selection is based mainly on sucrose content. In the final selection clones are marked out under three categories advance, consider and consider for crossing. There are very few clones under the consider category and generally have some good agronomic characteristic and high %fibre but low sucrose content. The clones marked for crossing are those with high sucrose content that have not been advanced because of the stunted growth but should only be considered after assessment.

LF2014 Stage 2

Trial details - There were 408 clones planted in six metre plots and in two blocks. This trial was irrigated soon after planting and established well, free of weeds 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 - Based on the selection criteria described above 57 varieties has been selected and advanced to stage 3 observation plot trial. The list of varieties selected is presented in Appendix 3. The sucrose content of the selected varieties ranged between 15.30 – 18.30 % and the standards from 15.27 - 17.46%. The sucrose content of 7 varieties (clone number: 52, 79, A16, A102, B86, B100 and B105) in descending order was better than the best standard variety Naidiri (17.46%). The fibre content of the selected varieties ranged between 6.66 – 14.65% and the standards from 9.27 – 13.67%. There are 7 varieties that have high fibre content.

Major drawback - The trial was accidentally burnt due to fire spread from the neighbouring farm prior to the harvesting of the selected clones. However, LF2014 Stage 3 will be planted in 2019 from first ratoon crop using the same set of data and another round of field observation.

LF2015 Stage 2

Trial details - There were 599 clones planted in six metre plots in one block. This trial was well managed after planting in terms of irrigation and husbandry practices. The cane was 10 months old at the time of selection and was not lodged. The varieties were easily accessed.

Discuss - Total of 95 varieties were selected from the 599 varieties after evaluation and planted as stage three. The sucrose content of the selected varieties ranged between 13.20 – 18.63 % and the standards from 13.15 - 17.60%. The fibre content of the selected varieties ranged between 6.23 – 17.06% and the standards from 9.27 – 13.67%.

LF2016 Stage 2

Planting - Total of 292 clones were selected from LF2016 Stage 1 after brixing and advanced to stage 2. The field was irrigated prior to planting.

Drawback - Poor germination of less than 5% was experienced in this trial after planting despite irrigation. The trial was ploughed out. Selection will be carried out from the first ratoon in 2019.

Stage 3 trial - LF2015 series to stage 4 seedbed

Stage 3 is the third stage of the 4 stages of evaluation of promising varieties that may have the potential to become commercial varieties for the Fiji Sugar Industry. Improvements have been made to the selection criterion applied to stage 3. Previously selection was based mainly on the biochemical data but this year additional information such as growth of cane was also considered during selection.

LF2015 Stage 3

Trial Details - There were 95 clones planted as LF2015 Stage 3 observational plot in four rows by four-meter plots and two standard varieties replicated two times each. This trial was irrigated soon after planting and established well. Evaluation and selection will be carried out in 2019.

1.2.2 VARIETY ADAPTATION TRIALS

SUMMARY

In 2018, following series were in Stage 4:

LF2011 series (2nd Ratoon):

- 10 test clones and 2 standards in 4 replicates
- Was planted at all mill locations however Penang trial was abandoned after damages caused by cyclone Winston.
- The trials were analysed between July-October

LF2012 series (Plant):

- 17 test clones and 3 standards in 4 replicates
- Was planted at all mill locations
- The trials were analysed between July-October

LF2013 series:

- 13 test clones with 3 standards has been planted in 4 replicates at all mills
- Will be analysed in 2019

Five varieties from LF2009 series was planted in 2 farmers field in Ba district for farmer feel effect whereas 1 variety from LF2011 series was identified and seedcane propagated in the view that this variety is further envisioned for large mill trials.

ADVANCED STAGE TRIALS

LF2011 Series

In 2018, the 2nd ratoon crop was evaluated at Drasa, Rarawai and Labasa. The trial in Penang was abandoned in 2016 after extensive damage sustained from TC Winston. The following table summarizes the data for all crop cycles being the consolidated average of data from all mills.

Table 1.2.2: Consolidated biochemical data for LF2011 series

Varieties	%POCS			%Fiber			Tch			Tsh		
	P	1R	2R	P	1R	2R	P	1R	2R	P	1R	2R
LF11 - 118	12.9	13.3	14.5	7.1	11.1	10.6	146	112	68	19.0	15.0	10.0
LF11 - 129	13.7	12.6	15.0	7.0	11.1	10.8	118	105	56	16.0	13.0	8.0
LF11 - 200	13.1	13.7	14.0	7.8	11.4	11.0	106	91	83	14.0	13.0	12.0
LF11 - 21	13.8	12.9	15.5	6.6	10.2	10.2	161	121	68	22.0	16.0	11.0
LF11 - 229	12.9	13.9	15.5	6.8	10.4	9.7	99	118	65	13.0	17.0	10.0
LF11 - 233	13.0	12.5	14.7	8.1	10.1	10.6	106	91	77	14.0	13.0	11.0
LF11 - 266	12.7	12.9	13.3	8.1	10.8	11.0	106	102	83	14.0	13.0	11.0
LF11 - 268	13.2	13.0	14.4	7.3	12.5	10.1	126	101	81	17.0	13.0	12.0
LF11 - 293	13.4	13.4	12.2	7.1	10.6	11.0	89	102	65	12.0	14.0	8.0
LF11 - 96	12.3	14.1	15.3	9.1	10.1	10.3	94	87	41	12.0	13.0	6.0
Mana	13.4	12.2	15.0	6.9	9.0	9.6	116	125	62	16.0	15.0	10.0
Naidiri	11.8	13.5	16.0	9.4	10.4	10.1	114	135	70	14.0	18.0	11.0

Note: P – plant, 1R – first ratoon, 2R – second ratoon

From the data above, 2 varieties namely LF11-200 and LF11-268 were found to have better sugar yield than standards however LF11-233 was found to be physically more appealing.

After further assessments, LF11-233 was also found to be non-flowering, tall medium to thick stalk cane as well as self-trashing hence has been considered to further propagation and for farmer feel effect program.

LF2012 Series

In 2018, 4 trials were evaluated in Rarawai, Drasa, Penang and Labasa. Following table is the consolidated average for all mills.

Table 1.2.3: Consolidated biochemical data for LF2012 series

Varieties	%POCS	%Fiber	Tch	Tsh
	P	P	P	P
LF12 - 112	13.3	9.6	46	6.0
LF12 - 114	14.0	11.9	59	9.0
LF12 - 153	13.6	10.2	65	9.0
LF12 - 154	11.7	11.2	42	6.0
LF12 - 2	14.4	10.1	60	9.0
LF12 - 22	13.2	13.7	72	9.0
LF12 - 233	12.6	11.1	59	7.0
LF12 - 253	12.5	12.5	52	7.0
LF12 - 255	12.6	12.0	60	8.0
LF12 - 276	14.4	9.5	61	9.0
LF12 - 282	13.2	11.8	65	9.0
LF12 - 31	11.4	10.5	70	8.0
LF12 - 34	13.3	10.4	38	5.0

Table 1.2.3: Cont'd				
Varieties	%POCS	%Fiber	Tch	Tsh
	P	P	P	P
LF12 - 40	13.3	12.1	47	6.0
LF12 - 63	12.3	11.9	56	7.0
LF12 - 74	12.1	13.8	51	6.0
LF12 - 76	13.6	10.2	55	8.0
MAN	13.3	9.0	57	8.0
NAD	14.2	10.6	63	9.0
RAG	14.9	11.2	62	9.0

Note: P – plant

With reference to above data table, none of the varieties could be identified that out-performed the commercial varieties (planted as standards) in terms of bio-chemical data. The data will be re-looked in the 1st ratoon to identify any varieties with commercial attributes.

Farmer Feel Effect

This program was established before release of Viwa and Qamea to assess farmer views as well as adaptability under routine farm management. In 2019, following varieties from LF2009 series Stage 4 was planted in 2 farms in Naloto and Moto sector in Ba:

Variety	%Fiber			%POCS			Tch			Tsh		
	P	1R	2R	P	1R	2R	P	1R	2R	P	1R	2R
LF09-1536	10.9	12.9	8.4	14.9	7.2	13.1	122	105	44	18	5	6
LF09-1558	12.3	13.5	8.4	13.0	13.8	12.8	111	122	52	14	13	7
LF09-1632	10.1	12.7	8.0	15.3	14.5	13.8	104	114	62	16	12	9
LF09-1707	11.2	12.7	8.5	15.6	10.5	13.2	144	125	57	22	10	7
LF09-635	9.5	15.5	8.2	15.6	5.9	13.8	106	104	59	17	7	8
MANA	9.3	13.3	7.2	15.5	9.7	14.3	125	128	49	19	9	7
KABA	9.6	12.0	9.0	13.8	7.9	13.5	133	118	46	18	6	6
NAIDIRI	11.0	13.1	9.4	15.7	7.7	13.3	92	102	35	14	6	5

Note: P – plant, 1R – first ratoon, 2R – second ratoon

These varieties will be continuously monitored in 2019 and possible promising varieties identified for further propagation and Large Mill Trial.

Conclusion

Advance Stage trials as well as pre-release program involving Farmer Feel Effect and Large Mill trials forms a crucial part of Plant Breeding by providing data from adaptation trials as well as farmer observations during routine farm management.

One variety has been identified from LF2011 series and will be propagated for further farmer feel effect and large mill by 2021 whereas 7 varieties have been marked in LF2012 series Stage 4 to be reassessed in the 1st ratoon. The 5 varieties for LF2009 series are in the farmer feel effect program and will be reassessed in 2019 to select varieties for large mill based on farmer feedback.

1.3 CROP MANAGEMENT

1.3.1 BIOCHEMICAL LAB

The small mill crushed 1464 samples in the year 2018 which was about 50% more than 2017. All the samples were analysed using the FT-NIR through the Spectracane 400. The Sugar laboratory successfully carried out all the validation analysing of the Spectracane saved samples. Along with the routine activity of analyzing sugarcane samples for research and breeding program a pre-crush validation analysis was carried out to verify the instruments performance. Emphasis on sample validation and adopting new instruments and procedures to increase efficiency and throughput had been encouraged during the season. The FT-NIR via Spectracane 400 analyses sugarcane samples for %POCS, %pol, %fibre, %purity and %brix

In the case of sucrose deterioration, the biochemical result is obtained from the Spectracane but the main indicator for sucrose deterioration which are Dextran, Reducing Sugar (RS), Gums, and starch that are analysed using Lambda 365, UV Spectrophotometer. One of the major indicators for sucrose deterioration is Dextran that is caused by *Leuconostoc sp*. bacteria causing juice viscosity that affects mill efficiency and eventually reduces income for millers and growers. The sugarcane samples that are analysed is from the respective areas of research including breeding program. In 2018, the Lautoka sugar laboratory analysed 1464 samples from breeding trials and research projects including sucrose deterioration.

The Impact of the sucrose post-harvest deterioration by Leuconostoc sp. bacteria on the Fijian sugar industry and profitability project was carried out on four varieties, Mana, LF91-1925, Naidiri & Qamea. There were 504 samples crushed and biochemically analysed but for the impact of sucrose post-harvest deterioration only 168 samples were analysed. The 168 samples were from one replication only. The 168 samples were analysed for dextran, reducing sugars, gums and starch deterioration within 7 days' period, dextran being the main indicator of sucrose deterioration either burnt or green (billet or whole stalk cane). The data obtained from this post-harvest deterioration trial could not be interpreted to get any trends.

The small mill biochemical analysis data is used for selecting varieties through breeding stages.

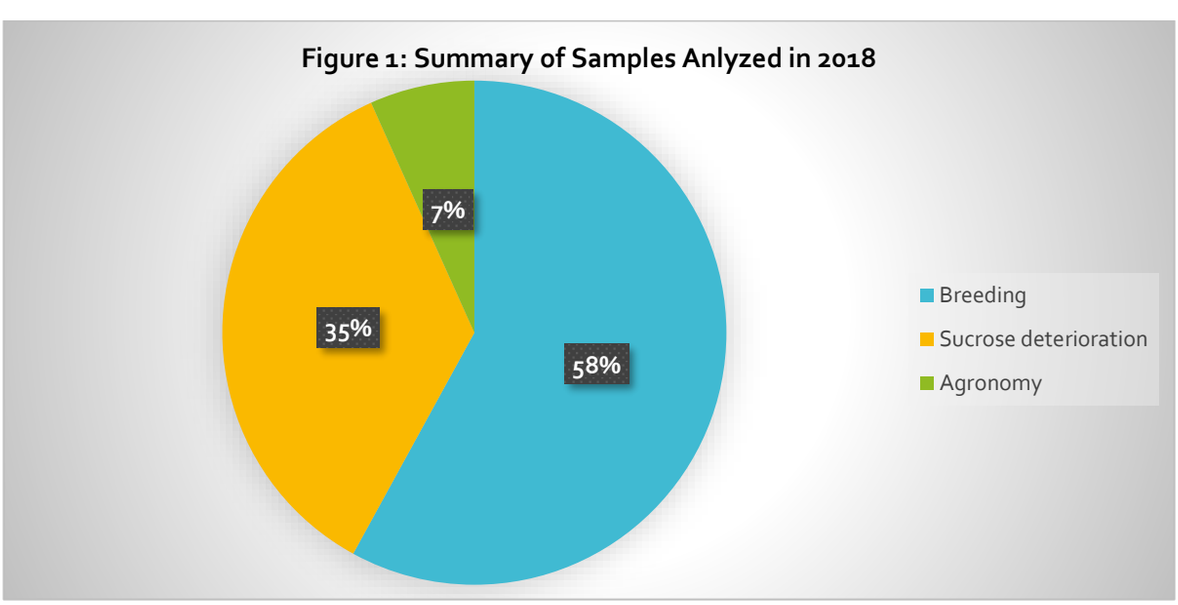


Table 1: Details of the analysed samples		
Trial Name	**No. of samples**	**Total**
Germplasm	640	640
LF2012 - stage 4	80	
LF2011 - stage 4	48	188
LF2013 - stage 3	60	
Sucrose deterioration	540	540
Agronomy	96	96
Grand Total		**1464**

1.3.2 FERTILIZER ADVISORY SERVICE

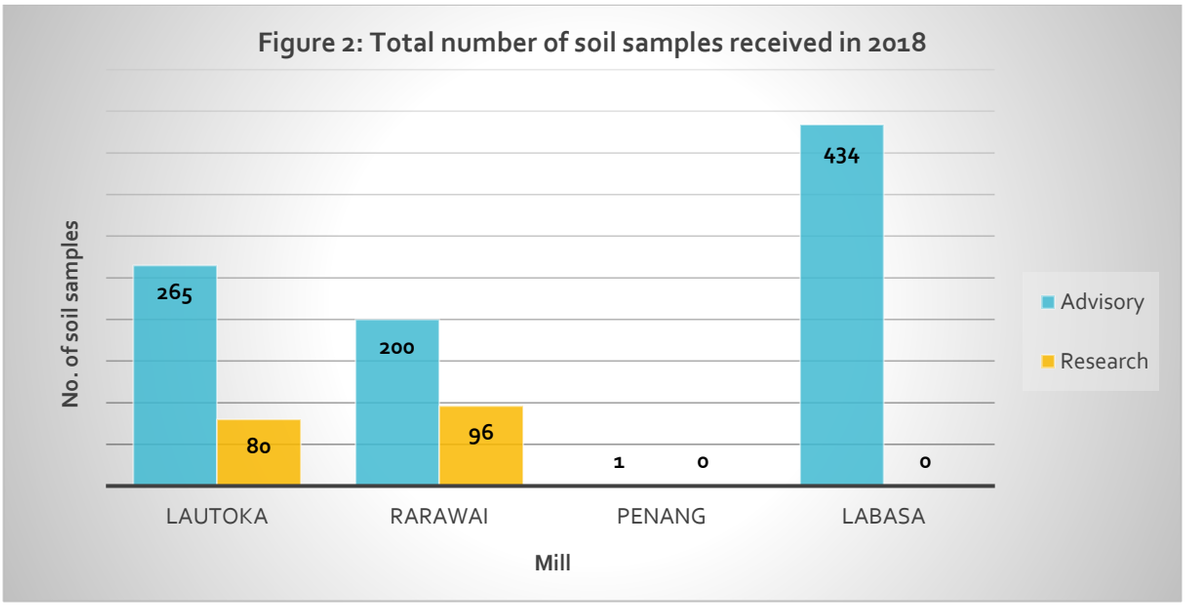
Fertilizer advisory service for the institute is based on soil samples and foliar (leaf) samples. Analysis of these samples produces fertilizer recommendation reports. The details of both soil and foliar samples is explained in greater details in section 1.3.3 below.

1.3.3 ANALYTICAL LABORATORY

SRIF provides essential analytical services to the sugar industry. Growers benefit from the services by following farm-based fertilizer recommendations by the institute. Apart from bio-chemical analysis of cane, the institute carries out soil and foliar analyses for the growers and the researchers. Samples are received from all sectors and from SRIF research trials. It is ensured that the documented procedures are followed. Paramount importance is given to the quality assurance of the instruments, providing consistent and reliable information of the samples.

SOIL ANALYSIS

Soil samples totalling one thousand and seventy-six were received for analysis comprising of nine hundred advisory soil samples and one hundred and seventy-six research soil samples. Fertilizer recommendations are made available within two - six weeks after receiving the samples. The FSC's extension staffs are responsible for delivering the fertilizer recommendation to the growers.



Sugar Industry Tribunal Request

The Sugar Industry Tribunal (SIT) is responsible for issuing new cane contracts and occasionally seeks the Institute's opinion on suitability of certain areas for planting cane. In 2018, two requests were made by SIT, of which one was preliminarily analysed and a second opinion was sought for on this land. Unfortunately, the applicant for this land could not be located thus no analysis was carried out. The second site was located on reclaimed land in Labasa. Fifty-one soil samples were taken from this site that has an area of 6.8ha by the Institute. Recommendations on the suitability of this land for growing cane is summarised below.

pH

The pH is a measure of acidity or alkalinity of soils. It is an important property of a soil in that it has a significant effect on the availability of many nutrients, with high or low pH causing reduced availability. The pH of all the composite samples indicates that the field is acidic in nature.

Table 2: pH range of composite soil samples

pH range	No.
Less than 4.5	51
4.5 – 5.5	0
More than 5.5	0
Total	**51**

At pH levels below 5.6, increasing levels of exchangeable aluminium can occur, which is toxic to most plants and can severely restrict root development. Since, the pH of the sample was less than 4.5, the Institute recommended that lime be applied at a rate of 2.7 tons/hectare. This needs to be broadcasted and incorporated into the soil to increase the pH by 1 (one) unit.

The land must be left idle after the application of lime for at least 6 months. This will allow for the lime to dissolve and react with the soil, given enough rainfall is received. Samples must be taken at regular intervals (2 monthly) and the pH measured. The moisture levels in the soil will influence the solubility of the lime.

Phosphorus

Phosphorus is generally present in medium levels.

Table 3: Typical phosphorus rating

Rating	Mod. Truog-P (mg/kg)
High	>60
Medium	20-60
Low	10-20
Very low	<10

Table 4: Phosphorus range of composite soil samples (Lease No. 21498)

Phosphorus range	No.
Less than 40 mg/kg	51
40 - 50 mg/kg	0
More than 50 mg/kg	0
Total	**51**

Extra phosphate additions and differing ways of applying the fertilizer (side-banding and split dressings) is to be followed if cane is planted.

Exchangeable Bases - Cations

Based on ammonium acetate method, Calcium (Ca), Magnesium (Mg), Potassium (K) and Sodium (Na) levels are as follows;

- Calcium – high
- Magnesium – very high
- Potassium – high
- Sodium – low

Electrical Conductivity

The electrical conductivity (EC) rating (average of 165 mS/m) indicates that the top soil (0-20cm) is generally non-saline and may not have serious effect on growth of sugarcane.

