2016 Annual Report

PARLIAMENT OF FIJI

PARLIAMENTARY PAPER NO. 79 OF 2019

Foreword 2016

Severe tropical cyclone Winston was the main weather feature during the year. It was one of the most powerful cyclones ever recorded in Fiji. Winston was the first Category 5 cyclone to make a landfall in Fiji. Heavy downpours was associated with tropical cyclone Winston and Lautoka Mill recorded 281mm of rainfall over a 48 hour period between February 20th and 21st, followed by Penang Mill with 255mm. Consequently, this led to flooding in low-lying areas, especially over Viti Levu. The trail of destruction left behind by Winston was so great that a State of Natural Disaster was declared.

New sugarcane varieties are developed from the flowers and is a very complex work that requires a lot of patience. It takes more than 12 years to develop and release a new variety. There was no crossing in 2016 because the crossing shed was destroyed and the arrowing beds sustained excessive damage to stalks. Most of the breeding trials were extensively damaged and not evaluated.

A total of two thousand three hundred and seventy eight soil and twenty-five plant samples were analysed for fertilizer recommendations and research trials. In an effort to address soil health, the choice of cover crop to plant was initiated. Two crops (Mucuna and Black gram) were trialed. In the earlier days the cover crop Mucuna was extensively used and an experiment was designed to test the seed production potential of Mucuna on trellis and plants allowed to grow freely on the ground. The plants grown on trellis had a better seed production.

In another trial seeds of black and green gram were inoculated and planted. Due to poor rains after planting this crop did not grow well but it was incorporated into the soil and allowed to decompose. Soil samples taken from this field before planting and after incorporation did not show much difference in the analysis results.

The protection of the industry against diseases and pest incursions is a major responsibility of the Institute and so far the Institute has managed to keep the industry reasonably free of most of the major pests and diseases. Routine screening of Fiji leaf gall (FLG) disease continued during the year. One hundred eighty soil samples from the Lautoka and Rarawai mill areas were analysed for plant parasitic nematodes.

The rouging unit inspected 2809 farms covering an area of 7273 hectares and removed 1156 diseased FLG stools.

During the year, studies were initiated on isolation and multiplication of Nitrogen fixing bacteria. The dissemination of information continued in 2016 through the Technology Transfer program and 14 Field days were held during the year.

I acknowledge the contributions from all the staff in our substations and the head office for their support and commitment to the Institute and I would also like to thank the Chairman and other board members for their guidance and support.

Acting Chief Executive Officer

Prem N Naidu

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

Prof. Rajesh Chandra	- Chairman
Dr. Shanmugha Sundaram	- Member
Prof. Paras Nath	- Member
Mr. Daniel Elisha	- Member
Mr. Abdul Khan	- Member
Mr. Sundresh Chetty	- Member
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Mr. Sanjay Prakash	- Acting CEO

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Mr. Abdul Khan	- Member
Mr. Sundresh Chetty	- Member
Mr. Sanjay Prakash	- Acting CEO

PARLIAMENT OF FIJI

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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
MoSI	-	Ministry Of Sugar Industry
SPF	-	South Pacific Fertilisers
FMS	-	Fiji Meteorological Services
EU	-	European Union
CIRAD	-	Centre de coopération internationale en recherche agronomique pour le
POCS or pocs	-	Pure obtainable cane sugar
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
GDT	-	Grower Demonstration Trial

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1.1 Meteorology

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 reductions in rainfall over most of Fiji which can, especially during moderate to strong events, lead to drought.

La Niña is a sustained cooling of the Pacific Ocean. The cooling is usually accompanied by persistent positive values of SOI, and increase in strength of the trade winds, decrease in cloudiness and higher than average rainfall for most of Fiji with frequent and sometimes severe flooding, especially during the wet season (November to April).

January

January's weather was influenced by severe (Category 3) tropical cyclone Ula through the Southern Lau Group, Tropical Depression TD07F, moist easterly wind flow and trough of low pressure.

RAINFALL; it was still significantly *drier than the normal* over most places in the country, with more than half of the stations receiving less than half the normal January rainfall. Rarawai Mill recorded the second highest rainfall of 80.0mm

AIR TEMPERATURES; the average maximum temperature was above normal while the nighttime temperatures were above normal. The highest temperature recorded was 37.8°C while the coolest night recorded 16.1°C.

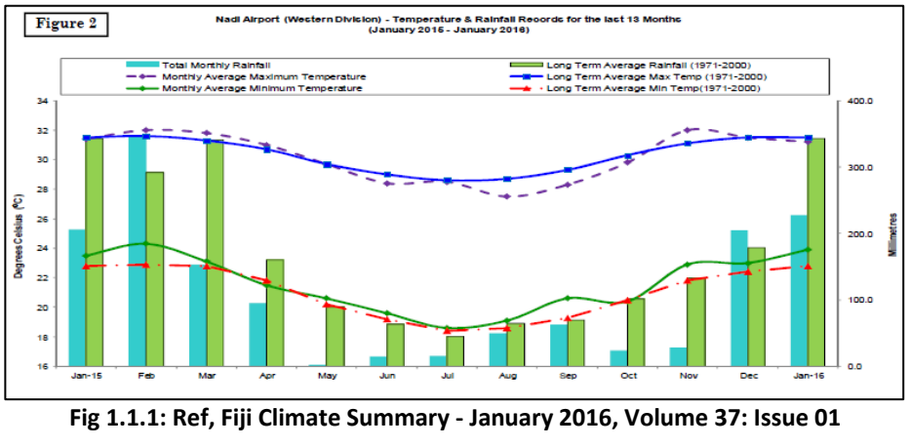

Fig 1.1.1: Ref, Fiji Climate Summary - January 2016, Volume 37: Issue 01

February

Severe tropical cyclone Winston was the main weather feature during the month. It was one of the most powerful cyclones ever recorded in Fiji. Winston was the first Category 5 cyclone to make a landfall in Fiji. Tropical cyclone Winston also resulted in some substantial rainfall over the country. Lautoka Mill recorded 281mm of rainfall over a 48-hour period between February 20 and 21, followed by Penang Mill with 255mm. Consequently, this led to flooding in low-lying areas.

RAINFALL; generally *average to above average* rainfall were observed during the month. Penang mill recorded 607.6mm of monthly rainfall while Lautoka recorded 535.5mm and Rarawai was at 501.8mm.

AIR TEMPERATURES; the average maximum temperatures were *above normal.* The highest maximum temperature recorded was 36.3°C. The nighttime temperatures during the month were rather high, with *above normal* temperatures recorded. The coolest night experienced 18.2°C.

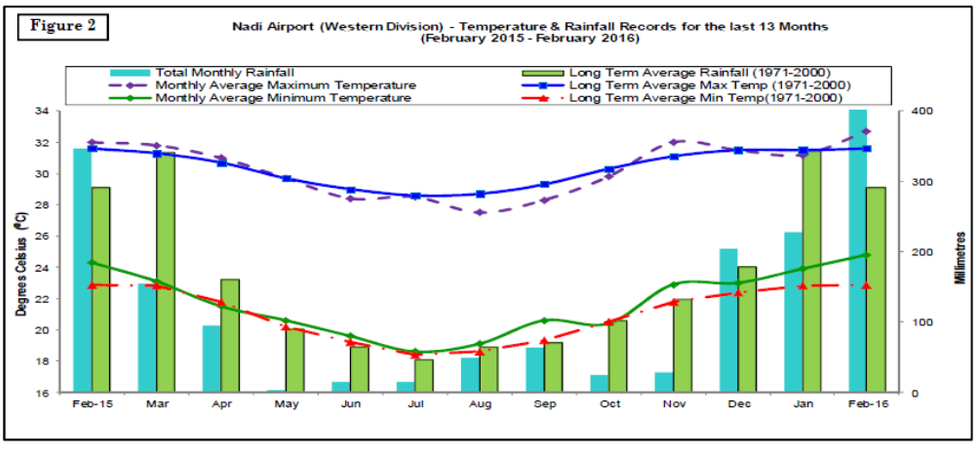

Figure 1.1.2: Ref, Fiji Climate Summary - February 2016, Volume 37: Issue 02

March

Hotter and drier than normal conditions were experienced during March after a wet February.

RAINFALL; generally *below average to well below average* rainfall was observed. Lautoka Mill recorded 286.6mm of rain.

AIR TEMPERATURES; The average maximum temperatures were *above normal* while the nighttime temperatures were generally *normal to above normal*. The highest maximum temperature recorded was 36.4°C while the lowest minimum temperature recorded was 16.8°C.