Table 5: Typical electrical conductivity rating & effect on cane

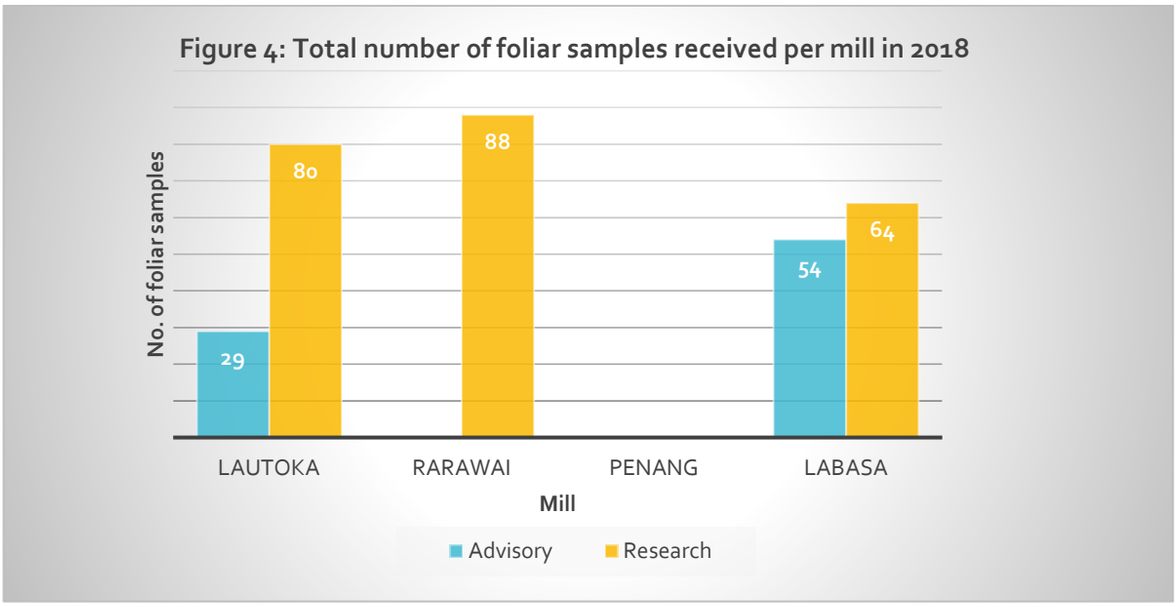
EC (mS/m)	Rating	Effect on cane
0 - 200	Non-saline	None
200 – 400	Slightly saline	Slight
400 - 800	Moderately saline	Moderately serious
> 800	Highly saline	Very serious

Figure 3: Type of soil for reclaimed land in Labasa

The site was visited by the Institute's technical staff and the applicant was advised that major drainage work needs to be carried out on this land before cane can be planted. A cover crop should be planted after incorporating lime and the cover crop should be ploughed into the soil to improve the organic matter content.

LEAF ANALYSIS

The analytical laboratory had received 315 plant samples for analysis. The samples have been analysed and fertilizer recommendations sent for the next year's ratoon crop.



Quality Assurance
The laboratory continues to adhere to quality control (QC) checks in every analysis. The laboratory conducts the QC checks by having standards as well as random control samples and referring to the accepted range of values for QC samples.

Any value out of the range is investigated and corrective measures are taken to ensure the criteria set for quality assurance is followed. As a full-service laboratory, the institute is committed to meeting quality requirements with accuracy and efficient turnaround times.

1.3.2 NUTRIENT BUDGET FOR THE FIJIAN SUGARCANE CROP

Introduction
Sugar has been the major agricultural export from Fiji for over 125 years, as well as a source of employment and foreign exchange. Sugarcane production peaked at about 4 million tons in the mid-1990 and has been about 2million tons in the recent years.

A number of reasons have been proposed for the decline in production, one of which is the fertiliser regime in use - the advice given to farmers and the practices of the farmers themselves. There is comparative lack of data about fertiliser use and behaviour in Fiji. In the event of determining the optimal fertiliser requirements for cane production under Fiji conditions there is much less focus paid to the issue of nutrient budgeting and the behaviour of nutrient elements within the various sectors of the industry as a whole.

Once the fertiliser leaves the factory, the situation becomes less clear, there is no certainty about how much fertiliser is added to a particular field and very limited information in how much nutrient is removed along with cane, enters and exits the mill either to local users or foreign markets. This study will provide insight to the sugar industry as a whole on the cost

benefit of the practiced agronomic practices in response to crop yield and finally carryover to sugar and molasses yields. Growers will be able to better understand the importance of nutrient management, while a quantification of carryover of nutrients into the final milling products is determined.

Objective

The project is conducted to develop a nutrient budget which captures how much nutrients is received in the country through the sugar industry, and relate to how much is recycled within the industry and how much is lost that could not be recovered. The effects of varying rates of nutrients applied on the cane yield will be determined, through trials established at the three mill districts (Labasa, Lautoka, and Rarawai).

Thus, through the trials established at each mill district a nutrient budget will be developed to verify the amount of fertiliser (nutrients) needed for optimum production, and indicating potential problems due to surplus accumulation or depletion risk of nutrients which may lead to reduce crop yield.

Methodology

The project was carried out in all mill (Rarawai, Lautoka, Labasa) areas at nine locations. Composite soil samples were taken out for analysis to determine the nutrient status of the soil. In addition, a detailed study of the soil profile was carried out. Soil samples were taken from different horizons up to 2 meters for analysis.

Soil horizons were identified based on physical and chemical characteristic of soil. The trials were planted using RCB design comprising of four treatments and four replications. The treatments were selected according to the current scenario to differentiate the nutrient deficit and surplus added by the farmers during the crop cultivation. Treatments consisted of different fertilizer rates as per table below

Table 1: Treatment allocation

Treatment No.	Treatments – Fertilizer
T1	Nil
T2	Farmer practice (actual usage)
T3	75% recommended rate
T4	Recommended rate

Naidiri variety was used for planting. The trials were planted in the replanting season of 2017. Cultivation of plant cane was carried out using best agronomic practices. Agronomic measurements were taken at 90, 150 and 210 days after planting (DAP). Leaf samples were taken during grand growth phase from each treatment to determine phosphorous, nitrogen and potassium levels.

Cane samples were analysed prior harvesting for biochemical analysis. Each plot was harvested and weighed separately. Sugar and cane yield were determined and statistically analysed. In addition to soil, rainwater samples were collected and analysed for pH, EC, phosphorus, calcium, magnesium, potassium, sodium, nitrogen and Sulphur as per rain days. Mill products including mill mud, mill ash, sugar, molasses and wastewater were collected and sent overseas for analyses.

Results and Discussions

a) Soil profile study

Details of the farm used in the study are tabulated below.

Table 2: Location of trial sites

Site	Mill Area	Farmer's name	Farm No	Area	Sector	Location	Coordinates
1	Rarawai	Gyan Singh	6303	0.2 ha	Koronubu	Koronubu flat near Ba river	-17.589248, 177.730604
2	Rarawai	FSC Rarawai estate	1696	0.2 ha	Rarawai estate	Field 18, plot 2	-17.544892, 177.685602
3	Rarawai	Subar Mani		0.2 ha	Rarawai	Etatoko	17°31'13.3"S 177°41'26.5"E
4	Lautoka	Rajendra Prasad	35	0.3 ha	Drasa	No. 18 road	17°34'31.5"S 177°31'15.4"E
5	Lautoka	Waqadra estate		0.2 ha	Waqadra estate	Waqadra estate	17°46'32.5"S 177°26'38.4"E
6	Lautoka	Rajnesh Naicker		0.3 ha	Lovu	Buabua	17.36599, 177.29321
7	Labasa	Vinod Chand	9126	0.2 ha	Solove	Seaqaqa	
8	Labasa	Sushil Chand	3104	0.3 ha	Waiqele	Waiqele	16.28'48.779" S 179.20'34.920" E
9	Labasa	Narayan Murthi	158	0.2 ha	Wailevu	Wailevu, Tiri	

Detailed soil profile studies were carried out at each site. Pits of dimension 2m x 2m x 2m were dug to study each soil profile. Soil samples from each profile were collected for analysis of nutrients. The profiles were described both physically and chemically. Physical description of each trial site is tabulated below;

Table 3a: Soil profile description at Nadi, Ba and Lautoka districts

Profile No.	SRIF- 1 Waqadra	SRIF- 2 Buabua	SRIF-3 Koronubu
Described by	Seru, Nazeea, Mere, Doreen	Seru, Nazeea, Mere, Doreen	Nazeea, Doreen, Mere, Seru
Date	09.08.17	09.08.17	17.08.17
Location	Waqadra alluvial basin along Nadi river west bank. Approximately 200m west of Nadi backroad bridge and cement works.	Base of Buabua foothills near Lautoka 2km inland from the highway. Rajnesh Naicker's farm	Gyan Singh cane farm, Koronubu about 4.7 km southeast of Rarawai sugar mill where the Ba river meets the Nadrou drainage system
Landscape	Level floodplain surface	Broad low angle outwash fan with pit along toe slope.	
Topography	Smooth, flat, ploughed, harrowed	Very smooth gentle slope of 0.5 degrees sloping south towards north	Very flat
Land use/ Vegetation	Sugarcane harvested and standing	Mission grass and sugarcane with Sporadic pine trees on adjoining slopes of 10 -20 degrees	Sugarcane just harvested
Parent Material	Alluvial deposit from Nadi River with some colluvia from nearby hills	Colluvia from 10 to 20 degrees slopes	Alluvia from the Ba and Nadrou rivers
Drainage	Very good on surface	Good on surface but imperfect deep down	Very good on surface, imperfect deep down
Rockiness/ Stones	None	A few large black basalt conglomerates on the foothills but none on the pit site 100m away	None but low ridges of soap stone just 100m to the South with steep basalt cliffs further south

Table 3a: Cont'd

Soil colour	Brown to reddish brown	Mealy coloured dusky red clay with fine white specks	Brown top soil on reddish brown subsoil
Cultivability	Very good but top soil is quite compact	No impediments except wet weather	Ideal in dry season
Mechanical cane harvester	Very suitable if dry	Very suitable only when dry	Suitable only when dry
Trafficability	Suitable for cane trucks if dry	For lorries only in dry weather	Lorries ideal in dry weather
Suggested improvements to the land	a) Subsoiling along north-south lines b) Cane trash to be ploughed in plus green manuring c) Liming up to 1 tonne/ha plus NPK	d) Vetiver grass hedges 50m apart across slope e) Liming at 1 tonnes/ha f) Ploughing into soil of cane trash	g) Sub soiling to make soil lighter h) Green manuring i) Ploughing in of cane trash and liming with 0.5 tonne/ha
Topsoil/ Subsoil texture	Clay loam on silty clay	Clay loam on clay	Clay loam over clay
Other observations			Very versatile land for horticulture using irrigation
Soil series Name	Nadi	Drasa	Vatuma
FAO Soil Legend	Orthic Ferralsols	Eutric Nitosols	Hasplic Kastanozem
Soil Taxonomy (USDA, 2003)	Tropeptic Eutrustox clayey, mixed, isohyperthermic	Ultic Haplustalfs, fine ferruginous Isohyperthermic	Fluventic Haplustolls fine, mixed Isohyperthermic
Sampling for analysis	All horizons	All horizons	All horizons
Soil pit description	2m x 2m x 2m pedon excavated by digger. Profile typifies the soil of the Nadi flood plain with its mixture of alluvia and colluvia from crests, backslopes and dissected terraces of the Nadi terrace systems.		2m x 2m x 2m pedon dug by mechanical digger. Represents the mix of alluvium and colluvium in the bottom lands of the Koronubu cliffs in the upper Ba region

Table 3b: Soil profile description at Ba and Lautoka districts

Profile No.	SRIF – 4 Etatoko, Ba Town	SRIF- 5 Rarawai Sugar Mill	SRIF – 6 Drasa
Described by	Doreen, Nazeea, Mere, Seru	Mere, Doreen, Nazeea, Seru	Mere, Doreen, Nazeea
Date	17.08.17	17.08.17	
Location	Etatoko locality near the Wailailai River system between Vadravadra and Ba town, 400m west of highway going to Tavua	40 chains south east of Rarawai Sugar mill- 300 yards west of Ba- Koronubu road	Rjendra's cane farm
Landscape	Alluvial flood plain	Alluvial flood plain	Alluvial flood plain
Topography	Very flat and smooth	Level	Very flat and smooth
Parent material	River alluvium	River alluvium deposited by the Ba river, also the Veisaru river	River alluvium deposited by Matawalu river

Table 3b: Cont'd

Drainage	Good but mottles are distinct showing a water table which moves up and down according to season	Imperfect water table at 200 cm	imperfect water table
Land use/ Vegetation	Sugarcane in paragrass land	Sugarcane and young karela seedlings	Sugarcane
Rockiness/ Stones	None	Only four rounded rocks about 15cm diameter	None
Soil colour	Greyish brown	Yellowish brown	Brownish to reddish brown
Trafficability	For trucks best when land is dry	Risky for trucks in wet weather	For trucks best when land is dry
Mechanical cane harvester	Best when land is dry	Very good if land is dry	Very good if land is dry
Cultivability	Good but top soil is rather large and cloddy when ploughed	Good but soil can be cloddy	Good but soil can be cloddy
Improvements suggested	Subsoiling to be taken seriously Cane trash to be ploughed in Aglime 1 tonne/ha and NPK	Subsoiling very necessary for maximum yields Liming seems needed at 800kg/ha Ploughing in of cane trash	Subsoiling very necessary Liming seems needed at 1 tonne/ha Cane trash to be ploughed in
Topsoil/ Subsoil textures	Clay throughout	Mostly silty clay	Clay throughout
Soil series name	Matavelo	Veisaru	Drasa
FAO Soil Map Legend	Dystric Gleysols	Dystric Gleysols	
Soil Taxonomy (USDA, 2003)	Aeric Epiaquept, fine, kaolinitic isohyperthermic	Aeric Epiaquept, fine, kaolinitic	
Soil pit description	2m x 2m x 2m pedon dug by a mechanical digger. The soils represent the wide flood plain north of Ba township. Deep wide drains are overdue.	2m x 2m x 2m pedon was excavated by a mechanical digger. This soil may represent the bulk of soils in the main valley south of Ba town. The drainage seems questionable and needs a more detailed assessment. Fertilizer efficiency is closely correlated with good soil drainage.	2m x 2m x 2m pedon dug by a mechanical digger.
Other observations	More drains required and deeper		
Sampling for analysis	All horizons	All horizons	All horizons

Table 3c: Soil profile description at Labasa and Seaqaqa districts

Profile No.	**SRIF 7 – Solove**	**SRIF 8 – Wailevu**	**SRIF 9 - Waiqele**
Described by	RRK, MLV	RRK, MLV	RRK, MLV
Date	25.08.17	28.08.17	08.09.17
Location	Vunimako, Solove sector, Seaqaqa	Movo, Tabia, Wailevu Sector	Kaba road, Waiqele central, Waiqele sector
Topography	Hilly flat	Very flat and smooth	Hilly flat
Land use/ Vegetation	Long fallow (7 years) – Paragrass land	Long fallow (5 years) – paragrass land	Fallow for 7 years before planning rice last year
Parent Material	River alluvium	River alluvium	River alluvium
Drainage	Good	Good	Needs more drains
Rockiness/ Stones	None	None	None
Soil colour	Reddish brown in colour	Greyish brown in colour	Greyish brown in colour
Cultivability	Good – easily cultivated and top soil is friable	Good but top soil is large and cloggy	Good – easily cultivated. Top soil is friable
Mechanical cane harvester	Best when land is dry	Best when land is dry	Best when land is dry
Trafficability	Best when land is dry	Best when land is dry	Best when land is dry
Improvements suggested	Minimum tillage Trash blanketing Aglime and NPK (Recommended rates)	Subsoiling Aglime and NPK (Recommended rates)	More drains needed Subsoiling Trash blanketing NPK (Recommended rates)
Topsoil/ Subsoil texture	Ferruginous (Sandy clay)	Loamy clay	Topsoil is moist and friable. Sandy clay soil type
Other observations	More drains needed Control the spread of paragrass from neighboring fields	More deeper drains required	More deeper drains required
Soil series	Korovuli	Tiri	Labasa
FAO Soil Legend	Dystric Nitisols	Thionic Fluvisols	Dystric Gleysols
Soil Taxonomy (USDA, 2003)	Typic Paleustults clayey, ferruginous, isohyperthermic	Typic Sulfaquept clayey over fine loamy, mixed, isohyperthermic	Humic Epiaquepts clayey over sandy, mixed, isohyperthermic
Sampling for analysis	All horizons	All horizons	All horizons

Soil profile at Solove trial site

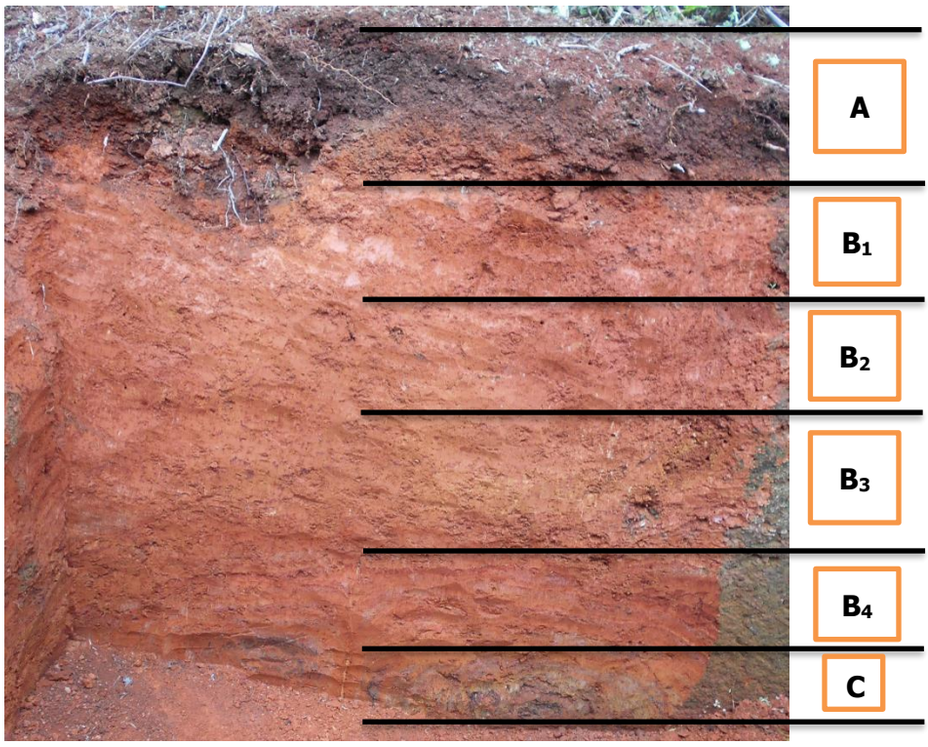


Table 4a providing description of each soil horizon at Solove trial site

Layers	Horizon	Depth	Description
Layer 1	A	0 – 11cm	Dark brown soil (7.5YR 4/2), moist sandy clay, soils are medium, granular and moderately formed, friable, clear horizontal boundary.
Layer 2	B_1	11 – 48cm	Red soil (2.5YR 5/6), moist sandy clay, medium, granular and moderately formed, friable, indistinct horizontal boundary.
Layer 3	B_2	48 – 81cm	Reddish brown in colour (5YR 5/4), moist sandy clay, medium, granular and moderately formed, friable, distinct yellowish mottle, distinct horizontal boundary.
Layer 4	B_3	81 – 101cm	Red in colour (2.5YR 5/8), moist sandy clay, medium, granular and moderately formed, firm, small distinct yellowish-brown mottle. Distinct horizontal boundary
Layer 5	B_4	101 – 120cm	Reddish brown in colour (5YR 5/4), moist, sticky sandy clay, medium, granular and moderately formed, firm, wavy horizontal boundary.
Layer 6	C	120 – 130cm	Very dark grey in colour (7.5YR N3), moist and silty, medium, aggregates and strongly formed, very firm, clear horizontal boundary.

Soil profile at Wailevu trial site.

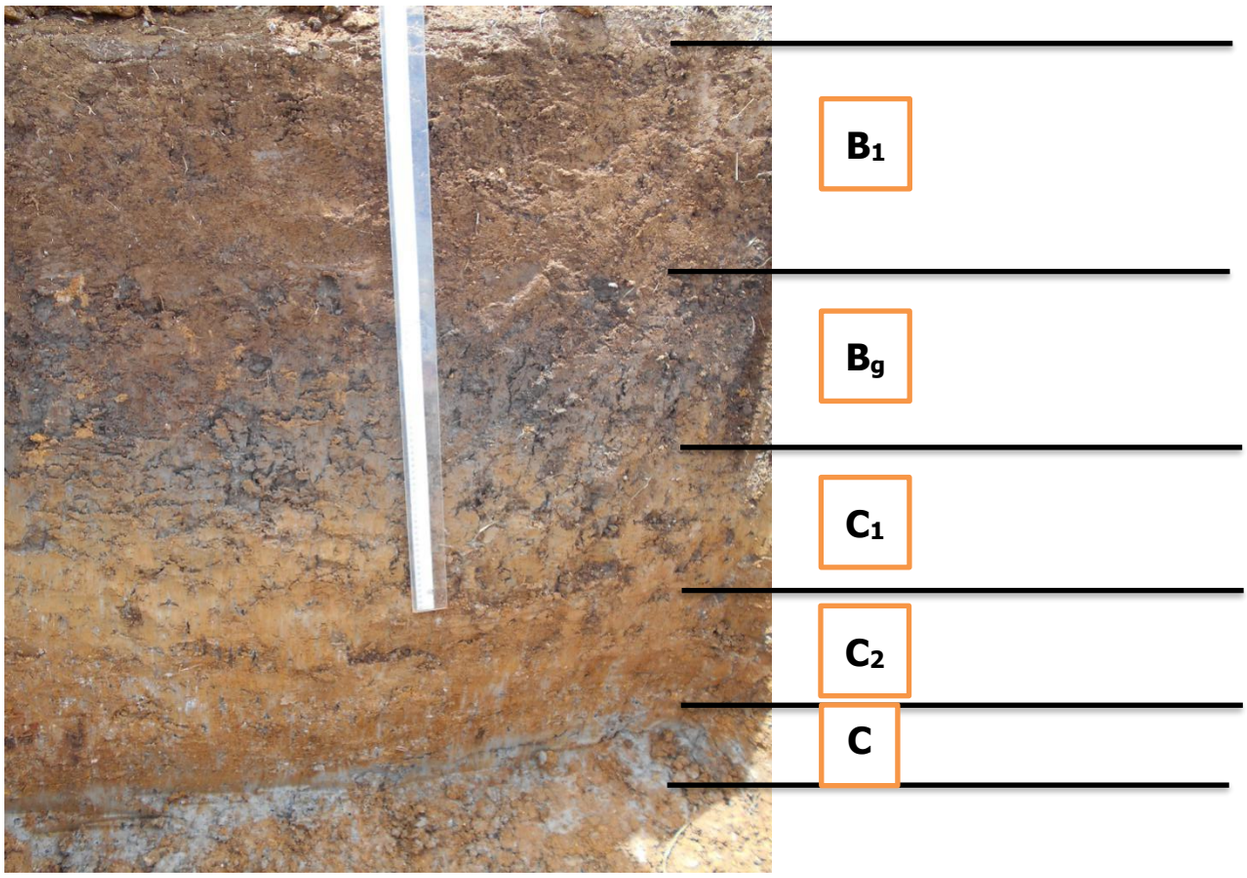


Table 4b providing description of each soil horizon at Wailevu trial site

Layers	Horizon	Depth	Description
Layer 1	B_1	0 - 47cm	Dark brown (10YR 3/3), moist, loamy clay, medium, granular and moderately formed, friable, distinct horizontal boundary.
Layer 2	B_g	47 – 69cm	Dark greyish brown (10YR 4/2), moist, loamy clay, medium, granular and moderately formed, friable, grey mottles visible, wavy horizontal boundary.
Layer 3	C_1	69 – 99cm	Brown in colour (10YR 5/3), very moist, heavy clay, medium, granular, moderately formed, sticky clay (can easily be moulded into shapes), clear horizontal boundary.
Layer 4	C_2	99 – 130cm	Reddish brown in colour (5YR 5/3), very moist and heavy clay, medium, granular and strongly formed, very sticky clay (can easily be moulded into shapes), greyish mottles visible, distinct horizontal boundary.
Layer 5	C_g	130 – 160cm	Greyish colour soil (5YR 6/1), very moist and heavy clay, medium, granular and strongly formed, very sticky clay (can easily be moulded into shapes), clear wavy boundary.

Soil profile at Waiqele site

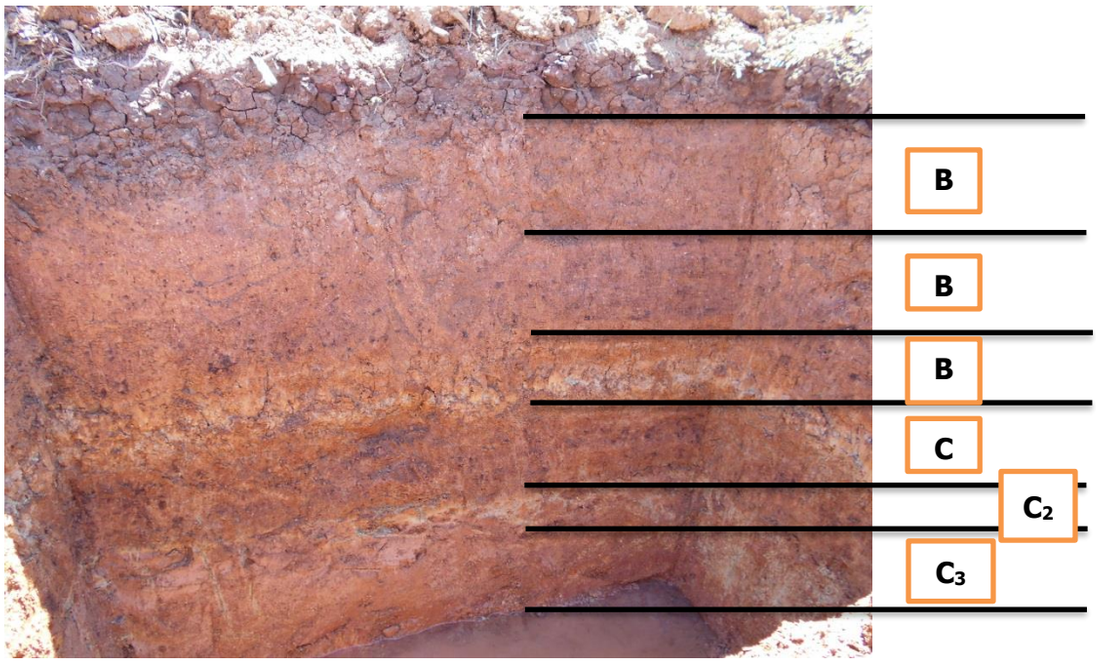


Table 4c providing description of each soil horizon at Waiqele trial site

Layers	Horizon	Depth	Description
Layer 1	B_1	0 - 32cm	Dark grayish brown (10YR 4/2), moist, clay, medium, granular and moderately formed, friable, clear horizontal boundary
Layer 2	B_2	32 – 64cm	Brown in colour (7.5YR 5/3), moist, clay, medium, granular and moderately formed, friable, clear horizontal boundary.
Layer 3	B_3	64 - 76cm	Brown in colour (7.5YR 5/3), moist, clay, medium, granular and moderately formed, friable, black mottles, clear horizontal boundary.
Layer 4	C_1	76 - 86cm	Grayish brown in color (10YR 5/2), very moist, sticky and heavy clay, medium, granular, moderately formed, friable, grey mottles visible, clear horizontal boundary.
Layer 5	C_g	86 - 108cm	Brown in colour (10YR 5/3), very moist, sticky and heavy clay (can easily be moulded into shapes), small grey mottles visible, distinct horizontal boundary.
Layer 6	C_2	108 – 142cm	Brown in colour (10YR 5/3), very wet, sticky clay (can easily be moulded into shapes), clear horizontal boundary.

b) Growth Attributes

Table 5a Growth attributes at Waiqele site

Treatment	Tillers per stool			Stalk					
				Population (10^3)			Height (cm)		
	Months			Months			Months		
	3	5	7	3	5	7	3	5	7
1	3	5	5	55	57	51	63	68	88
2	4	5	5	98	106	83	90	101	141
3	5	5	5	100	120	90	90	109	127
4	5	5	6	102	127	112	90	128	165

Table 5b Growth measurement at Koronubu site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	2	3	24	35	148	160
2	3	3	34	38	150	157
3	2	3	27	32	140	148
4	2	3	32	35	137	144

Table 5c: Growth measurement at Rarawai site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	5	4	35	31	145	163
2	6	6	53	53	165	182
3	6	5	41	36	153	174
4	5	4	39	31	147	164

Table 5d Growth measurement at Etatoko site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	4	5	26	54	168	145
2	4	3	24	62	167	156
3	3	3	22	66	161	165
4	4	5	27	57	175	159

Table 5e: Growth measurement at Drasa site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	4	4	43	51	143	225
2	4	4	51	45	152	207
3	4	5	59	37	165	210
4	5	4	48	40	152	231

Table 5f: Growth measurement at Buabua site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	5	3	51	43	178	188
2	6	3	55	63	170	213
3	5	3	44	56	184	329
4	5	3	45	54	183	211

Table 5g: Growth measurement at Waqadra site

Treatment	Tillers per stool		Stalk			
			Population (10^3)		Height (cm)	
	Months		Months		Months	
	5	7	5	7	5	7
1	5	6	52	55	120	123
2	5	5	68	69	134	136
3	5	6	53	55	123	124
4	4	5	59	62	131	132

Table 5h: Growth measurement

Treatment	Tillers per stool			Stalk					
				Population (10^3)			Height (cm)		
	Months			Months			Months		
	3	5	7	3	5	7	3	5	7
1	3	5	5	55	57	51	63	68	88
2	4	5	5	98	106	83	90	101	141
3	5	5	5	100	120	90	90	109	127
4	5	5	6	102	127	112	90	128	165

Table 5i: Growth measurements

Treatment	Tillers per stool			Stalk					
				Population (10^3)			Height (cm)		
	Months			Months			Months		
	3	5	7	3	5	7	3	5	7
1	62	69	71	45	56	62	5	5	5
2	89	98	91	60	77	91	5	5	5
3	93	98	89	58	83	94	4	4	4
4	97	102	92	72	96	104	5	5	4

C) Yield and bio-chemical data

Table 6a: Yield and biochemical data at Waqadra site

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	49	10.2	15.6	7.8
2	59	10.1	14.8	8.7
3	56	10.5	15.0	8.5
4	61	10.9	16.0	9.8

Table 6b: Yield and biochemical data at Buabua

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	36	10.4	14.8	5.3
2	56	10.7	15.0	8.4
3	53	10.3	15.0	8.0
4	51	10.2	14.7	7.5

Table 6c: Yield and biochemical data at Rarawai

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	34	11.1	14.4	5.0
2	39	11.4	14.7	5.8
3	34	9.6	15.2	5.2
4	30	10.3	14.7	4.4

Table 6d: Yield and biochemical data at Koronubu

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	19	11.8	13.9	2.7
2	12	11.6	14.8	1.7
3	11	12.1	14.2	1.6
4	15	10.2	14.1	2.1

Table 6e: Yield and biochemical data at Waiqele Site

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	51	11.1	14.2	7.2
2	88	12.3	14.8	13.0
3	98	12.8	14.5	14.2
4	126	11.7	14.8	18.6

Table 6f: Yield and biochemical analysis data at Solove site

Treatment	Yield Tph	Fiber %	% Pocs	Tsh
1	36	12.9	14.0	5.0
2	84	12.3	13.3	11.1
3	111	12.0	13.4	14.9
4	133	10.5	13.0	17.3

The results show that fertilizer added by using recommended rate from the lab gave better growth and sugar yield. Farmer practices and 25% less than recommended rate was close in giving sugar yield but less than the recommended rate from the soil analysis. The practice of adding less fertilizer will contribute to detrimental effects to the soil and eventually to the sugarcane production. The nutrients need to be evaluated for successive ratoon after which a nutrient budget will be formulated.

1.4 CROP PROTECTION

1.4.1 PATHOLOGY

Fiji leaf gall disease

Fiji leaf gall (FLG) was first described in Fiji and is widespread in the Fijian islands. FLG threatened the existence of the Fijian Sugar industry in the late 1800s and there have been periodic outbreaks whenever a susceptible variety has been released. The primary method of managing FLG is varietal resistance.

Resistant varieties have been successfully used in Australia and Fiji to manage outbreaks of FLG. Mana the dominant variety in the Fijian sugar industry is intermediate to susceptible to FLG. FLG is spread by a vector (disease carrying agent), called plant hopper (*Perkinsiella vitiensis*). The aim of this routine project is to conduct screening of *Saccaharum officinaru*m clones from stage 3 (LF 2015) series for Fiji leaf gall resistances.

A total of 30 cages of hoppers were collected and bred on Fiji10 (standard) varieties in the nursery. Fiji10 variety is susceptible to FLG thus used as a standard to test new clones. A total of 83 clones planted in the insectary were tested for FLG. The test lasted for 100 days for the susceptible clones to show symptoms of FLG. The 100 days screening showed no symptoms of FLG including standards thus the clones will be reassessed next year.

1.4.2 NEMATOLOGY

A long history of association has existed between nematodes and sugarcane. Plant parasitic nematodes have been identified in all the mill regions of sugarcane belt, which might be a contributing factor towards decline in sugarcane production in Fiji. The survey of 2017 has showed nematode infestation in Penang mill 12%, Labasa mill 7%, Rarawai mill 35% and Lautoka 46% respectively.

Nematode infestation in crops can result in root damages, reduced water and nutrient uptake, stunted growth, reduced number of millable stalks and decreased stalk length. Seven sugarcane varieties were screened against plant parasitic nematodes on treated and untreated soil. Significant variations ($p \leq 0.05$) were observed in the response of sugarcane cultivars to nematode infestation (figure 1&2) at different days after planting.

The collected data at 40days after planting had shown that amongst the sugarcane varieties LF19-1925, Viwa and Mana were able to tolerate nematode infestation towards plant growth (figure 1) at 40 days in untreated soil. Further studies on growth at 80 days after planting had shown that treated soil have the impact on growth of sugarcane.

This indicates that after 80days of planting sugarcane in untreated soil has negative impact on growth and reduces the plant height. Among the sugarcane cultivars evaluated, LF19-1925 at 80 days after planting was classified as resistant since it supported the growth in untreated soil which recorded the same height in comparison with the treated soil (figure 2).

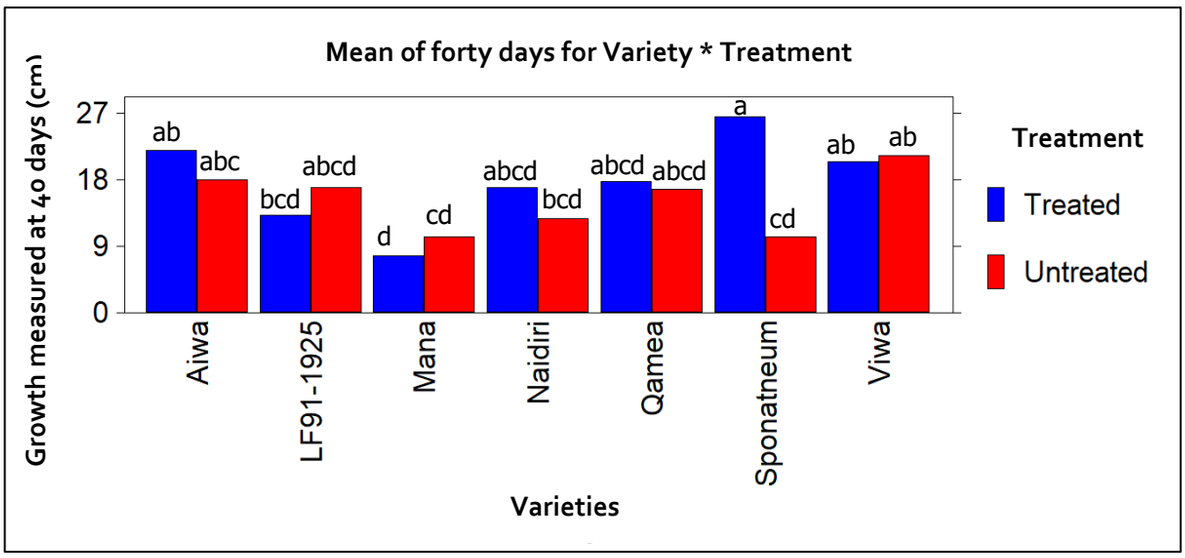


Figure 1: Effect of treated and untreated soil on growth of sugarcane at fortieth day after planting. Bars headed by the same letters are not significantly (p≥0.03) different by least significant difference test.

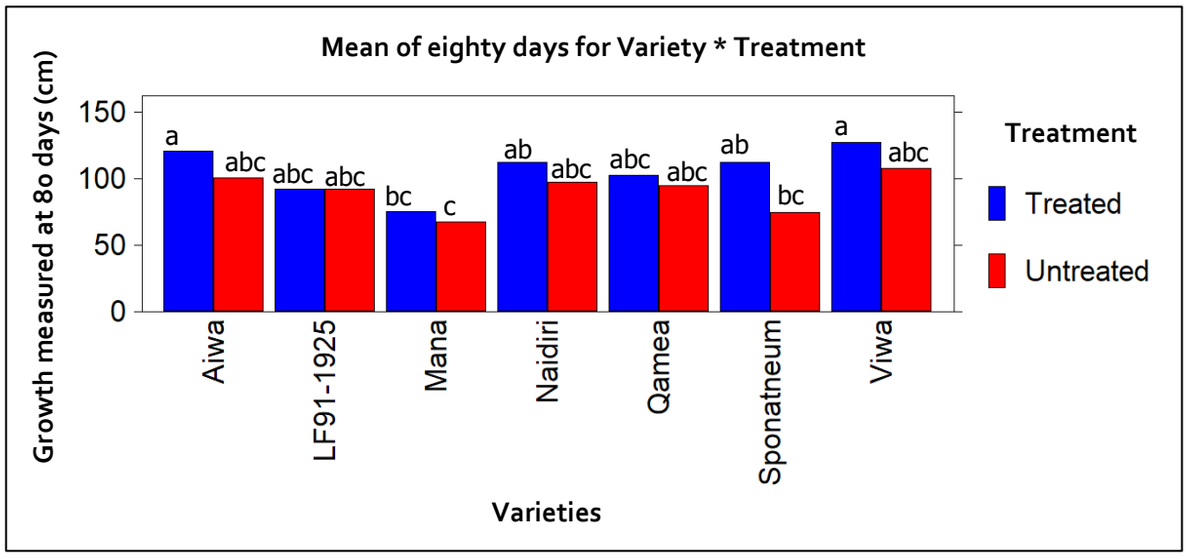


Figure 2: Effect of treated and untreated soil on growth of sugarcane at eighty days after planting. Bars headed by the same letters are not significantly (p≥0.03) different by least significant test

Nematode resistance and susceptibility are collectively terms used when a host plant allows nematode development and reproduction. In this regard, root damage due to nematodes and their population densities, were used to establish the status of host resistance of selected sugarcane varieties to nematodes. In this study, differences in plant growth were an indication of the varying levels of host resistance among the sugarcane varieties at different days. While environment in itself may have contributed to the variations in root biomass, nematode population densities and reduced growth were significant (p=0.05). Treated soil with zero plant parasitic nematodes resulted in an increase in plant growth. The preliminary study has demonstrated that sugarcane cultivars LF19-1925 has variable host resistance status to nematodes at 80 after planting. In view of the progress made in understanding nematode cultivar resistance, this study has helped to classify sugarcane cultivars in Fiji according to

their host response to plant parasitic nematodes in treated and untreated soil. It is recommended that screening for plant nematodes are made mandatory for new cultivars.

1.4.3 ENTOMOLOGY – TERMITES, CWB & N-FIXING BACTERIA

Termites

The termite, Asian Subterranean Termites (AST) pest is a major concern to the Fiji Sugar industry which is a next key pest after sugarcane weevil borer (*R.obscurus*). The cane infested with termite shows symptoms of yellowing and drying of leaves (spindle). Millable canes are tunnelled and are filled with soil within the coning epidermis; termites feed on the inner tissues, the rind remains intact and is filled with moist soil. The damage infestation by *Coptotermes gestroi* on sugarcane is approximately 60cm from the base of the millable stalk. The objective of the project was to monitor infested farms and apply insecticide (*Termidore powder*). A total of 17 farms were monitored all throughout the year on a fortnight basis with the Biosecurity Authority of Fiji. The bait was changed fortnightly and Termidore powder applied accordingly. Bait boxes were removed at the time of harvesting.

Integrated pest management of the Cane Weevil Borer

Cane weevil borer, *Rhabdoscelus obscurus* is an introduced pest of sugarcane in Fiji. It is estimated that overall loss caused by CWB is equivalent to $2 million Fiji dollars. CWB is prevalent in all the sectors of the cane belt and is a major concern to the industry. Infestation by CWB contributes to lowering purity of cane (%POCS). The internal chewing and tunnelling of the borer larvae within the stalk internodes directly decrease the amount of juice that can be extracted and the percentage of sucrose that is present in the juice. This leads to a corresponding decrease of juice purity and an increase in total organic non-sugars such as dextran. Damaged stalks are lighter and do not keep as well as undamaged cane after they are cut for milling. The objective of this project was:

- To setup and monitor CWB traps in infested farms
- To formulate entomopathogenic fungus to control the weevil borer population

Ten farms in Lovu sector were randomly selected and placed with split bait traps for monitoring CWB population density on fortnightly basis. Total of 403 adult males and 602 adult females were collected from the traps.