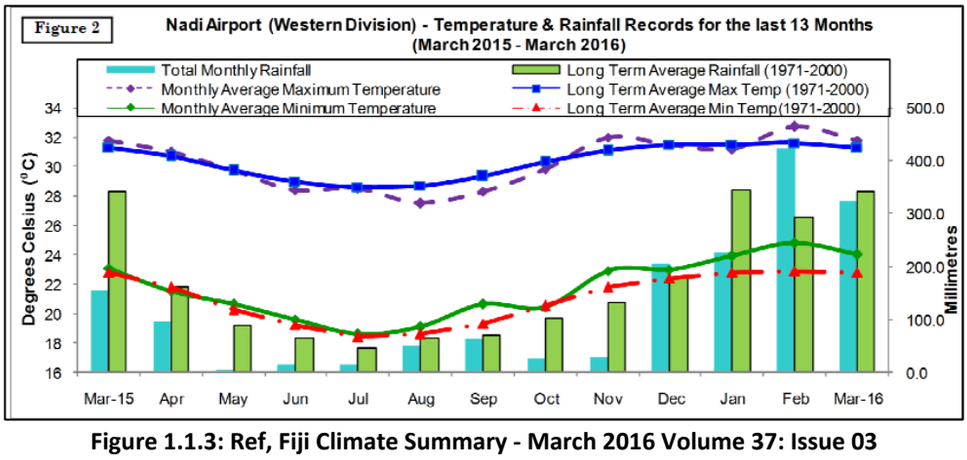

Figure 1.1.3: Ref, Fiji Climate Summary - March 2016 Volume 37: Issue 03

April

A number of tropical depressions including tropical cyclone "Zena" TD16F drove Fiji's weather during this period. It was a significantly wet month with *above average to well above average* rainfall recorded. Tropical depression, TD14F, resulted in torrential rainfall and Rarawai Mill recorded 457mm of rainfall over a 72-hour period.

RAINFALL; the daily maximum rainfall for Rarawai Mill and Penang Mill was 200.0mm and 181.0mm respectively on the 5th.

AIR TEMPERATURES; The average maximum air temperatures were generally *normal to below normal* while the minimum air temperatures were *above normal.* The highest maximum temperatures were at 33.5°C while the lowest nighttime temperature was at 16.3°C.

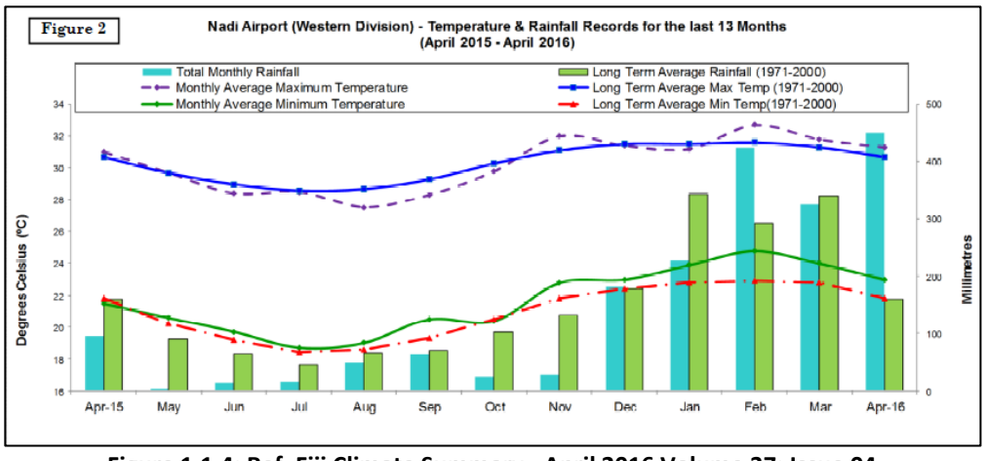

Figure 1.1.4: Ref, Fiji Climate Summary - April 2016 Volume 37: Issue 04

May

The weather and climate patterns in May were typical of transition from wet to dry conditions with wetter April and much drier May.

RAINFALL; was *below average to well below average.* Lautoka Mill recorded the second driest station with 6.6mm while Rarawai Mill recorded 13.6mm.

AIR TEMPERATURES; The average maximum temperatures were generally *normal to above normal* while the minimum temperatures were generally *normal to above normal*. The highest maximum temperature was 33.7°C while the lowest minimum temperature was at 11.6°C.

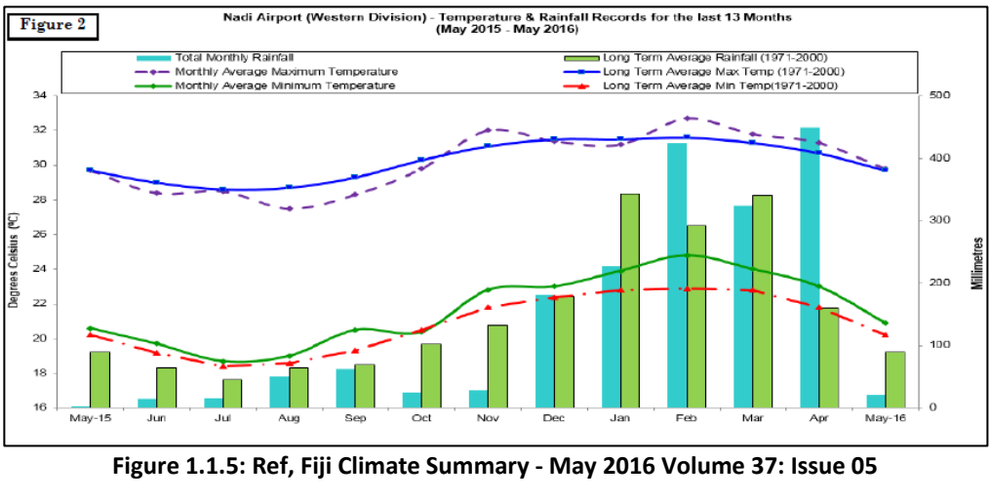

Figure 1.1.5: Ref, Fiji Climate Summary - May 2016 Volume 37: Issue 05

June

June was considerably *drier than normal* with generally *well below average to below average* rainfall recorded. Rainfall in the Western Division varied considerably and ranged from 26% to 97%.

RAINFALL; was generally *drier than normal* with *average to well below average* rainfall being recorded. Rainfall in the Western Division ranged from well below average to average with percent of normal rainfall ranging from 26% to 97%. The driest station during the month was Lautoka Mill with total monthly rainfall of 18.9mm.

AIR TEMPERATURES; The average maximum temperatures were generally *above normal* while the minimum temperatures were generally *normal to above normal.* The highest maximum temperature recorded was 33.1°C while the overnight temperature fell to 12.5°C

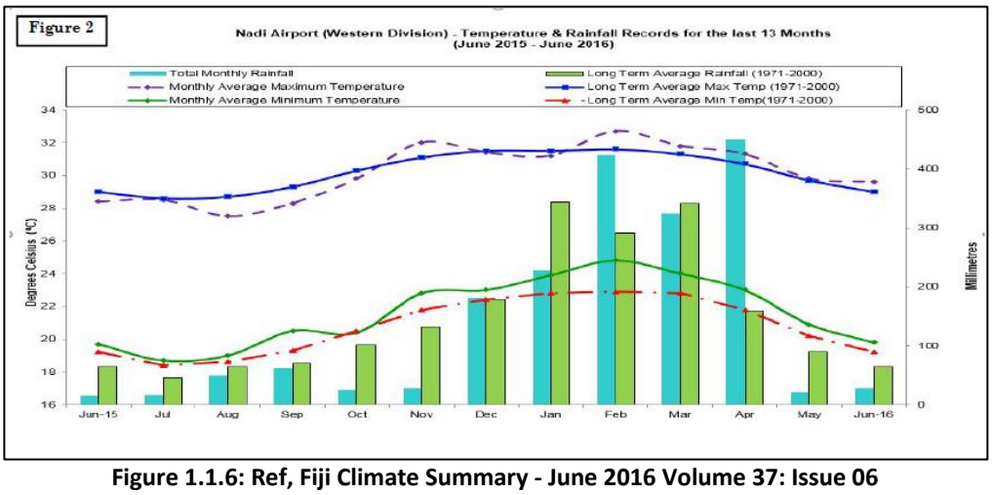

Figure 1.1.6: Ref, Fiji Climate Summary - June 2016 Volume 37: Issue 06

July

The trend of dry conditions continued during the month with stations receiving *below average to well below average* rainfall.