Table 1: Split bait traps placed in growers' field in Lovu sector

Farmer Name	Farm No.	Total Male trapped	Total Female Trapped
Rama Krishna	19052	42	62
Patro	19012	45	72
Abay Nand	22111	36	52
Hari Shankar	177	32	46
Mun Sami	178	23	35
Ramesh Kumar	164	36	54
Ramesh Kumar	166	88	122
Nakul Deo	160	44	67
Vickamala	19038	30	52
Parbha Wati	18179	27	40
Total		**403**	**602**

Nitrogen Fixing Bacteria

Nitrogen in legumes originates from nitrogen in the air, as well as nitrate and ammonium in soil solution. Much of the nitrogen required for plant growth is from fixed nitrogen. The fixed nitrogen of soybean often comprises over 50% of the total nitrogen of the plant (Vincent, 1974). Most fixed nitrogen is thought to come from nitrogen-fixing symbionts, such as

Rhizobium, Bradyrhizobium, Mesorhizobium, or *Sinorhizobium*, in the nodules of leguminous plants. However, much nitrogen continues to be taken up by plants even after the flowering stage, at which stage the nitrogen fixation of nodules begins to decrease rapidly. Nitrogen absorbed by legumes in the later stages are thought to be inorganic nitrogen compounds formed from decomposition of organic matter in the soil. Presence of Nitrogen-fixing bacteria in sugarcane, diazotrophic bacteria belonging to the Beijerinckia genera have been found in large numbers in the rhizosphere (the soil volume adjacent to, or within a few millimetres from the root surface) and in the rhizoplane (the soil: root interface) of sugarcane (Döbereiner,1961.)

According to (Minamitani,1985) the amount of increase of nitrogen content in soil where plants grow and that the nitrogen-fixing potential of rhizosphere soil of soybean plants increases markedly after flowering. The continuous increase in nitrogen of leguminous plants may suggest the presence of some species of diazotrophs, not nodule-forming but closely associated with the roots, that provide much fixed nitrogen to the plants.

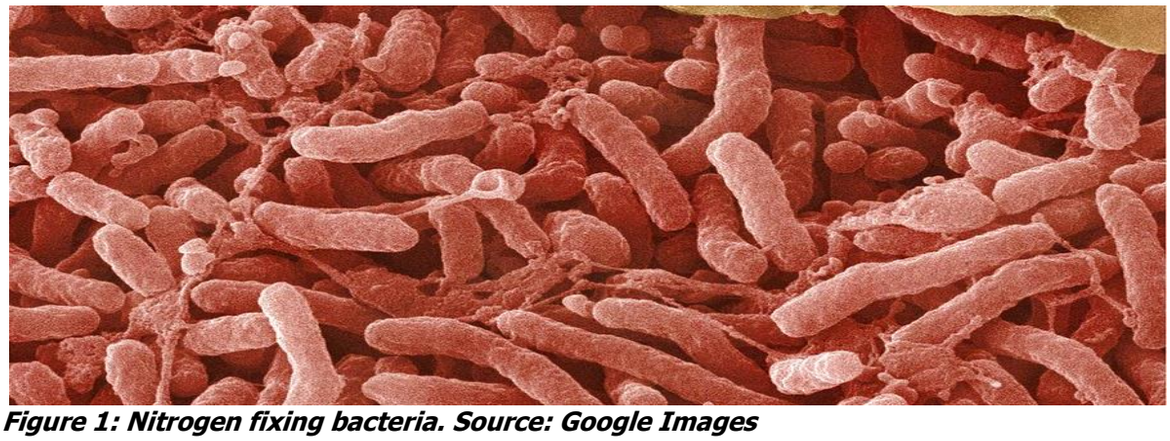


Figure 1: Nitrogen fixing bacteria. Source: Google Images

Bio fertilizer is important in crop farming systems because it is an inexpensive source of nitrogen for higher yields of crops. This process diminishes the need for expensive chemical fertilizer. Thus, the extensive use of bio fertilizers would provide economic benefits to farmers, improve the socioeconomic condition of people and preserve natural resources. To promote sugarcane growth and high yield of sugar, the transport of N from diazotrophic endophytes to the host plant is important in addition to the occurrence of high nitrogen fixation activity. Living bacteria actively excrete fixed N into the apoplast of the host tissue and the plant cells then absorb the released N compounds.

The extraction of N- fixing soil microbes were successfully isolated. A number of plates were sent to CABI for ID and was identified as *Azotobacter* and *Rhizobium tropici.* Along with these N-fixing bacteria an aquatic bacteria of family *Rhodobacteraecae*, found in the marine was present, this could be the result of flooding, and however, further studies may be done in the future to calculate the impact of such bacteria on sugarcane health. The identified N-fixing bacteria was mass produced and added to sterile compost, which acted as a carrier. This was mixed with top soil and filled in pots. Four commercial varieties (Naidiri, Mana, Kiuva, Viwa) and a promising variety (LF11-233) was planted. Pot trials were conducted for which the results will be presented in 2019.

1.4.5 DISEASE CONTROL

The major disease currently in Fijis sugar cane field is Fiji leaf gall (FLG) presently found only on the island of Viti Levu. The principal method of controlling this disease is growing resistant

varieties combined with intensive rouging. Since the 1920s, rouging to remove and destroy infected cane plants has been one of the main methods of controlling Fiji disease. Each mill area has a Disease Control Unit whose daily task is to inspect cane stools row by row and rogue out diseased plants. However, rouging has two limitations. Firstly, stools that are infected but show no symptoms cannot be detected. Secondly, rouging will succeed only where disease incidence is low and cannot really cope in areas where susceptible varieties are planted near to host plants (Duruka). Although there is one dominant variety Mana in Viti Levu, the existing rouging system is able to keep diseases under acceptable control. The objective of the project is to reduce the initial inoculum of Fiji disease and to decrease the rate of disease development through routine inspection in commercial farms (Rouging). The roguing team covered an area of 5770ha during their crop inspection. Of this total 1330ha plant crops and 4440ha were ratoon cane.

Table 3: Rouging Report from January-December 2018

Months	Lautoka		Nadi		Sigatoka		Ba/Tavua		Penang		Labasa	
	Plant Ha	Ratoon Ha	Plant Ha	Ratoon Ha	Plant Ha	Ratoon Ha	Plant Ha	Ratoon Ha	Plant Ha	Ratoon Ha	Plant Ha	Ratoon Ha
Jan	3.2	80.6	30.0	39.4	17.5	11.5	3.1	10.5	0.0	7.8	0.0	0.0
Feb	2.1	123.2	20.6	58.6	36.3	51.3	0.0	27.3	0.0	0.0	123.0	111.3
Mar	26.4	155.0	26.9	80.6	27.5	63.8	6.2	48.2	4.1	2.5	137.0	42.5
Apr	0.0	168.9	61.1	66.3	8.2	71.8	0.0	47.7	0.0	0.0	0.0	0.0
May	9.9	151.1	45.2	70.6	12.8	66.6	0.0	90.0	6.4	6.9	71.4	66.1
Jun	3.7	153.5	35.8	67.3	8.0	67.7	4.6	49.4	16.1	40.0	63.0	62.2
Jul	0.0	106.0	40.2	68.1	3.3	84.7	0.0	14.0	9.2	30.1	66.3	66.7
Aug	2.6	140.6	36.5	86.3	11.2	96.3	0.0	0.0	1.2	69.0	39.6	88.2
Sep	1.7	103.0	30.8	69.9	4.2	66.9	0.0	86.6	0.0	19.3	58.8	53.6
Oct	1.9	157.5	23.5	110.9	8.4	62.7	0.0	20.0	0.0	12.3	41.4	72.2
Nov	3.3	99.9	36.3	92.9	3.4	69.3	0.0	0.0	1.1	11.7	52.3	85.3
Dec	2.3	49.5	7.0	64.3	0.0	55.6	0.0	0.0	0.0	0.0	33.9	66.6
Total	**57.1**	**1489.0**	**394.0**	**875.3**	**141.0**	**768.0**	**14.0**	**394.0**	**38.1**	**199.5**	**687.0**	**714.7**

The trend at which Fiji Leaf Gall Disease is increasing in the sugarcane farms is an indication that the disease can flare up at any time given the availability of the pathogen *(Perkensiella vitiensis*), weather conditions and planting of only one major variety – Mana. Also, the planting of *Saccharum edule* –Duruka, an alternate host of Fiji Leaf Gall Disease planted along and near cane fields contributes to the increasing number of the disease found in some Districts.

Table 4: Summarized Rouging Report from January-December 2018

Mill District	No. of Farms Inspected	Area Rouged (Ha)		No. of FLGD stools Rouged
		Plant	Ratoon	
Lautoka	380	57.1	1488.8	514
Nadi	257	393.8	875.3	138
Labasa	359	686.5	714.7	0
Sigatoka	345	140.8	768.1	872
Rarawai/Tavua	97	13.9	393.5	0
Penang	168	38.1	199.5	0
Total	**1606**	**1330.2**	**4439.9**	**1524**

This can be credited to disease free area or good field management practices used by farmers such as having a good, healthy and clean planting material. Sigatoka has the most infected stools. Out of the total 1606 farms inspected, 1524 stools were rouged.

1.4.6 BIOSECURITY

Sugar cane smut disease

Sugarcane smut is a fungal disease caused by *Sporisorium scitamineum* (*Ustilago scitamineum*). Smut, the most easily recognized disease of sugarcane has a black whip that is of pencil thickness. It is sliver- greyish black in colour and powdery. The nearest source of this disease is Australia and is a threat disease for Fiji. On maturity it ruptures and a large number of the minute black smut spores (teliospores) are liberated and disseminated by the wind. It causes a great deal of damage, leading to loss of yield in susceptible varieties.

The teliospores may survive in the soil for long periods, up to 10 years. The spores and sporidia are also present in the infected plant debris in the soil. The smut spores and dormant mycelium also present in or on the infected setts. The primary spread of the disease is through diseased seed-pieces (setts). Spores present in the soil also spread through rain and irrigation water and cause soil-borne infection. The secondary spread in the field is mainly through the smut spores developed in the whips, aided by air currents.

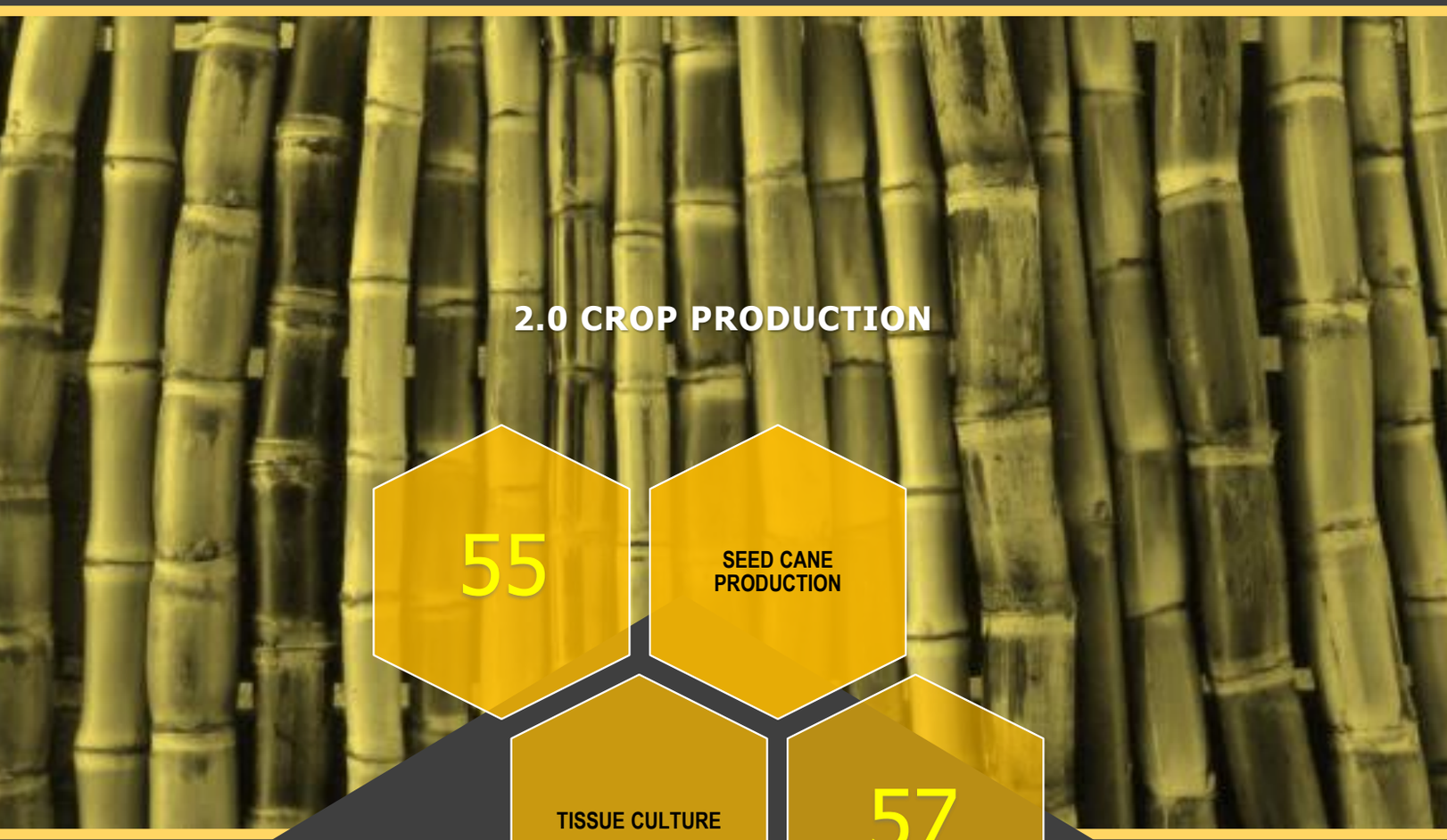
Favorable Conditions -continuous ratooning and dry weather during tillering stage favors the disease. Spore Trap Detection and contingency planning of possible sugarcane smut incursion is an ongoing routine project whereby visual and molecular studies will be done. The Burkard Spore Trap (Burkard) is a volumetric air sampler that is one of the standard devices for monitoring airborne pollen and spores.

Spore identification is done by the two techniques: light microscopy and molecular tests. A molecular test intensifies capacities of spore trapping and is a certain method for smut spore confirmation. The polymerase chain reaction test will be used. PCR can detect small amounts of sugarcane smut DNA extracted from spores fixed on the spore trap tape. Three Spore traps were procured on the 16th of June, 2017. Two of which were placed at the beginning of 2018; one at SRIF"s premises and the other at Fiji Ports Authority.

The third one to be placed in the arrivals area at the Airports in Fiji. The spore trap tape was changed every 7 days. The tapes were brought back to the lab and diagnosed under microscope. There were no positives from the tapes analysed. This however, was not only difficult but unreliable data.

Molecular training was provided for a week with Biosecurity after which it was decided to seize the placements of trap until SRIF's molecular lab was reconstructed for a directional workflow which most significantly would keep contamination minimal. A Memorandum of Understanding was signed between SRIF and Biosecurity on 5th April, 2018. A draft SMUT incursion plan for the Fiji Sugar Industry has been put in place to encounter the disease.

Figure 2: Type of spore trap that has been deployed by SRIF



2.0 CROP PRODUCTION

2.1 SEED CANE PRODUCTION

Good quality seed material is an important factor for yield improvement in plant and multi-ratoon cropping of sugarcane. The potential cane yield that should be obtained will not be achieved if seed cane of poor quality is planted. Seed cane quality is determined by freedom from diseases and pests and varietal purity.

The Fijian sugar industry has been fortunate that pests and diseases are kept under control by an active pest and disease control programme. However, Ratoon Stunting disease (RSD) (Leifonia xyli subsp. Xyli) is prevalent in Fiji (Johnson et al.2006) and can cause loss up to 27% in cane yield annually (Johnson and Tyagi, 2010).

In Fiji, risk of this disease spreading rapidly is very high due to the introduction of mechanical harvesters, planters and fertilizer applicators. Absence of any standard hygiene operating procedures for these machines make it difficult to prevent this disease from spreading. Therefore, adoption of hot water treated Seedcane is the only way to combat spreading of this major disease.

2.1.1 LABASA

It is in the best interest of the farmers that they plant clean and quality seed materials in order to avoid cane and sugar yield loss through diseases and unapproved varieties. SRIF has established a hot water treatment plant in Labasa with aid from European Union. This treatment plant was used in 2018 to treat and plant 12 hectares of mother plot (estate and farmers field).

Figure 1: New hot water treatment plant

Figure 2: Hot water plant in operation

The total hot water treated seed bed established in Vanua Levu in the Oct - Nov, 2018 planting window is shown in the table below:

Table 1: Hot water treated seed bed

Farm/Location	Variety	Hectare Planted	Estimate Tonnes
Yenoos - Batanikama	Naidiri	0.9	60
FSC NLDC - Estate	Qamea	1.1	50
Shusil - Waiqele	Viwa	1.5	70-80
SRIF Estate farm	Naidiri	4.0	250
	Ragnar	2.0	130
	Kiuva	1.2	70
Batanikama farm	Kaba	0.3	15-20
	Naidiri	0.2	10-15
Sanju Reddy Bucaisau	Qamea	0.9	45-50

The planted seed bed will be used by the farmers in the coming planting window of 2019. It is made convenient for the farmers to take the seed cane from the mother plot established in their sector and the team leaders are advised to monitor the planting and ensure that farmers utilize the seed cane from the seed bed in their sector. Establishing the seed bed in the sectors reduces seed cane transportation cost for the farmers. The picture below shows one of the seed beds established in the sector.

Figure 3: Viwa hot water treated seed bed at Waiqele

2.1.2 LAUTOKA

Seedcane Nurseries

One of the challenges we face in promoting adoption of quality seed cane is that majority of our seedcane nurseries are established in miller owned farm. Due to transportation cost only close vicinity farmers are able to take seed cane from these nurseries, while majority find it cheaper to use seedcane from their own farms or neighbour's farm. Seedcane weighing is another major factor in remote sectors which contributes to low seedcane uptake from certified plots due to conflict related to quantity of seed cane between buyers and the sellers of seedcane. Around 13.52 ha of Hot water treated seedcane was planted in Lautoka mill farm as well as surrounding farms in Lovu Sector through the European Union's Annual Action Plan 2012 project funding. Seedcane from this mother plot was used to establish the 10-grower demonstration plots in different locations. Additionally, 150 tonnes of Seedcane from these mother plots were taken by nearby growers in Drasa and Lovu Sector.

Figure 4: LEFT: Well-maintained Seed cane in Hot Water Treated (HWT) Mother plot in Drasa. RIGHT: Harvested HWT seed material for planting

Single Eye bud Nursery

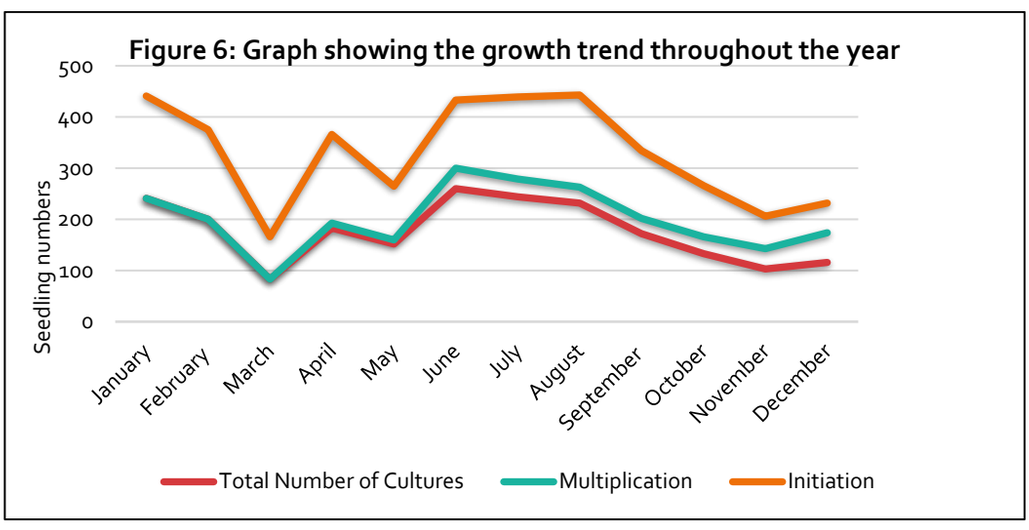
About 100,000 single eye bud seedlings were established in the greenhouse in Drasa. The main purpose of this project was to have seedling for gap filling in Hot Water treated Mother plots. FSC made a request for the production of single eye bud seedlings for gap filling in commercial farms where yield was very low. As a result, an additional 100,000 polythene bags were supplied to FSC to have a single eye bud nursery at each of the sector office. This was part of the demonstration for growers on how to raise single eye bud seedling on their own farms and to show farmers the importance of gap filling. Gap filling (tum-tum) is a practice which has diminished over the years. About 18,000, seedlings were planted at different sectors.