RAINFALL; the dryness was particularly notable over the Western Division with Lautoka Mill recording only 1 rain day (rainfall ≥0.1mm) and Rarawai Mill with 3 rain days. Rarawai Mill and Lautoka Mill registered 12mm and 6mm of rainfall respectively.

AIR TEMPERATURES; The average maximum temperatures were generally *normal to above normal* while the night-time temperatures were also generally *normal to above normal.* The highest recorded maximum temperature of 33.5°C was at Rarawai Mill while the lowest nighttime temperature recorded was 10.1°C.

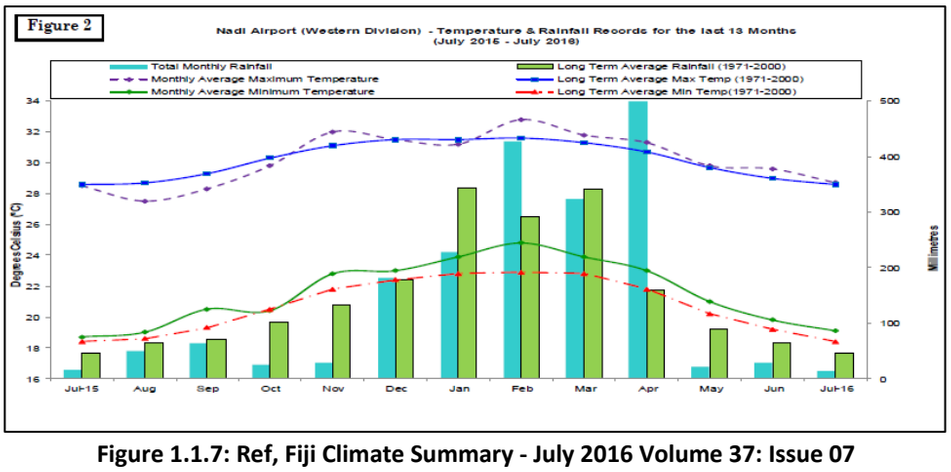

Figure 1.1.7: Ref, Fiji Climate Summary - July 2016 Volume 37: Issue 07

August

It was considerably wetter than usual August. Two rainfall events resulted in *above average to well above average* rainfall across the country.

RAINFALL; Dobuilevu recorded a total of 278mm in 4 days while in contrast, Rarawai Mill registered 163.9mm. Rarawai Mill recorded the least rain days of eight.

AIR TEMPERATURES; the average maximum temperatures varied across the country while most stations recorded above normal mean monthly minimum temperatures. The greatest maximum temperature recorded was 34.2°C and the lowest daily nighttime temperature recorded was 9.5°C.

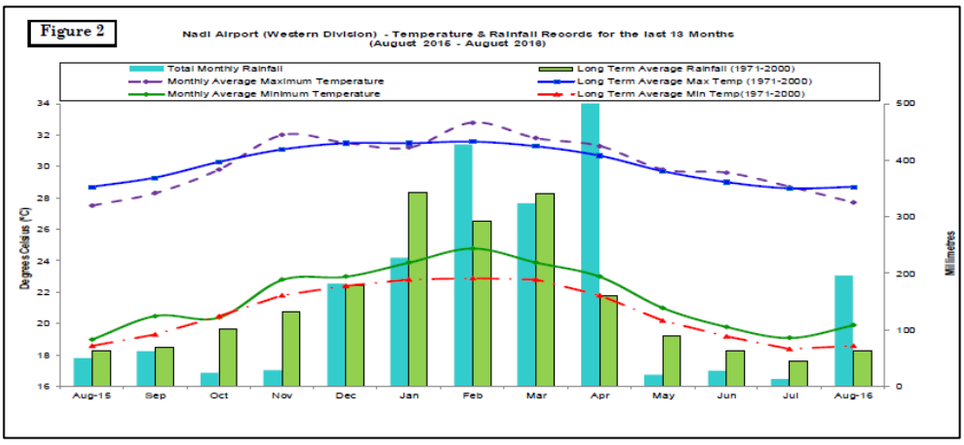

Figure 1.1.8: Ref, Fiji Climate Summary - August 2016 Volume 37: Issue 08

September

September was considerably drier than normal, observing well *below average* rainfall. Unusually hot days recorded at Penang and Rarawai with daytime temperatures exceeding 33.5°C.

RAINFALL; on the three month (3months) timescale, Dobuilevu and Penang were in meteorological drought warning stage.