Figure 5: LEFT: Single eye bud seedling planted at Natova Sector office for gap filling. RIGHT: Single eye bud seedling inside SRIF's greenhouse.

2.2 TISSUE CULTURE

The re-established tissue culture laboratory became operational in January 2018. Dissection was carried out in six varieties that was suitable for tissue culture: Qamea, Viwa, LF 91-1925, Aiwa, Kaba and Naidiri. Maximum growing percentage was noted in June and continuation with callus production was immobile due to high contamination rate. The following table shows the monthly data of the cultures carried out with Multiplication stage and Initiation stage.

Table 2: Monthly progress of tissue culture production by stages			
Month	Total # of Cultures	Multiplication stage ($M0$-M_4)	Initiation stage (Io-I_1)
January	241	-	241
February	200	-	200
March	83	-	83
April	183	10	173
May	152	8	105
June	260	40	133
July	244	35	160
August	232	31	180
September	172	30	132
October	133	33	100
November	103	40	63
December	116	58	58



Training

Due to the high number of contaminations observed in quick proliferation for callus and shoot tip culture, a training was conducted to ascertain two important factors. First was to identify the cause of the contamination and second was hands-on training covering all aspects of tissue culture and combating contamination. In addition, procedures for tissue culture were documented.

Figure 1: Tissue cultured plants (LEFT: shooting stage & RIGHT: Rooting stage)

2.3 FIELD ACTIVITIES CROP PRODUCTION FIGURES

Appendix 1: Main features of 2018 season compared with 2017

Mill →	Lautoka		Rarawai		Labasa		Penang		All mills	
Year →	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Total registrations (Numbers)	5,408	5,425	5,328	5,357	4,087	4,117	1,737	1,747	16,560	16,646
Total farm basic allotments (tonnes)	945,713	948,321	958,811	964,105	916,035	929,944	273,085	274,458	3,093,644	3,116,828
Total registered area (hectares)	22,927	22,967	22,093	22,182	19,268	20,049	8,017	8,069	72,305	73,267
Total area cultivated (hectares)	10,990	10,990	12,218	10,956	13,666	15,338	3,428	3,497	40,302	40,781
Total area harvested (hectares)	10,113	9,132	10,277	10,225	14,246	14,473	3,404	3,275	38,040	37,105
Total farm harvest quotas (tonnes)	Open									
Sugar makes actual (tonnes)	54,174	57,856	55,596	38,017	70,620	64,332	N/A	N/A	174,102	57,856
Tonnes 94 N.T sugar	52,021	60,256	57,167	42,947	73,249	67,011	N/A	N/A	176,199	60,256
Yield tonnes 94 N.T. sugar per hectare	5.1	6.6	5.6	4.2	4.8	4.6	N/A	N/A	5.1	5.1
Tonnes cane per tonnes sugar 94 N.T.	8.4	10.5	8.7	11.2	9.2	9.3	N/A	N/A	8.8	9.9
%POCS	11.8	10.6	11.4	10.1	11.2	11.1	N/A	N/A	11.4	10.9
Cane purity average for season	83.2	80.6	82.2	77.3	82.3	82.0	N/A	N/A	82.5	81.3
Tonnes cane harvested	429,570	457,480	407,861	479,625	675,731	620,328	118,231	139,937	1,631,393	1,697,370
Tonnes cane crushed	429,570	457,480	499,806	466,233	675,371	620,328	NIL	NIL	1,604,747	1,544,041

Appendix 2: Monthly rainfall(mm) for 2018 compared with long term average

Mills	No. of years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lautoka	2018 actual	370	350	502	329	84	67	1	0	26	209	80	112	2129
	109 yrs. avg. to 2018	307	327	323	184	97	65	51	68	72	91	126	189	1899
Rarawai	2018 actual	489	308	402	463	105	55	0	0	17	171	83	135	2228
	132 yrs. avg. to 2018	357	361	358	285	79	38	29	93	100	143	217	238	2299
Labasa	2018 actual	319	663	475	898	92	26	25	0	74	283	31	86	2971
	129 yrs. avg. to 2018	360	365	379	238	109	65	47	52	101	102	203	252	2271
Penang	2018 actual	394	321	507	475	60	459	9	199	35	340	70	72	2940
	120 yrs. avg. to 2018	432	359	402	376	122	72	52	92	85	145	152	246	2533

Appendix 3: Crop production details										
	Lautoka		Rarawai		Labasa		Penang		All mills	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Areas harvested (hectares)										
Plant	637	756	1,309	1,799	2,008	1,673	226	452	4,670	4,680
First ratoon	539	653	475	1,340	1,286	1,908	456	193	4,160	4,094
2nd ratoon	817	478	809	400	1,616	1,351	398	306	3,231	2,535
Other ratoons	8,120	7,245	7,685	6,686	9,335	9,541	2,325	2,324	26,466	25,796
Total	10,113	9,132	10,277	10,225	14,246	14,473	3,405	3,275	38,527	37,105
Cane harvested (tonnes)										
Plant	34,740	44,428	62,516	96,398	97,027	80,177	8,420	16,134	236,152	237,137
First ratoon	28,068	39,011	22,794	70,173	65,538	94,983	15,019	11,386	178,798	215,553
2nd ratoon	37,577	25,896	35,295	18,662	71,563	59,588	12,256	17,847	140,148	121,633
Other ratoons	329,185	348,146	287,256	294,392	441,603	385,580	82,537	94,571	2,732,643	1,122,689
Total	429,570	457,480	407,861	479,625	675,731	620,328	118,232	139,937	1,703,158	1,697,370
Yield tonnes cane per hectare (tch)										
Plant	54.6	58.8	47.8	53.6	48.3	47.9	37.2	35.7	48.5	49.0
First ratoon	52.1	59.8	48.0	52.4	51.0	49.8	33.0	58.9	47.1	55.2
2nd ratoon	46.0	54.1	43.6	46.7	44.3	44.1	30.8	58.3	42.0	50.8
Other ratoons	40.5	48.1	37.4	44.0	47.3	40.4	35.5	40.7	41.8	43.3
Avg. yield/ha	42.5	50.1	39.7	46.9	47.4	42.9	34.1	42.7	42.7	45.7
Varieties crushed (% of total cane harvested)										
Ragnar	0.6	1.5	0.4	0.3	21.0	20.2	1.2	0.7	5.8	5.7
Aiwa	0.7	0.0	0.6	0.3	0.2	0.1	0.1	nil	0.4	0.1
Beqa	0.1	1.2	nil	nil	nil	nil	nil	nil	nil	0.3
Galoa	0.2	0.7	nil	nil	5.9	5.5	0.1	nil	1.8	1.6
Kaba	2.5	2.7	6.3	6.0	0.5	0.5	0.4	0.2	2.5	2.4
Mali	0.0	0.0	nil	0.3	9.7	8.9	0.1	0.1	2.5	2.3
Mana	91.0	90.6	89.5	90.3	nil	0.0	94.6	96.5	68.8	69.4
Naidiri	2.4	2.1	1.0	1.2	40.7	45.4	2.8	2.2	11.7	12.7
Vatu	0.0	0.1	nil	nil	12.4	10.3	nil	nil	3.1	2.6
Waya	0.0	0.1	0.1	0.3	6.4	5.4	0.4	0.1	1.7	1.5
LF91-1925	1.5	0.4	1.2	1.0	2.2	2.7	0.3	nil	1.3	1.0
Kiuva	0.5	0.4	nil	nil	0.5	0.3	nil	nil	0.3	0.2
Qamea	0.2	0.1	nil	nil	nil	nil	nil	nil	nil	0.0
Viwa	nil	nil	nil	nil	nil	0.3	nil	nil	0.1	0.1
Expt./Others	0.4	nil	0.3	0.3	0.5	0.5	nil	0.1	0.3	0.2
Total	100	100	100	100	100	100	100	100	100	100

Appendix 4: Rainfall (mm) at mill centres										
Mill	For 12 months ended 31st December					For 12 months ended 30th September				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Lautoka	1541	974	2072	1721	2129	1250	991	1666	1380	2070
Rarawai	1250	1101	1908	1993	2228	1009	998	1768	1547	2286
Labasa	1679	1167	1773	2122	2971	1134	1519	1167	1471	2981
Penang	2179	1310	2086	1799	2940	1490	5452	1685	1711	2787

Appendix 5: Rainfall distribution affecting 2018 crop(mm)					
Month	**Period**	**Lautoka**	**Rarawai**	**Labasa**	**Penang**
Jul-17	Early	0.0	0.0	3.3	0.0
	Mid	0.0	0.0	0.0	0.2
	Late	24.3	0.8	1.8	1.2
Aug-17	Early	0.0	0.0	0.4	2.7
	Mid	32.2	45.9	31.6	42.8
	Late	12.5	4.8	66.9	3.2
Sep-17	Early	7.6	19.0	0.1	54.2
	Mid	1.2	1.2	35.3	6.0
	Late	0.3	0.0	34.7	0.4
Oct-17	Early	0.4	7.0	1.1	0.2
	Mid	5.1	3.4	2.9	0.3
	Late	7.0	29.2	59.5	7.6
Nov-17	Early	64.9	79.0	89.5	99.7
	Mid	38.1	85.7	185.4	37.8
	Late	49.5	14.8	22.0	49.7
Dec-17	Early	63.9	49.1	100.1	48.3
	Mid	13.5	73.5	86.7	23.1
	Late	39.8	84.7	64.7	61.6
Jan-18	Early	38.3	62.1	59.7	9.9
	Mid	234.5	464.9	133.7	223.5
	Late	57.9	54.1	125.5	44.8
Feb-18	Early	259.0	257.4	349.2	143.1
	Mid	186.2	108.9	68.8	58.1
	Late	109.6	135.5	256.9	128.7
Mar-18	Early	112.1	220.1	233.7	118.7
	Mid	41.5	29.4	54.6	10.7
	Late	340.6	229.9	231.2	275.7
Apr-18	Early	380.8	629.2	705.6	381.6
	Mid	0.9	1.3	31.1	124.2
	Late	22.4	59.0	12.2	84.5
May-18	Early	67.3	59.7	25.7	13.3
	Mid	0.0	0.0	14.2	30.8
	Late	55.5	27.3	64.3	16.2
Jun-18	Early	46.1	60.5	28.7	449.0
	Mid	11.1	5.6	3.2	0.0
	Late	0.8	0.0	1.3	10.0
Early - 1st to 10th of the month Mid - 11th to 20th of the month Late - 21st to end of the month					

Appendix 6: Hectares harvested										
Mills		Average for period of five seasons					Last four seasons individually			
	Crop	1991/ 1995	1996/2000	2001/2005	2006/2010	2011/2015	2015	2016	2017	2018
Lautoka	P	3634	2944	1042	788	775	1006	515	637	756
	R	20580	19701	19730	14614	10630	9876	8105	9476	8376
	Total	24214	22645	20772	15402	11405	10882	10122	10113	9132
Rarawai	P	2899	3164	1055	1127	953	1095	403	1309	1799
	R	17360	14613	17585	14553	11367	10754	9610	8968	8426
	Total	20259	17777	18640	15680	12320	11849	10013	10277	10225
Labasa	P	3120	2597	1269	1116	1403	1756	1027	2008	1673
	R	19604	18348	15911	14039	11500	11216	12423	12238	12800
	Total	22724	20945	17180	15155	12903	12972	13450	14246	14473
Penang	P	1386	1120	542	339	368	580	302	226	452
	R	4958	4674	4568	3991	3142	3008	2907	3178	2823
	Total	6344	5794	5110	4330	3510	3588	3209	3404	3275
All mills	P	11039	9825	3908	3369	3499	4437	2247	4180	4680
	R	62502	57336	57794	47197	36640	34854	35292	33860	32425
	Total	73541	67161	61702	50567	40139	39291	36794	38040	37105

Appendix 7: Tonnes of cane harvested									
Mills	Average for period of five seasons					Last four seasons individually			
	1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2015	2016	2017	2018
Lautoka	1,283,569	1,216,597	971,454	763,321	516,159	521,065	372,288	429,570	457,480
Rarawai	1,017,374	957,507	878,509	738,316	551,682	490,765	269,800	407,861	479,625
Labasa	1,166,055	1,017,061	840,388	695,728	547,372	662,600	653,353	675,731	620,328
Penang	29,1206	309,205	239,044	213,253	170,698	170,129	91,806	118,231	139,937
All mills	3,758,204	3,500,370	2,929,395	2,410,619	1,785,912	1,844,559	1,387,247	1,631,393	1,697,370

Appendix 8: Tonnes of cane per hectare harvested										
Mills		Average for period of five seasons					Last four seasons individually			
	Crop	1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2015	2016	2017	2018
Lautoka	P	64.7	64.2	63.9	67.2	57.7	55.5	48.9	54.6	58.8
	R	51.2	51.4	45.9	47.6	44.3	47.1	35.0	46.2	41.7
	Total	52.4	53.7	46.8	49.1	45.2	47.9	36.8	42.5	42.5
Rarawai	P	61.2	62.1	59.6	58.8	56.7	49.6	49.6	47.8	58.8
	R	48.1	52.9	46.4	44.8	43.8	40.6	26.6	43.0	54.0
	Total	50.1	53.9	47.1	46.5	44.8	41.4	26.9	39.7	56.4
Labasa	P	59.3	56.5	59.7	56.7	53.4	58.9	55.1	48.3	47.9
	R	50.4	47.4	47.6	43.5	41.4	49.9	46.1	47.5	44.8
	Total	51.3	48.6	48.9	45.8	42.7	51.1	48.6	47.4	46.4
Penang	P	57.2	62.6	54.2	56.3	50.6	52.2	32.2	37.2	35.7
	R	43.1	51.2	46.4	48.3	48.4	46.5	28.9	33.1	52.6
	Total	46.0	53.3	46.8	49.1	48.6	47.4	28.6	34.7	44.2
All	P	61.2	61.8	58.3	59.5	55.3	54.9	46.5	47.0	50.3
Mills	R	48.1	50.0	46.0	45.8	43.5	45.9	37.1	42.5	48.3
	Total	50.2	52.1	47.5	47.3	44.5	46.9	35.2	41.1	49.3

Appendix 9: Hectares harvested in relation to registered area and cultivated area (ha)					
Mills	2018 hectares (A)			Hectares harvested as % of various categories "A"	
	Registered (1)	Cultivated (2)	Harvested	(1)	(2)
Lautoka	22967	10990	9132	39.8	83.1
Rarawai	22182	10956	10225	46.1	93.3
Labasa	20049	15338	14473	72.2	94.4
Penang	8069	3497	3275	40.6	93.7
Total	73267	40781	37105	50.6	91.0

Appendix 10: Plant cane harvested as percentage of total cane harvested									
Mills	Average for period of five seasons					Last four seasons individually			
	1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2015	2016	2017	2018
Lautoka	15.0	13.0	5.0	5.5	8.5	10.7	6.8	8.1	9.7
Rarawai	14.0	18.0	6.0	8.2	9.7	11.1	5.3	15.3	20.1
Labasa	14.0	12.0	7.0	8.2	13.4	15.6	8.7	14.4	12.9
Penang	23.0	19.0	11.0	8.2	10.7	17.8	10.6	7.1	11.5
All mills	16.0	15.0	7.0	7.4	10.5	13.2	6.1	11.2	13.6

Appendix 11: Plant, ratoon yields and percentage of total area harvested - 2018 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	58.8	756	8.3	59.8	653	7.2	51.1	7723	84.6	56.6	9132
Rarawai	53.6	1799	17.6	52.4	1340	13.1	45.4	7086	69.3	50.5	10225
Labasa	47.9	1673	11.6	49.8	1908	13.2	42.3	10893	75.3	46.7	14474
Penang	35.7	452	13.8	58.9	193	5.9	49.5	2630	80.3	48.0	3275
All Mills	49.0	4680	12.6	55.2	4094	11.0	47.1	28332	76.4	50.5	37106

Appendix 12: Seasonal %POCS in cane									
Mills	Rough average for period of five seasons					Last four seasons individually			
	1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2015	2016	2017	2018
Lautoka	12.5	11.4	11.5	10.8	11.4	12.4	10.7	11.8	10.6
Rarawai	12.9	11.4	11.9	10.9	11.3	12.6	9.7	11.4	10.0
Labasa	12.1	11.1	11.5	10.7	11.5	12.1	11.7	11.1	11.5
Penang	12.6	11.1	11.9	11.1	11.1	11.9	NIL	NIL	NIL
All Mill Avg.	12.5	11.2	11.7	11.0	11.4	12.3	10.6	11.6	10.7

Appendix 13: Weekly POCS in cane 2018 season				
Week	Lautoka	Rarawai	Labasa	Week average
1	10.2	9.2	9.0	9.5
2	10.1	10.4	11.1	10.5
3	10.5	10.5	11.3	10.8
4	10.7	10.6	11.3	10.9
5	11.2	10.6	11.1	11.0
6	11.4	10.7	11.3	11.1
7	11.8	10.7	11.6	11.3
8	11.1	10.7	11.9	11.2
9	11.2	10.8	11.6	11.2
10	11.4	10.8	11.8	11.4
11	11.4	10.5	12.0	11.3
12	11.4	10.0	11.7	11.0
13	11.5	10.1	11.9	11.2
14	11.5	10.1	11.7	11.1
15	10.9	10.4	11.5	10.9
16	10.4	10.2	10.9	10.5
17	10.4	10.0	10.0	10.2
18	10.0	10.1	8.9	9.7
19	10.2	10.1	10.4	10.2
20	9.7	9.8	10.7	10.1
21	9.6	8.3	10.6	9.5
22	8.5	8.0	9.4	8.6
23	8.0	7.4	9.5	8.3
24	7.8		9.3	8.5
Season average	10.5	10.0	8.3	9.6

Note – Penang mill did not operate damaged by Cyclone Winston

Appendix 14: Sugar produced (tonnes 94 N.T. equivalent)									
Mills	**Tonnes sugar 94 N.T equivalent**								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Lautoka	43,384	50,306	48,129	41,874	76,456	63,784	40,595	52,021	60,256
Rarawai	31,580	61,028	45,732	60,039	68,277	61,083	25,979	57,167	42,708
Labasa	40,943	45,146	45,398	63,423	69,647	82,744	76,466	67,010	64,332
Penang	18,530	16,838	19,908	19,258	21,684	18,731	N/A	N/A	N/A
All mills	134,436	173,318	159,166	184,594	236,065	226,342	143,040	176,198	167,296

Appendix 15: Sugar tonnes 94 N.T equivalent per hectare (tsh)										
Mills	**Average for period of five seasons**					**Last five seasons individually**				
	1991/ 1995	**1996/ 2000**	**2001/ 2005**	**2006/ 2010**	**2011/ 2015**	**2014**	**2015**	**2016**	**2017**	**2018**
Lautoka	6.2	5.6	4.9	4.4	4.9	6.9	5.9	4.0	8.4	10.5
Rarawai	6.3	5.6	5.4	4.0	4.9	5.6	5.2	2.6	8.7	11.2
Labasa	6.0	5.0	5.0	4.0	5.1	5.6	6.4	5.7	9.3	9.3
Penang	5.5	5.4	4.7	5.4	5.5	6.5	5.2	NIL	5.7	NIL
Average	6.1	5.4	5.1	4.3	5.1	6.1	5.8	3.9	8.0	10.3

Appendix 16: Length of season (weeks) - Start and finish of crushing (date)

Mills	Average length of season (5 yearly)					Last four seasons individually			
	1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2015	2016	2017	2018
Lautoka	28.0	29.7	27.6	27.0		21.0 02/07/15 To 24/11/15	21.0 20/06/16 To 16/11/16	19.1 06/06/17 To 17/10/17	24 09/07/18 To 17/10/18
Rarawai	25.3	26.5	24.2	28.0	22.1	19.4 23/06/15 To 28/10/15	19.0 20/07/16 To 31/11/16	20.5 07/06/17 To 28/10/17	22.9 17/07/18 To 24/12/18
Labasa	29.4	30.7	24.1	25.9	18.7	19.2 17/06/15 To 28/10/15	20.4 16/06/16 To 06/11/16	24.4 01/06/17 To 19/11/17	26 19/06/18 To 12/12/18
Penang	21.5	26.2	20.4	22.5	18.1	15.9 29/06/15 To 19/10/15	 No crushing	 No crushing	 No crushing
All mills	26.1	28.2	24.1	25.9		18.9	20.1	21.3	24.3

Appendix 17: Varieties Percent of hectares harvested

	Lautoka		Rarawai		Labasa		Penang		All Mills	
Varieties	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Ragnar	0.6	1.5	0.4	0.3	21.0	20.2	1.2	0.7	5.8	5.7
Waya	0.0	0.1	0.1	0.3	6.4	5.4	0.4	0.1	1.7	1.5
Mali	0.0	0.0	0.5	0.3	9.7	8.9	0.1	0.1	2.5	2.3
Galoa	0.2	0.7	0.0	0.0	5.9	5.5	0.1	0.0	1.6	1.6
Aiwa	0.7	0.0	0.6	0.3	0.2	0.1	0.1	0.0	0.4	0.1
Mana	91.0	90.6	89.5	90.3	0.0	2.7	94.6	96.5	68.8	70.0
LF91-1925	1.5	0.4	1.2	1.0	2.2	0.0	0.0	0.0	1.3	0.4
Kaba	2.5	2.7	6.3	6.0	0.5	0.5	0.3	0.2	2.4	2.4
Vatu	0.0	0.1	0.0	0.0	12.4	10.3	0.4	0.0	3.1	2.6
Beqa	0.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Naidiri	2.4	2.1	1.0	1.2	40.7	45.4	0.0	2.2	11.7	12.7
Kiuva	0.5	0.4	0.0	0.0	0.5	0.3	2.8	0.0	0.0	0.2
Qamea	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Viwa	-	-	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1
Exp.	-	-	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other var.	0.4	0.0	0.3	0.3	0.5	0.5	0.1	0.1	0.3	0.2

Appendix 18: Area planted in hectares as % of registered and cultivated areas

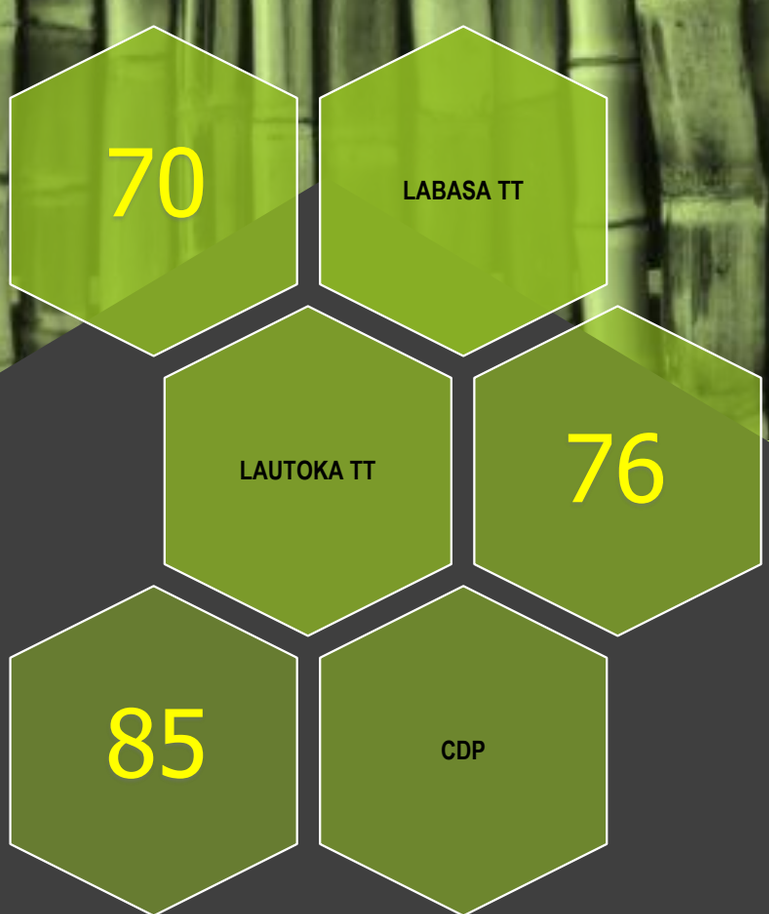
Mills	Hectares planted			Hectares planted as % of registered area			Hectares planted as % of cultivated area		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Lautoka	753	892	861	3.3	3.9	3.7	6.7	8.1	7.8
Rarawai	1450	2163	1706	6.6	9.8	7.7	12.4	18.2	15.6
Labasa	1567	2160	2035	11.1	11.2	10.2	11.3	15.2	13.3
Penang	248	418	476	3.1	5.2	5.9	7.0	12.2	13.6
Total	4018	5634	5077	5.6	7.8	6.9	9.8	14.0	12.5

Appendix 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
2016		-	-	0.3	3.8	-	-	-	-	-	-
2017	Ragnar	0.2	1.7	0.1	1.8	13.5	291.0	-	-		
2018		0.2	2.1	-	-	8.3	169.4	-	-	3.4	171.5
2016		-	-	1.1	15.8	-	-	-	-	-	-
2017	Waya	-	-	0.2	4.0	1.8	38.7	-	-		
2018		-	-	0.2	2.6	2.0	40.8	-	-	-	-
2016		-	-	85.5	1240.7	-	-	-	-		
2017	Mana	93.2	831.4	92.7	2005.5	-	-	88.5	370.0		
2018		96.3	829.4	97.7	1666.5	-	-	94.4	449.3	58.0	2945.2
2016		-	-	-	-	-	-	-	-	-	-
2017	Galoa	0.0	0.4	-	-	3.7	79.8	-	-		
2018		-	-	-	-	2.8	57.8	-	-	1.1	57.8
2016		-	-	-	-	-	-	-	-	-	-
2017	Vatu	-	-	-	-	12.4		-	-		
2018		-	-	-	-	4.8	97.8	-	-	1.9	97.8
2016		-	-	-	-	-	-	-	-	-	-
2017	Mali	-	-	-	-	5.2	112.7	-	-		
2018		-	-	-	-	3.0	60.8	-	-	1.2	60.8
2016		-	-	0.6	8.3	-	-	-	-		
2017	Aiwa	0.6	5.7	0.0	1.0	0.4	0.0	-	-		
2018		0.3	2.4	0.2	3.2	0.0	0.2	-	-	0.1	5.8
2016		-	-	-	-	-	-	-	-		
2017	Beqa	-	-	-	-	0.0	0.0	-	-		
2018		0.1	0.7	-	-	-	-	-	-	0.0	0.7
2016		-	-	8.4	121.8	-	-	-	-		
2017	Kaba	0.8	7.4	5.2	112.2	0.3	6.4	-	-		
2018		0.5	4.1	1.8	30.0	0.2	4.4	-	-	0.8	38.5
2016		-	-	1.9	28.0	-	-	-	-		
2017	Naidiri	3.6	32.5	1.1	24.3	62.3	1347.0	8.8	36.8		
2018		0.8	7.1	0.0	0.6	72.7	1478.8	5.6	26.9	29.8	1513.4
2016		-	-	-	-	-	-	-	-		
2017	Kiuva	-	-	-	-	0.2	5.3	-	-		
2018		0.0	0.3	-	-	0.4	8.1	-	-	0.2	8.4
2016		-	-	1.3	19.0	-	-	-	-		
2017	LF91-1925	0.8	7.2	0.4	7.9	6.3	136.0	0.4	1.8		
2018		0.7	6.2	0.1	1.3	4.8	98.1	-	-	2.1	105.6
2016		-	-	-	-	-	-	-	-	-	-
2017	Qamea	-	-	-	-	-	-	-	-	-	-
2018		-	-	0.1	1.6	0.5	11.1	0.0	0.4	0.3	13.8
2016		-	-	0.9	13.0	-	-	-	-		
2017	Experiment	-	-		-	-	-	-	-	-	-
2018		-	-			-	-				
2016		-	-	-	-	-	-	-	-	-	-
2017	Others	0.5	4.1	0.3	6.5	1.1	23.2	-	-		
2018		-	-	-	-	-	-	-	-	-	-

Appendix 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	2010	3,964	1.0	129,410	25.0	394,094	75.0	527,468	100
	2011	9,491	1.5	144,569	22.2	498,273	76.4	652,333	100
	2012	2,065	0.4	113,819	23.6	365,599	75.9	481,483	100
	2013	12,464	1.7	168,852	23.3	544,730	75.0	726,046	100
	2014	1,436	0.3	116,328	22.4	402,500	77.4	520,264	100
	2015	nil	nil	111,036	21.3	410,029	78.7	521,065	100
	2016	50	0.0	85,410	22.9	286,831	77.0	372,291	100
	2017	168	0.0	73,141	17.0	356,261	82.9	429,570	100
	2018	nil	nil	70,995	15.5	386,486	84.5	457,481	100
Rarawai	2010	25,106	5.0	126,450	24.0	370,460	71.0	522,016	100
	2011	23,586	3.6	332,792	50.1	307,396	46.3	663,774	100
	2012	14,772	3.6	106,393	24.9	387,485	71.4	508,650	100
	2013	22,054	6.3	104,779	30.2	220,584	64.0	347,417	100
	2014	14,006	2.2	113,691	18.0	468,653	79.8	596,350	100
	2015	12,032	2.5	93,635	19.1	385,098	78.5	490,765	100
	2016	8,189	3.0	45,598	16.6	221,077	80.4	274,864	100
	2017	5,577	1.4	52,370	12.8	349,914	85.8	407,861	100
	2018	1,132	0.2	67,303	14.0	411,190	85.7	479,625	100
Labasa	2010			171,042	34.0	383,485	66.0	554,527	100
	2011	nil	nil	162,856	29.0	407,610	71.0	570,466	100
	2012	840	0.2	117,543	28.4	294,902	71.4	413,285	100
	2013	nil	nil	137,018	25.1	409,138	75.0	546,156	100
	2014	nil	nil	149,353	27.4	395,000	72.6	544,353	100
	2015	nil	nil	181,420	27.4	481,180	72.6	662,600	100
	2016	nil	nil	178,355	26.0	508,736	74.0	687,091	100
	2017	12,012	1.8	130,502	19.3	533,217	78.9	675,731	100
	2018	nil	nil	164,846	26.6	455,482	73.4	620,328	100
Penang	2010			44,447	25.0	131,254	75.0	175,701	100
	2011	nil	nil	55,422	26.5	153,438	73.5	208,860	100
	2012	nil	nil	38,712	27.0	104,856	73.0	143,568	100
	2013	nil	nil	40,797	26.0	118,923	75.0	159,720	100
	2014	nil	nil	36,454	21.3	134,760	78.7	171,214	100
	2015	nil	nil	31,707	18.6	138,422	81.4	170,129	100
	2016	nil	nil	nil	nil	91,806	100.0	91,806	100
	2017	nil	nil	nil	nil	118,231	100.0	118,231	100
	2018	nil	nil	nil	nil	139,938	100.0	139,938	100
All mills	2010	29,070	1.6	471,349	26.5	1,279,293	72.0	1,779,712	100
	2011	33,077	1.6	695,639	33.2	1,366,717	65.2	2,095,433	100
	2012	17,677	1.1	376,467	24.3	1,152,842	74.5	1,546,986	100
	2013	8,630	2.0	451,446	26.2	1,293,375	74.1	1,779,339	100
	2014	15,442	0.8	415,826	22.7	1,400,913	76.5	1,832,181	100
	2015	12,032	0.7	417,798	22.7	1,414,729	76.6	1,844,559	100
	2016	8,239	0.5	309,363	21.7	1,108,450	77.7	1,426,052	100
	2017	1,776	1.1	256,013	15.7	1,357,623	83.7	1,631,393	100
	2018	1,132	0.1	303,144	17.9	1,393,096	82.1	1,697,372	100

Appendix 21: Percentage burnt cane of total tonnes crushed										
Year	Lautoka		Rarawai		Labasa		Penang		Average	
	%	Total	%	Total	%	Total	%	Total	%	Total
1981	17.6	1,444,504	21.2	1,248,910	19.4	930,265	17.0	307,753	18.8	3,931,432
1982	23.2	1,507,831	24.8	1,100,133	13.6	1,140,552	13.2	326,348	18.7	4,074,864
1983	18.3	639,823	18.4	561,774	18.0	761,454	12.0	239,482	16.7	2,202,533
1984	25.1	1,731,580	8.2	1,146,140	12.9	1,136,737	10.0	382,030	14.1	4,396,487
1985	28.6	947,593	25.2	864,264	22.4	934,166	16.2	296,418	23.1	3,042,441
1986	29.5	1,526,648	15.1	1,204,661	15.1	1,017,372	11.3	360,284	17.8	4,108,965
1987	23.8	1,090,111	34.2	685,994	20.9	877,652	19.0	306,706	24.5	2,960,463
1988	37.7	1,116,916	15.2	742,128	16.0	1,034,788	19.2	291,440	22.0	3,185,272
1989	20.6	1,537,337	13.6	1,250,977	12.7	974,201	10.0	336,418	14.2	4,098,933
1990	24.3	1,347,531	30.4	1,148,070	13.7	1,171,817	14.6	348,110	20.8	4,015,528
1991	42.5	1,112,957	46.4	961,961	32.0	1,029,223	27.6	276,261	37.1	3,380,402
1992	52.5	1,109,778	52.1	962,936	44.4	1,162,108	41.1	297,818	47.5	3,532,640
1993	35.6	1,341,537	33.4	1,013,627	29.2	1,124,357	19.4	224,383	29.4	3,703,904
1994	39.0	1,337,977	36.0	1,104,246	27.0	1,298,285	19.8	323,743	30.5	4,064,251
1995	43.4	1,515,880	42.5	1,044,098	37.6	1,216,290	28.7	333,790	38.1	4,110,058
1996	54.8	1,561,446	48.1	1,229,978	39.9	1,238,443	33.2	349,348	44.0	4,379,215
1997	50.7	1,160,879	49.1	906,495	33.5	910,137	34.8	302,095	42.0	3,279,606
1998	67.0	625,763	67.7	406,811	54.5	832,622	44.6	232,825	58.5	2,098,021
1999	41.6	1,433,143	39.8	992,968	17.0	1,192,735	26.3	339,292	32.4	3,958,138
2000	56.1	1,301,752	54.6	1,251,282	37.8	911,370	49.0	322,475	50.6	3,786,879
2001	56.7	906,743	50.3	844,411	18.9	845,444	49.5	208,183	42.9	2,804,781
2002	46.8	1,137,123	41.8	1,071,579	21.4	938,450	33.9	275,431	37.1	3,422,583
2003	40.1	890,499	32.8	836,728	29.3	638,851	22.0	243,602	33.4	2,609,680
2004	42.7	1,032,127	39.5	878,121	18.3	848,533	35.5	242,408	34.3	3,001,189
2005	44.4	890,779	38.4	761,704	25.0	910,663	34.9	225,594	35.7	2,788,740
2006	60.5	1,051,097	58.5	1,039,474	34.4	871,031	46.5	264,498	51.7	3,226,100
2007	39.0	741,231	40.5	738,478	39.1	769,138	53.5	229,844	40.8	2,478,691
2008	50.9	770,569	53.6	732,165	49.1	604,314	48.5	214,572	51.1	2,321,620
2009	43.5	726,046	33.3	659,351	18.6	679,584	28.8	181,650	31.8	2,246,631
2010	30.4	527,663	33.6	522,114	18.6	554,575	16.3	175,701	25.0	1,780,053
2011	28.5	652,333	28.2	663,774	17.9	570,468	26.6	208,860	25.3	2,095,435
2012	43.8	481,483	44.7	508,638	18.7	413,285	28.3	143,568	35.9	1,546,974
2013	77.8	726,046	31.9	347,417	14.2	546,156	27.0	159,720	37.7	1,779,339
2014	50.7	520,264	49.9	596,350	22.0	544,353	28.0	171,214	39.9	1,832,181
2015	47.0	244,680	48.5	238,167	27.7	183,840	31.0	52,688	39.0	719,375
2016	75.7	281,824	89.7	242,008	81.6	220,034	50.2	85,336	74.3	829,202
2017	24.9	214,336	20.9	170,472	30.5	206,433	34.3	40,552	34.3	40,552
2018	64.2	293,513	57.8	365,936	28.9	274,535	60.9	85,262	55.6	943,378

3.0 TECHNOLOGY TRANSFER



Summary

Technology transfer is a critical function in delivering research outcomes to the farmers and millers. The success of the scheme is to bring about a long-term commitment and collaboration between growers, research scientists and extension personnel in assisting growers to adopt best management practices in order to raise cane and sugar yield on their farms. The major challenges for the institute is to disseminate the techniques developed by the research team for the farmers. Under the Technology/Knowledge Transfer programs the following activities are undertaken SRIF portrays the solutions of the issues under concern through establishment of Grower Demonstration Trials, establishment of Green Manure Trials, Field Information Days, Seed Cane Production, Tissue Culture and distribute Factsheets. Attending to farmer queries and complaints is also a part of SRIF's on-going activities. The new systems and methods developed by our institute takes into consideration the cost: benefit ratio and the impact it has on the environment.

3.1. LABASA TECHNOLOGY TRANSFER

The major challenge for the institute is to disseminate the techniques developed by the research team for the farmers. The major issues in today's farming is depleting soil health, weed management, use of appropriate varieties, adaptation to new machineries and their operations. SRIF portrays the solutions of the issues under concern through planting demonstration plots and conducting field days in the sectors for the farmers.
These are effective tools through which we directly demonstrate the effectiveness as well as the benefits of new and improved technologies, which can be used to enhance sugarcane productivity, profitability and sustainability.

3.1.1 LABASA GROWER DEMONSTRATION

A total of eleven demonstration plots were planted in 2018. Seven field days have been conducted in the sectors. The demonstrations conducted in Vanua Levu covered several topics such as: Varieties, Integrated weed management, Mechanization and Inter-cropping.

Varieties

Varieties play vital role in the production of quality sugar. 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. Three field days were conducted in Bulivou, Solove and Natua sector in Seaqaqa. 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.

Figure 1: Farmers observing Viwa variety in Solove sector, Labasa

Figure 2: Farmers at the Qamea & Naidiri demonstration plot in Bulivou sector, Labasa

Figure 3: Farmers viewing Qamea variety and its characteristic in Natua sector, Labasa

Integrated weed management

Weed management is a very important cultivation aspect towards good yield. Timely weeding and application of Pre and post emergent weedicides is very vital for sugarcane growth. To create awareness amongst growers on the importance of integrated weed management, two field days were conducted.

Figure 4: Farmers having a discussion on IWM in Waiqele sector, Labasa

Figure 5: Farmers at an IWM field in Bucaisau sector, Labasa

Farmers visiting the integrated weed management field to witness the effects of timely weed management. The fields were applied with pre-emergence weedicide after planting and then post emergence weedicide after 8 weeks of planting. Followed by one round of tiller cultivation and spot weeding of para grass and guinea grass.

Figure 6: Field being planted using cutter planter in Bucaisau sector, Labasa

Mechanization

Farmers are turning to mechanization due to lack of labour force. SRIF at this standpoint educates farmers on machinery such as planters, boom sprayers, fertilizer applicators, mill mud, lime applicator and other implements that requires minimum labour to operate. A

demonstration was carried out at a farmer's field on how to use cutter planter and boom sprayer. This made farmers aware and interested in the machines and its capacities.

Figure 7: Field being Sprayed with pre-emergent herbicide in Bucaisau sector, Labasa

Figure 8: Farmers with cutter planter and boom sprayer demonstration in Bucaisau sector, Labasa

Inter-cropping

Soil fertility depletion is one of the leading factors responsible for low crop yields in Fiji. Decades of mono-cropping combined with poor management practices such as burning of trash, keeping ratoons for too long and over cultivation have contributed to poor soil fertility. This decline coupled with increasingly unfavourable weather and climate change poses a

threat to the sustainability of Fiji Sugar Industry. However, research has shown that Good agricultural practices, like the use of green manure crops increases soil fertility and crop yields. Hence, these are very promising tools for farmers to improve their soil fertility and adapt to changing climate. Sugarcane has been cropped as a mono crop for many years. Sugarcane is a heavy feeder of nutrients and thus it exhausts the soil when continuously mono-cropped. Soil is a living entity which needs time to replenish itself. This can be done by fallowing the land, adding organic amendments and inter-cropping with sugarcane crop. There was an inter-crop demonstration plot planted in Vunimoli sector. The growers were shown how cowpea was planted in between the rows with sugarcane without having any effects on germination and growth stages of the cane, in addition to this, the benefits of planting legumes on soil health was highlighted.

Figure 9: Cowpea inter-cropping with sugarcane in Vunimoli sector, Labasa

Figure 10: Discussion on inter crop demonstration at farmer's house in Vunimoli sector, Labasa

3.2. LAUTOKA TECHNOLOGY TRANSFER

3.2.1 LAUTOKA GROWER DEMONSTRATION

Improving Soil Health: Green Manure Trials

Green manure or cover crops play a major role in improving soil fertility and farm productivity. This type of manure refers to as cover crops or plants that are grown between the main crops and during fallow periods to improve the quality of the soil. Legumes such as urd, moong and cowpea are planted, to ensure adequate supply of good quantities of nitrogen into the soil. This is through fixation of nitrogen in the roots of these legumes. When ploughed back into the soil, the legumes ensure nitrogen and other nutrients are recycled (returned) into the soil. The nutrients are released slowly to the soil as the dead plants rot. Since legumes grow fast, they accumulate a lot of biomass within a short time that slowly improves soil organic matter content.