AIR TEMPERATURES; both the average daytime temperatures and the average nighttime temperatures varied. The highest recorded maximum temperature of 33.9°C was at Rarawai Mill while the lowest nighttime temperatures were at 13.0°C.

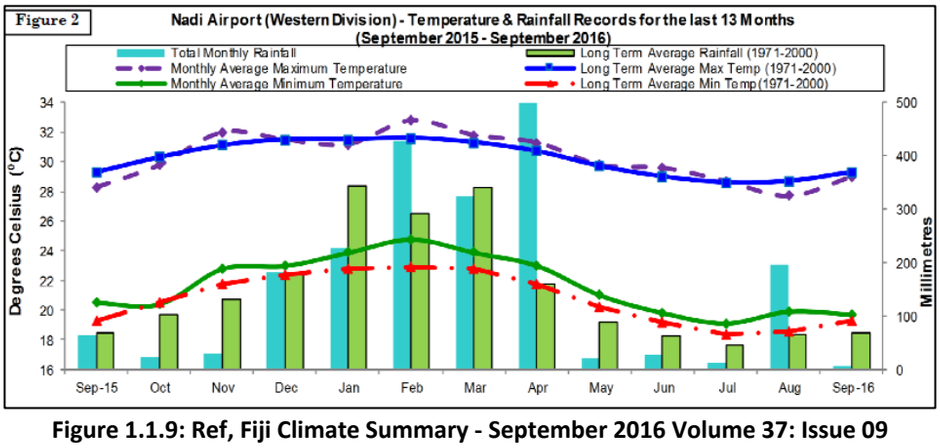

Figure 1.1.9: Ref, Fiji Climate Summary - September 2016 Volume 37: Issue 09

October

October was generally wetter than normal experiencing *average to well above average* rainfall.

RAINFALL; recorded monthly total rainfall between 300.0mm and 100.0mm

AIR TEMPERATURES; The day time temperatures were generally *above normal* while the night temperatures ranged from *normal to above normal*. The highest recorded maximum temperature of 34.4°C was at Rarawai Mill. The coolest night observed 14.0°C followed by Rarawai Mill with 16.9°C.

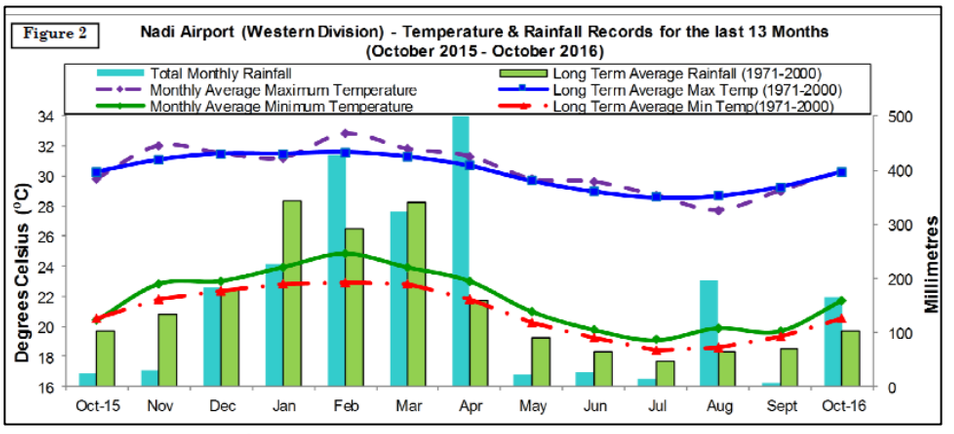

Figure 1.1.10: Ref, Fiji Climate Summary - October 2016 Volume 37: Issue 10

November

Drier than normal conditions returned following a wet October.

RAINFALL; drier than normal conditions returned in November, with *below average to well below average* rainfall. The monthly rainfall of Dobuilevu was 189.5mm while Lautoka and Penang recorded totals of more than 100mm.

AIR TEMPERATURES; the daytime temperatures were generally *above normal* while the night temperatures ranged from *normal to above normal.* The highest maximum temperature recorded was 37.1°C while the coolest night observed was at 13.2°C.