In 2018, 3 Green Manure trials were planted. Two in SRIF Drasa estate and one in Nadi district. Before planting soil samples was taken and analysed. Results showed that the soil from these three sites had very low organic matter content(less 2%). To achieve good yield and for sustainability, soils should have 4 to 10 % organic matter. Green Manure is one of the means to improve soil health, however subsequent practices such as Green Cane harvesting, trash conversation, and soil conservation needs to be aligned.

Grower Demonstration Trials and Field information's days

The following Topics was covered, in the 10 Grower Demonstrations trials and respective field days, which were held;

- Importance of improving Soil Health through Green Manuring
- Good Land Preparation and Soil Sampling
- Quality Seedcane.
- Sugarcane Varieties.
- Mechanical Planting of Sugarcane using whole stalk cane planter.
- Mechanical spraying (pre-emergence and Post emergence).
- Importance of Blend A and Blend B application.
- Importance of changing farm layout to suit mechanical harvesting.
- Benefits of using Mill mud.
- Integrated weed Management
- Timeliness of operations
- Benefits of intercropping
- Irrigation

Figure 1: Good Land preparation Demonstration in Raviravi, Drasa sector.

Figure 2: Quality Seedcane harvested from Hot water treated Mother Plot.

Figure 3: Demonstration of Mechanical Planter in farm # 10726 in Nawaicoba Sector.

Figure 4: Mechanically planted sugarcane in farm # 10726 in Nawaicoba sector at 6 months

Figure 5: Demonstration of pre-emergence application using a Boom Sprayer in farm # 8087 in Raviravi, Drasa Sector.

Figure 6: Growers observing a method of Green Manure incorporation using cotton King in Drasa estate

Figure 7: Growers witnessing Viwa variety during a field day in Qeleloa Sector, Farm # 2426

Figure 8: Demonstration of mill mud spreader in Drasa sector

Figure 9: Weed free farm achieved through Integrated weed Management (IWM) in Drasa sector

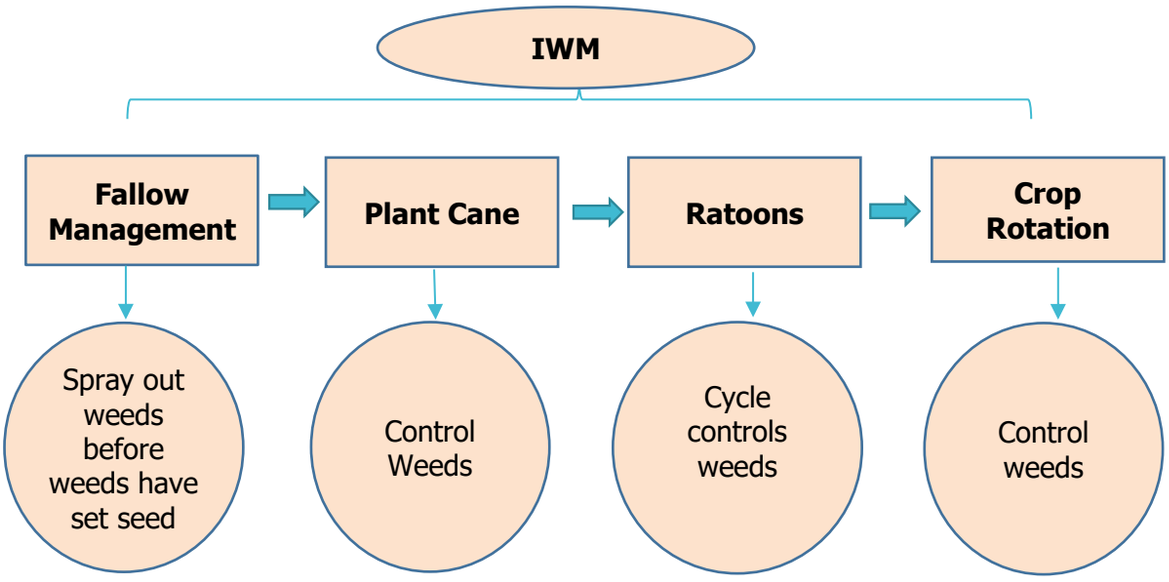


Figure 10: Integrated Weed Management Chart

Summary of Grower Demonstration Trials

The table below summaries the grower demonstration trials that was carried out in 2018:

- 10 trials conducted; in addition to this, 3 Green Manure trials were conducted.
- Approximately 400 growers attended the demonstration trial field days
- 6 technology transfer meetings were held in Lautoka and Nadi, a total of 108 growers attend during the evening meetings.

Table 1: Summary of grower demonstration trials

No	Sector /Location	Topic	Theme/attendance
1.	Drasa SRIF Estate	Green Manure Farm Mechanization	Importance of improving soil health, Farm Mechanization
2.	Drasa, Farm # 8087 Raviravi	Integrated Weed Management	Importance of Land preparation Timely weed control
3.	Meigunyah, Farm #: 2140 Nasau	Green Manure and Varietal Spread	Importance of improving soil health Varietal Spread 51 farmers attended the field day
4.	Qeleloa, Farm # 2426 Qeleloa	Farm Mechanization + Varietal Spread	Mechanical planting Varietal Spread Timely planting and operations 55 farmers attended the field day
5.	Nawaicoba Farm # 10726 Nawaicoba	Varietal Spread	Mechanical planting Weed control Varietal Spread 100 farmers attended the 2-field day organized on this farm.
6.	Olosara Farm # 5695 Nawamagi	Intercropping/ Sugarcane Varietal Spread	Field day pending, to be held in 2019
7.	Lomawai Farm # 11237 Tuva	Sugarcane Varietal Spread	Field day pending, to be held in 2019
8.	Olosara Farm # 5533	Intercropping/	Field day pending, to be held in 2019
9.	Lovu Farm # 19085 Vitogo	Farm Mechanization	Field day pending, to be held in 2019
10.	Lovu Farm #18162 Anjaan Road	Mill mud trial	Field day pending, to be held in 2019
11.	Natova Farm # 866	Intercropping	Field day pending, to be held in 2019

Trash Conservation

The depleting soil health and crop productivity in the sugarcane cultivating areas of Fiji is a major concern. This is evident from the national sugarcane productivity average being close to 44ton/hectare in the last couple of years compared to its potential yield of about 65 - 80

ton/hectare. Although soil fertility is closely linked to the physical and chemical characteristics of the environment, it is strongly, influenced by human management practices. One such detrimental practice followed by farmers in Fiji is burning of trash after harvesting of sugarcane.

It is estimated that about 7 to 12 tons (depending on Variety) of trash can be obtained from 1 ha of sugarcane. Every ton of sugarcane trash contains about 5.4 kg N, 1.3 kg P_2O_5, and 3.1 kg K_2O and small quantities of micronutrients. However, when sugarcane trash is burnt, most of the organic matter and nutrients in the trash are lost, leading to environment pollution. Farmers usually burn trash with the opinion that its management is laborious, trash will reduce germination, crop will be burned and it will hinder routine ratoon cultivation practices.

The trash/organic matter decomposition is mostly dependent on the carbon to Nitrogen ratio (C: N). When crop residues high in C: N ratio are added to the soil, extra N needs to be added to prevent immobilization in soil. This is known as Nitrogen factor. Nitrogen factor is, defined as the number of units of inorganic N that has to be supplied to 100units of organic material in order to prevent net immobilization of N from the soil (Source: University of New Castle). A trial was conducted in SRIF Drasa estate on trash conservation using urea to enhance the decomposition of trash using two different treatments. In treatment 1, 300 kg of Urea was applied in 600 litres of water per hectare.

This treatment was based using N factor as 2.29kg per every 100kg trash. Estimated amount of trash per hectare was estimated to be around 6000kg (6 tonnes). N content of Urea fertilizer is equal to 46% N. The second treatment was, based on a recommendation, from a farmer from New South Wales in Australia, Mr. Robert Quirk. According to him, in Australia there has been lot of studies done to ascertain the correct amount of Urea to be applied in sugarcane trash to enhance decomposition.

His recommendation was 5kg Urea in 300 Litres of water per hectare, the rate that he has been using on his farm for last 10 to 15 years. Three months after application, a physical observation was done, in the field to see the results of the two different treatments. Both treatments had similar outcomes, in terms of trash decomposition, however based on economics and risk of losing excess Nitrogen into the environment, 5kg Urea in 300 Litres of water per hectare is recommended, which is sufficient for enhancing trash decomposition.

Figure 10: Spraying of Urea in sugarcane trash immediately after harvest in Lovu sector

Figure 11: Trash decomposition (LEFT: Before & RIGHT: After)

Drip irrigation trial

In sugarcane, germination and grand growth phase are the two important periods, which requires more water. It needs about 1500-2500 mm of water throughout its growing period. In Fiji, we receive adequate rainfall during the **grand growth phase** of sugarcane as it falls between November, to April annually. Normally we receive 1800mm to 2200mm, of which 65 to 70 % is received between the months of November to April, which is simultaneous to the grand growing phase of sugarcane.

In recent years, Fiji has experienced some severe meteorological drought that affects the sugarcane during germination and tillering phase. As a result, it had a drastic impact on sugarcane yield.

Considering the average rainfall for the last 10 years for each mill area and National average, it is evident that we received adequate rainfall during the grand growth period (November to April). However, a lot of time, insufficient amount of rainfall is received during the planting and germination period, which is from May to October. This is one of the main reasons, desired yields are not achieved, which was planted through cane planting grants in previous years. A project on drip irrigation trial was initiated through partnership between Sugar Research Institute of Fiji, Fiji Sugar Corporation and Rivulis Australia. Rivulis is a global company and has a rich history in the irrigation industry with more than 50 years of expertise developing, manufacturing and deploying micro irrigation products and solutions. Rivulis Australia agreed to finance a 4ha drip irrigation trial in FSC Drasa Estate Farm.

Drip irrigation around the globe enables to double the yields (especially in India) while saving 20-40% water, 30% fertilizers compare to furrow irrigation. Furthermore, drip irrigation accounts for the improvement in sucrose content compared to conventional furrow and Overhead sprinkler irrigation. Drip system can be above surface or as sub-surface drip irrigation (SDI). The SDI is gaining more popularity as it is more suitable for ratoon crop and mechanical harvesting (Source: NaanDanJain Irrigation). However, it's noted that India receives half the quantity of annual rainfall, which Fiji receives. Supplementary irrigation is

needed during planting and germination phase which falls in the dry months from May to October annually.

A four-hectare drip irrigation in FSC Drasa Estate, which was, established in early November, comprised of the following treatments:

- 1.5 ha Plant cane on 1.5 m T-Tape spacing using 715-30-250 (one tape per row of cane).
- 1.5 ha Plant cane on 3m T-Tape spacing using 715-20-500 (one T-Tape / 2rows of cane).
- 1 ha Ratoon cane on 1.5 m T-Tape spacing (one T-Tape / row cane).
- 0.12ha plant cane on Gravity system with 1 tape per 2 rows.

Figure 12: Drip irrigation in plant sugarcane at the FSC Estate Drasa.

The sugarcane from this trial will be harvested in the coming year and a detailed report will be prepared together with cost benefit analysis, to ascertain the Return on Investment. Once the report is finalized, SRIF will be in better position to make further recommendations regarding adoption of Drip irrigation system for Fiji Sugar Industry.

3.3 CANE DEVELOPMENT PROGRAMME

A collaboration project with the Fiji Sugar Cooperation (FSC) started in October, 2017. Meetings were conducted between stakeholders to discuss the way-forward of the joint project. It was discussed that FSC will provide SRIF with 4 nil producers per sector. Activity started with sector level introductory visits. Gang and locality meetings were also attended with FSC extension team. Any issues/queries/questions raised by the grower were noted and

addressed immediately. The main objective was to increase sugarcane production from the present 40 tons/ha to at least 70tons/ha. Of all the farms selected and monitored by both FSC and SRIF, only 29% of the farmers succeeded in establishing cane on their fields. These nil producers had other factors that affected the uptake of advice given, such as dispute over land, lack of labour and the diversion of tenants to other industries.

3.3.1 LAUTOKA

A total of 24 farms have been visited within Lautoka District, comprising of Drasa, Lovu, Lautoka, Saweni and Natova sectors. Five farms have completed land preparation and planting through the help of Sugarcane Development and Farmer Assistance Grant. The common observations amongst farms visited is summarised in the table below;

Table 1: Common observations amongst farms visited
Farmer is not interested in cane farm.
Farmer is elderly but has shown interest in mechanical cultivation of cane.
Farmer has planted cane and has been advised on weed control measures.
Gap filling and appropriate weed control will be communicated to the farmer.
Farmer has joined cooperative and would be utilizing contractor to plant cane in her farm.
Farmer does not have access to labours.
Cane is damaged by animals from neighbouring farm
Farmer works full time and is unable to look after farm.
Farmer has no access to farm machinery.

3.3.2 LABASA

SRIF was involved in giving technical advice together with FSC staffs and follow-up was done with the farm's operation. Nil producing farmers in Labasa have either abandoned their land and settled elsewhere or have considered sugarcane farming a secondary source of income. It is challenging for both SRIF and FSC to bring these farmers into production. FSC has started a joint venture program to bring the farms into production where possible. The common observations amongst farms visited is summarised in the table below;

Table 2: Common observations amongst farms visited
Farmer carrying out harvesting
Farmer has planted cane and has been advised on weed control measures & fertilizer application
Neither planting nor harvesting carried out
Farmer committed to planting but waiting for favourable weather

3.3.3 PENANG

Five farms were identified under the crop development program in Penang district. During the visits, the farmers were advised on quality seed cane, timely fertilizer application, weed management, soil health management and varietal spread. The common observations amongst farms visited is summarised in the table below;

Table 3: Common observations amongst farms visited
Farmer carrying out harvesting
Farmer has planted cane and has been advised on weed control measures & fertilizer application
Joint venture farming

4.0 SRIF ESTATES

4.1 DRASA ESTATE

The total cane produced in 2018 was 1808 tonnes from an area of 26.5 hectares giving an yield of 68.2 tph. Harvesting was carried out mechanically. 96.7% of cane was harvested green. 3.28% cane was sent burnt due to accidental fire. The following table summarises the harvesting carried out in Drasa Estate from 2016-2018.

Table 1: Harvesting summary – Drasa Estate

Year	Total tons	Burnt	%Burnt	Green	%Green	Rail	%Rail	Lorry	%Lorry	Area (ha)	Tph
2016	1219	17	1	1202	99	0	0	1219	100	33	36
2017	1565	0	0	1565	100	0	0	1565	100	31	50
2018	1808	59	3	1749	97	236	13	1572	87	28	65

5.7 hectares of cane was planted for seed cane nursery comprising of Qamea, Viwa, Kaba and Mana varieties. 0.6 hectares were utilized for planting variety research trial.

4.2 LABASA ESTATE

The major objective of the Labasa estate land is to produce hot water treated seed cane for the farmers. By establishing seed bed that will ensure no unapproved and mixture of the varieties are planted by the farmers. Labasa has an area of 13 hectares of land for research trials and hot water treated seed cane, out of which 8 hectares was fallowed and has been used for hot water treated seed bed planting for the year 2018 – 2019 season. Total of 405 tonnes of cane was sent to mill for crushing.

Table 2: Harvesting summary – Labasa Estate

Year	Total tons	Burnt	%Burnt	Green	%Green	Rail	%Rail	Lorry	%Lorry	Area (ha)	Tph
2016	773	505	60	267	40	-	-	-	100	10	77
2017	654	218	30	437	70	-	-	-	100	8	82
2018	405	148	30	257	70	-	-	-	100	7	58

The growth of the seed cane was affected by drought but recovered during the rainy season. Hot water treated seed cane should be available to the farmers in the coming planting season. An area of 3.7 ha has been fallowed for the establishment of the hot water treated seed bed with a further 3.0 ha that has been cultivated for 2nd ratoon which will be used for seed cane in the March – April planting window of 2019. An estimated 150 tonnes of seed cane will be available from this area. A total area of 6.7 ha was fallowed for seed bed that was planted during Oct - Nov, 2018 season with the hot water treated seed cane.

Batanikama farm

During 2018, 0.5 ha of hot water treated seed bed had been established. The rest of the land is used for stage 4 seed bed and stage 4 trials when required. Around 2 ha of land is under commercial cane.

Outsource

SRIF provided services in Land preparation and cutter planting. In 2018, fifteen farmers acquired the services from SRIF and 27.15ha was planted.

5.0 MEDIA & PUBLICATION

5.1 MEDIA

Media department is responsible for marketing SRIF's activities to all stakeholders. This involves updating SRIF's website with current research, developing videos and pamphlets. Information packages involving videos and pamphlets are provided to growers during the information day. Information packages are also given to school students during educational tours to the institute. Two videos were developed on leaf sampling and improving soil health through green manuring. Videos on cane diseases including Smut, cane grub and Fiji Disease are being complied and will be published to the website. The institute has a Facebook account that provide updates on a daily basis.

Figure 1: Sample social media platform presence of SRIF

6.0 APPROVED VARIETIES FOR 2019 PLANTING

The list of sugarcane varieties approved for planting has been revised to include maturity trends. Varieties that are no longer planted have been removed from the approved varieties list. The varieties are recommended to growers on their soil type. The growers have a choice of at least three varieties to plant on their farms as laid down in 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

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

Mill/Sectors	Soil types	Varieties recommended on maturity trends	
		Early – mid maturing	Mid – late maturing
Rarawai/Yaladro	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
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
Labasa/Labasa	Flat Fertile soils	Aiwa, Beqa,Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
Labasa/Labasa	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

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

7.0 ABBREVIATIONS

SRIF	-	Sugar Research Institute of Fiji
FSC	-	Fiji Sugar Corporation Ltd
SIT	-	Sugar Industry Tribunal
SCGC	-	Sugar Cane Growers Council
SCGF	-	Sugar Cane Growers Fund
MoS	-	Ministry of Sugar
SPF	-	South Pacific Fertilizers
FMS	-	Fiji Meteorological Services
EU	-	European Union
CIRAD	-	Centre de coopération internationale en recherche agronomique pour le
POCS or pocs	-	Pure obtainable cane sugar
SUC or Suc	-	Sucrose
NPK	-	Nitrogen, Phosphorus, Potassium
N	-	Nitrogen
P	-	Phosphorus
K	-	Potassium
RCBD	-	Randomized Complete Block Design
Rep	-	Replication
Trt or Trts	-	Treatment(s)
Tph or Tpha	-	Tonnes cane per hectare
Tsh or Tsha	-	Tonnes sugar per hectare
TC/TS or tc/ts	-	Tonnes cane per tonnes sugar (tonnes of cane required to produce 1 ton of sugar)
AVG./Avg.	-	Average
LF[YEAR]	-	Lautoka Fiji [year in which the fuzz was planted], e.g. LF2014
G x E	-	Genetic by Environment
FFE	-	Farmer Feel Effect
QBPS	-	Quality Based Payment Scheme
FSI	-	Fijian Sugar Industry
ASPAC	-	Australian Soil and Plant Analysis Council
LBC	-	Lime Buffering Capacity
FTIR	-	Frontier Transform Infra-Red
CQD	-	Cane Quality Department
IMG	-	Industry Management Group
UV-VIS	-	Ultra violet visible light spectrum
RMSECV	-	Root Mean Square Error of Cross validation
SOI	-	Southern Oscillation Index
ENSO	-	El Niño Southern Oscillation
IWM	-	Integrated Weed Management
BAF	-	Biosecurity Authority of Fiji

8.0 GLOSSARY

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.
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.
Germplasm	A collection of clones that has recorded desirable traits such as high fiber, disease tolerant, etc.
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.
Ratoon	Commonly referred to the sugarcane crop that established or grew after the initial plant crop was harvested.
Breeding Plots / Flowering Beds	Small areas planted with sugarcane for the purpose of harvesting flowers from.
Gene Pool	Basically, referring to the Germplasm from a genetics point of view.
Standards	Sugarcane varieties that have already been released to growers to plant for commercial use.
Brix	Measure of dissolved solids in sugar juice, liquor or syrup using a refractometer.
G X E trials	Genetic by Environment trials to test the interaction of the genetic attributes of varieties against environmental conditions.
Supply	The term is normally used when "supplying" seedcane referring to sugarcane field that have
Phytotoxic	Poisonous to plants.
Farmorganix/Stand Up SummaGrow	Brand names of new organic fertilizers being tested at SRIF.
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.
%brix	Total soluble solutes in cane juice
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.
%pol	Percent total sucrose in cane juice
Fiber	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.
%fiber	Percent of fiber present in sugarcane
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.
%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 fiber 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.
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.
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.
CQD	The body within the Fiji Sugar Industry Tribunal charged with implementing the QBPS procedures.
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.
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.
Nematology	The scientific study of nematode worms.
Pathology	The science of the causes and effects of diseases

9.0 FINANCIAL REPORT

Sugar Research Institute of Fiji

Financial Statements

For the year ended 31 December 2018

Sugar Research Institute of Fiji

Contents

Sugar Research Institute of Fiji

Directors' Report

Board report

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 2018 and the related statement of profit or loss and comprehensive income and statement of cash flows for the year ended on that date and report as follows:

Board members

The Board members in office during the year end at the date of this report are:
Professor Rajesh Chandra - Chairman (re-appointed 2 March 2018)
Dr K.S Shanmugha Sundaram (term expired on 1 March 2018)
Mr Daniel Elisha (term expired on 1 March 2018)
Mr Sundresh Chetty (term expired on 1 March 2018)
Mr Graham Clark
Ms Reshmi Kumari
Dr Sanjay Anand
Mr Raj Sharma (appointed on 12 June 2018)
Mr Ashween Nischal Ram (appointed on 18 June 2018)
Professor Ravendra Naidu (appointed on 13 March 2018)

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 2018 and the accompanying statement of profit or loss and other comprehensive income and statement of cash flows give a true and fair view of the results and cash flows 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.

At the date of this report, the Directors are not aware of any circumstances which would render the values attributable to the current assets in the financial statements to be misleading.

Receivables

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

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

Related party transactions

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

Sugar Research Institute of Fiji

Directors' Report (continued)

Other circumstances
At the date of this report, the Directors are not aware of any circumstances not otherwise dealt with in this report or financial statements which would render any amounts stated in the accounts to be misleading.

Unusual circumstances
The results of the Institute's operations during the financial year have not in the opinion of the Directors been substantially affected by any item, transaction or event of a material and unusual nature other than those disclosed 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 the Government, 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 has a positive working capital of $6,477,683 after excluding deferred income of $12,458,893 (2017: $7,114,808 after excluding deferred income of $11,144,379).

Accordingly, these financial statements have been prepared on a 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 liabilities that may be necessary should the Institute be unable to continue as a going

Events subsequent to balance date
There has not arisen in the interval between the end of the year and the date of this report any item, transaction or event of a material and unusual nature likely, in the opinion of the Board Members, to affect significantly the operations of the Institute, the results of those operations or the state of affairs of the Institute in subsequent financial years.

Dated at Lautoka this 15th day of July 2019 .

Signed in accordance with a resolution of the Board.

Chairman **Board member**

Independent Auditors' Report

To the Board Members of Sugar Research Institute of Fiji

Report on the Audit of the Financial Statements

Opinion

We have audited the accompanying financial statements of Sugar Research Institute of Fiji ("the Institute"), which comprise the statement of financial position as at 31 December 2018, the statements of profit or loss and other comprehensive income and cash flows for the year then ended, and notes, comprising significant accounting policies and other explanatory information as set out in notes 1 to 19.

In our opinion, the accompanying financial statements give a true and fair view of the financial position of the Institute as at 31 December 2018, 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 the International Standards on Auditing (ISAs). Our responsibilities under those standards are further described in the *Auditors' Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Institute in accordance with International Ethics Standards Board for the Accountants Code of Ethics for professional Accountants (IESBA Code) and the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements and the IESBA Code. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information

Management is responsible for the other information. The other information comprises the information included in the Directors' report, but does not include the financial statements and our auditors' 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 and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on 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.

Independent Auditors' Report

To the Board Members of Sugar Research Institute of Fiji (Continued)

Report on the Audit of the Financial Statements (Continued)

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation of financial statements that give a true and fair view in accordance with IFRS for SMEs and for such internal control as management determines 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 is 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 either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so.

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

Auditors' 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 auditors' 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 International Standards on Auditing (ISAs) will always detect a material misstatement when it exists. Misstatements can arise from fraud or 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 these financial statements.

As part of an audit in accordance with ISAs, we exercise professional judgment 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.

Independent Auditors' Report

To the Board Members of Sugar Research Institute of Fiji (Continued)

Report on the Audit of the Financial Statements (Continued)

Auditors' Responsibilities for the Audit of the Financial Statements (Continued)

- Conclude on the appropriateness of 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 a material uncertainty exists, we are required to draw attention in our auditors' 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 auditors' 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 identify during out audit.

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 purposes of our 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 knowledge 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.

KPMG

15th July, 2019

Nadi, Fiji

KPMG

Chartered Accountants

Sugar Research Institute of Fiji
Statement of profit or loss and other comprehensive income
For the year ended 31 December 2018

	Note	2018 $	2017 $
Contributions and grants	3	3,457,237	2,347,161
Estate income		174,951	245,496
Other income	4	137,411	6,709
Total income		3,769,599	2,599,366
Cost of operations	5	(2,624,869)	(1,394,434)
Administrative expenses	6 (a)	(1,161,750)	(1,244,297)
Deficit from operations		(17,020)	(39,365)
Finance income	7	17,739	39,365
Finance expense		(719)	-
Deficit before tax		-	-
Income tax benefit		-	-
Balance at the beginning of the year		-	-
Deficit for the year		-	-

The notes on pages 9 to 20 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Statement of financial position
As at 31 December 2018

	Note	2018	2017
Assets		$	$
Current assets			
Cash and cash equivalents	11	1,339,941	2,240,430
Receivable and prepayments	12	204,710	77,098
Receivable from related parties	16 (b)	7,345,857	7,167,499
Total current assets		8,890,508	9,485,027
Non-current assets			
Property, plant and equipment	9	5,979,253	4,027,118
Intangible assets	10	1,957	2,453
Total non-current assets		5,981,210	4,029,571
Total assets		14,871,718	13,514,598
Liabilities			
Current liabilities			
Deferred income	13	12,458,893	11,144,379
Employee benefits	14	32,165	18,716
Trade and other payables	15	114,975	85,818
Payable to related parties	16 (c)	2,265,685	2,265,685
Total current liabilities		14,871,718	13,514,598
Total liabilities		14,871,718	13,514,598

Signed on behalf of the board

Chairman

Board Member

The notes on pages 9 to 20 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Statement of cash flows
For the year ended 31 December 2018

	Note	2018 $	2017 $
Operating activities			
Receipts from stakeholders and donors		4,772,793	1,916,203
Payment to suppliers and employees		(3,379,672)	(2,341,717)
Interest received		17,739	32,756
Net cash from / (used in) operating activities		1,410,860	(392,758)
Investing activities			
Acquisition of property, plant and equipment	9	(2,341,158)	(359,845)
Payment for intangible assets	10	-	(2,453)
Proceeds from sale of property, plant and equipment		29,809	-
Net cash used in investing activities		(2,311,349)	(362,298)
Net decrease in cash and cash equivalents		(900,489)	(755,056)
Cash and cash equivalents at the beginning of the year		2,240,430	2,995,486
Cash and cash equivalents at the end of the year	11	1,339,941	2,240,430

The notes on pages 9 to 20 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Notes to and forming part of the Financial Statements
For the year ended 31 December 2018

1. General Information

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, Fiji.

The functions of the Institute are outlined under 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.

2. Basis of preparation and accounting policies

(a) Statement of compliance

The financial statements have been prepared in accordance with International Financial Reporting Standard for Small and Medium-Sized Entities ("IFRS for SMEs") as adopted by the International Accounting Standards Board (IASB).

These financial statements are the first financial statements for the Institute to be prepared in accordance with IFRS for SMEs, previously the financial statement was prepared in accordance with IFRS.

An explanation on the transition to IFRS for SMEs and the impact of the previously reported numbers is provided in Note 18.

The financial statements were authorised for issue by the Board on 15th July, 2019.

(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 the Government, 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 has a positive working capital of $6,477,683 after excluding deferred income of $12,458,893 (2017: $7,114,808 after excluding deferred income of $11,144,379)

Accordingly, these financial statements have been prepared on a 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 liabilities that may be necessary should the Institute be unable to continue as a going concern.

(c) Basis of measurement

The financial statements have been prepared on the historical cost basis and do not take into account changing money values or except where stated, current valuations of non-current assets.

2. Basis of preparation and accounting policies (continued)

(d) Functional and presentation currency

The financial statements are presented in Fiji dollars, rounded to the nearest dollar, which is the Institute's functional currency, unless otherwise indicated.

(e) Foreign currency transactions

Transactions in foreign currencies are translated to Fiji dollars at exchange rates at the dates of the transactions. Monetary assets and liabilities denominated in foreign currencies at the reporting date are retranslated to Fiji dollars at the exchange rate at that date. The foreign currency gains or losses on translation are recognised in profit or loss.

(f) Property, plant and equipment

Recognition and measurement

Items of property, plant and equipment are measured at cost less accumulated depreciation and impairment losses. Cost includes expenditure that is directly attributable to the acquisition of the asset. Any gain and loss on disposal of an item of plant and equipment (calculated as a difference between net proceeds from disposal and carrying amount of the item) is recognised in profit or loss.

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 and 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.

Depreciation

Depreciation is calculated to write off the costs of 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 or loss. The estimated useful lives of property, plant and equipment for current and comparative periods are as follows:

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

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

2. Basis of preparation and accounting policies (continued)

(g) Intangible assets

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.

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

(h) Cash and cash equivalents

Cash and cash equivalents comprises cash at bank and cash on hand.

(i) 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.

(j) Trade and other payables

Trade and other payables are obligations on the basis of normal credit terms and do not bear interest.

(k) 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 whenever 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 does exceed the carrying amount that would have been determined, net of depreciation or amortisation, if no impairment loss has been recognised.

(l) 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. It is then recognised in the profit or loss as grant income on a systematic basis as the Institute recognises expenses by achieving the relevant conditions of the grant.

2. Basis of preparation and accounting policies (continued)

(l) Contributions and grants (continued)

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 expenses.

(m) Employee benefits

Superannuation

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

Employee entitlements

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

Short-term benefits

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

(n) Receivable from related parties

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

(o) Comparative figures

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

3. Contributions and grants

Contributions from stakeholders and grants that compensate the Institute for revenue and capital expenditure are recognised from deferred income as follows:

	2018	**2017**
	$	**$**
Contribution from the Fiji Government	594,366	544,795
European Union	1,674,139	712,776
Fiji Sugar Corporation (FSC)	594,366	544,795
Sugar Cane Growers	594,366	544,795
	3,457,237	2,347,161

	2018	2017
4. Other income	**$**	**$**
Gain on sale of fixed assets	29,809	-
Outsource income	107,322	-
Others	280	6,709
	137,411	6,709
5. Cost of operations		
Advertising	1,511	1,468
Amortisation	496	27
Bank charges	5,451	5,205
Consultancy fees	21,015	-
Depreciation	389,023	306,026
Electricity	47,568	39,777
EU Cost	1,316,042	454,146
Communication expenses	26,188	31,607
Material costs	37,484	24,422
Motor vehicle running expenses	107,194	156,357
Repairs and maintenances	108,607	8,729
Subcontract expenses	203,295	75,822
Travel	-	400
Wages and salaries (refer note 6(b))	360,995	290,448
Total cost of operations	2,624,869	1,394,434
6. Expenses		
(a) Administrative expenses		
Auditors remuneration	9,500	9,500
Accounting fees	35,060	40,627
Accommodation and meals	8,534	2,163
Annual leave expense	13,449	7,554
Board allowance	14,959	10,926
Cleaning and Landscaping	10,444	-
Office security	52,465	48,526
Office supplies	21,774	-
Director's fees	78,935	79,109
Fiji National Provident Fund contributions	105,028	96,437
Freight	56,942	35,648
Fringe benefit tax	6,531	13,174
General expenses	13,011	142,141
Hire of services	-	4,503
ICT consumables	-	4,561
Balance carried forward	**426,632**	**494,869**

6. Expenses (continued)	2018	2017
	$	$
(a) Administrative expenses (continued)		
Balance carried forward	**426,632**	**494,869**
Insurance	46,443	60,241
Legal fees	183	750
Land rent	12,419	-
Loss on disposal	-	19,276
Medical expense	6,086	546
Media and publication	17,753	2,335
Other expenses	10,603	4,579
Postage	623	897
Repair and maintenance	39,867	2,119
Rent expense	16,372	63,241
Staff expenses	12,736	-
Stationery	5,155	998
Training and Productivity Authority of Fiji	8,773	8,821
Travel	7,026	-
Utilities	9,587	4,641
Wages and salaries (refer note 6(b))	541,492	580,984
	1,161,750	1,244,297
(b) Personnel expenses		
Fiji National Provident Fund contributions	**105,028**	**96,437**
Training and Productivity Authority of Fiji	**8,773**	**8,821**
Key management compensation - short term benefits	**99,326**	**99,687**
Wages and salaries	**803,161**	**771,745**
	1,016,288	**976,690**
7. Finance income		
Interest received	**17,739**	**39,365**

8. Income tax benefit

In 2012 the Fiji Revenue and Customs Services confirmed that the entity is not subject to income tax.

9. Property, plant and equipment

	Land and building	Fixtures and fittings	Plant and equipment	Motor vehicles	Computers	Work in Progress	Total
	$	$	$	$	$	$	$
Cost							
Balance at 1 January 2017	2,877,822	130,939	2,002,944	1,203,909	357,634	-	6,573,248
Acquisitions	-	9,181	226,689	116,752	7,223	-	359,845
Transferred during the year	(20,835)	-	-	-	-	-	(20,835)
Balance at 1 January 2018	2,856,987	140,120	2,229,633	1,320,661	364,857	-	6,912,258
Acquisitions	-	22,199	703,545	317,459	63,040	1,234,915	2,341,158
Disposal	-	-	-	(53,633)	-	-	(53,633)
Balance as at 31 December 2018	2,856,987	162,319	2,933,178	1,584,487	427,897	1,234,915	9,199,783
Depreciation							
Balance at 1 January 2017	165,378	40,530	975,233	1,114,152	285,380	-	2,580,673
Depreciation charge	32,223	11,452	211,855	28,310	22,186	-	306,026
Disposal	(1,559)	-	-	-	-	-	(1,559)
Balance at 1 January 2018	196,042	51,982	1,187,088	1,142,462	307,566	-	2,885,140
Depreciation charge	31,875	13,706	236,003	76,768	30,671	-	389,023
Disposal	-	-	-	(53,633)	-	-	(53,633)
Balance at 31 December 2018	227,917	65,688	1,423,091	1,165,597	338,237	-	3,220,530
Carrying amount							
At 1 January 2017	2,712,444	90,409	1,027,711	89,757	72,254	-	3,992,575
At 1 January 2018	2,660,945	88,138	1,042,545	178,199	57,291	-	4,027,118
At 31 December 2018	2,629,070	96,631	1,510,087	418,890	89,660	1,234,915	5,979,253

10. Intangibles

	Software	Total
Cost	**$**	**$**
Balance at 1 January 2017	-	-
Acquisition	2,480	2,480
Balance at 1 January 2018	2,480	2,480
Acquisition	-	-
Balance at 31 December 2018	2,480	2,480
Accumulated amortisation		
Balance at 1 January 2017	-	-
Amortisation	27	27
Balance at 1 January 2018	27	27
Amortisation	496	496
Balance at 31 December 2018	523	523
Carrying amounts		
At 1 January 2018	2,453	2,453
At 31 December 2018	1,957	1,957

	2018	2017
11. Cash and cash equivalents	$	$
Cash at bank	1,339,889	2,240,420
Cash on hand	52	10
Cash and cash equivalents in the statement of cash flows	1,339,941	2,240,430

12. Receivables and prepayments

Trade receivables	14,046	-
Staff advances	1,327	24,458
Deposits	4,506	2,750
VAT receivable	178,222	43,281
Interest receivable	6,609	6,609
	204,710	77,098

Staff advances are recovered through payroll deductions.

13. 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 movement in deferred income is as follows:

13. Deferred income (continued)	**2018**	**2017**
	$	**$**
Balance at the beginning of the year	11,144,379	10,393,323
Funds received or receivable during the period	5,101,854	3,400,418
Utilised during the period	(3,787,340)	(2,649,362)
Balance at 31 December	12,458,893	11,144,379
This is comprised as follows:		
Fiji Government	67,732	145,471
Fiji Sugar Corporation (FSC)	6,399,043	6,297,062
Sugar Cane Growers	2,700,000	2,700,000
European Union grant	2,834,061	1,869,154
Estate income	248,515	130,834
Insurance income	1,759	1,858
Other income	207,783	-
	12,458,893	11,144,379

14. Employee benefits		
Balance at 1 January	18,716	11,162
Provision created / utilised during the year	13,449	7,554
Balance at 31 December	32,165	18,716

15. Trade and other payables		
Trade payables	42,010	25,200
Other payables	72,965	60,618
	114,975	85,818

16. Related parties

Related parties of the Institute include key stakeholders in the Fiji Sugar Industry, namely, the Government of Fiji, Fiji Sugar Corporation, 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 following are the Board members of the Institute during the financial year:
Professor Rajesh Chandra - Chairman (re-appointed 2 March 2018)
Dr K.S Shanmugha Sundaram (term expired on 1 March 2018)
Mr Daniel Elisha (term expired on 1 March 2018)
Mr Sundresh Chetty (term expired on 1 March 2018)
Mr Graham Clark
Ms Reshmi Kumari
Dr Sanjay Anand
Mr Raj Sharma (appointed on 12 June 2018)
Mr Ashween Nischal Ram (appointed on 18 June 2018)
Professor Ravendra Naidu (appointed on 13 March 2018)

16. Related parties (continued)	**2018**	**2017**
	$	**$**
(b) Amounts receivable from related parties		
Fiji Sugar Corporation - grant income	6,424,999	6,267,499
- other income	20,858	-
Sugar Cane Growers	2,700,000	2,700,000
Allowance for uncollectability - Sugar Cane Growers	(1,800,000)	(1,800,000)
	7,345,857	7,167,499
Reconciliation of Allowance for Uncollectability		
Balance at the beginning of the year	1,800,000	1,800,000
Provision created during the year	-	-
Balance at the end of the year	1,800,000	1,800,000

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

	2018	**2017**
	$	**$**
(c) Amounts payable to related parties		
Fiji Sugar Corporation	2,265,685	2,265,685
	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 $4,159,314 as at 31 December 2018. Subsequent to year end 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 of Fiji 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 2018 is $4,159,314 and is reconciled as follows:

	$
Balance at 31 December 2017	4,001,814
Contributions during the year	900,000
Payments made in 2018	(742,500)
Balance at 31 December 2018	4,159,314

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.

16. Related parties (continued)

(e) Transactions with related parties	2018	2017
Deferred income	$	$
Grant income - Fiji Sugar Corporation	681,193	825,688
Grant income - Fiji Government	825,688	1,238,532
Grant income - Sugar Cane Growers	825,688	825,688
Estate income - Fiji Sugar Corporation	292,633	225,993
	2,625,202	3,115,901

(f) Key management personnel

Key management personnel include the Chief Executive Officer and Finance and Administration Manager of the Institute.

Transactions with 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 6(b).

17. Capital commitments and contingencies

Capital commitments and contingent liabilities as at 31 December 2018 amounted to $Nil (2017:

18. Explanation of transition to IFRS for SMEs

As stated in Note 2(a), these are the Institute's first financial statements prepared in accordance with IFRS for SMEs. In prior years, the Institute prepared its financial statements under IFRS.

The accounting policies set out in Note 2 have been applied in preparing the financial statements for the year ended 31 December 2018, the comparative information presented in these financial statements for the year ended 31 December 2017 and in the preparation of an opening IFRS statement of financial position at 1 January 2017 (the Institute's date of transition).

In preparing its opening IFRS for SME statement of financial position, there were no adjustments required by the Institute to the previously reported amounts in the financial statements in accordance with International Financial Reporting Standard (IFRS).

(a) Adjustments to statement of financial position as at 1 January 2017

There were no differences between the statement of financial position presented under IFRS for SMEs and the statement of financial position previously reported under IFRS.

(b) Adjustments to statement of cash flows for 2017

There were no differences between the statement of cash flows presented under IFRS for SMEs and the statement of cash flows previously reported under IFRS.

19. Events subsequent to balance date

There has not arisen in the interval between the end of the year and the date of this report any item, transaction or event of a material and unusual nature likely, in the opinion of the Board Members, to affect significantly the operations of the Institute, the results of those operations or the state of affairs of the Institute in subsequent financial years.

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