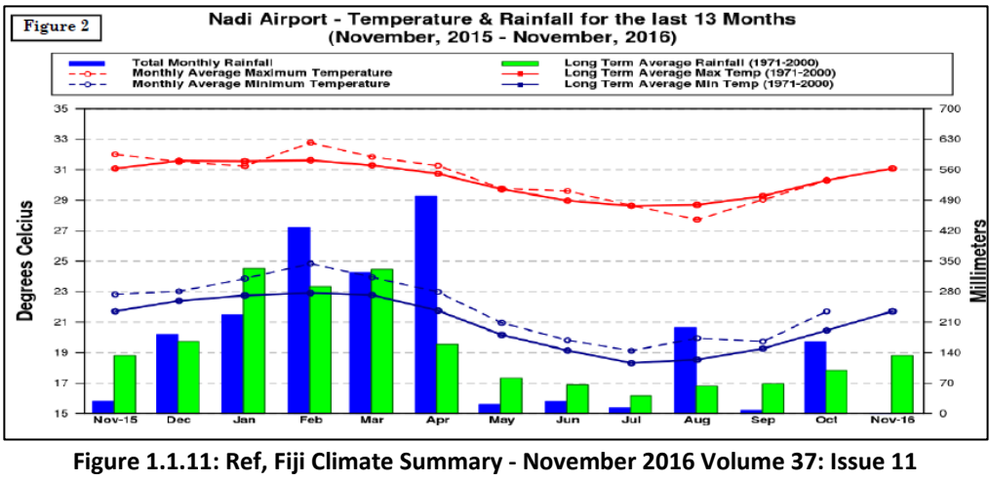

Figure 1.1.11: Ref, Fiji Climate Summary - November 2016 Volume 37: Issue 11

December

Neutral El Niño Southern Oscillation conditions persisted but some indicators were leaning towards a weak La Niña condition. Tropical Depression, TD04F, was the significant weather feature for the month causing an overwhelming amount of rainfall.

RAINFALL; significantly wetter than normal conditions were experienced, reporting well *above average* (>200% of normal) rainfall. Furthermore, new total monthly rainfall records established were at Dobuilevu.

AIR TEMPERATURES; generally, *normal* daytime temperatures were recorded while the night temperatures ranged from *normal to above normal.* The highest maximum temperature recorded was 38.0°C while Rarawai Mill was at 36.0°C and Lautoka with 35.0°C. The coolest night observed was 15.0°C and Rarawai Mill with 19.9°C.

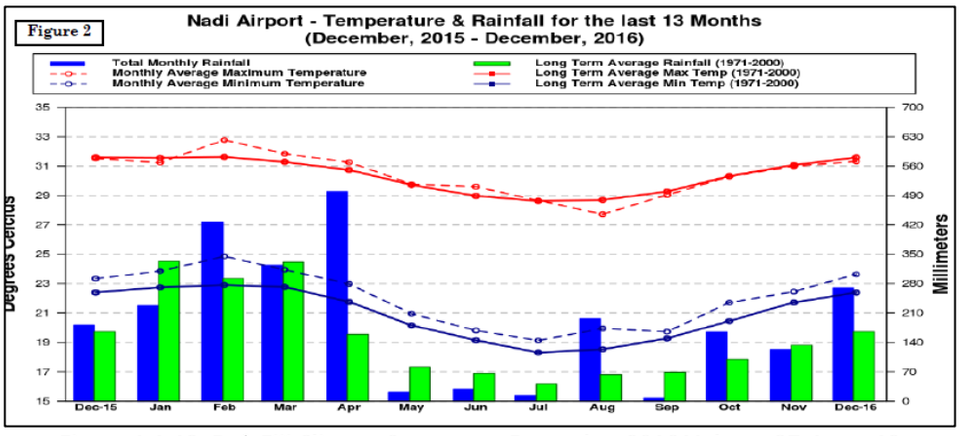

Figure 1.1.12: Ref, Fiji Climate Summary - December 2016 Volume 37: Issue 12

Rainfall

Fiji enjoys a tropical maritime climate without extremes of heat or cold. The peak period for cyclones in the region is usually from January to March. Last cyclone season, there were eight cyclones, one of which was TC Winston. Severe Tropical Cyclone Winston was the strongest tropical cyclone to make landfall in Fiji and the South Pacific Basin in recorded history. The annual average rainfall is usually in the range 2000mm to 3000mm. From table 1.1.1, the total rainfall for all mills was either, very close to, or in the annual average rainfall range.

Table 1.1.1: Rainfall (mm) figures for all mills

Lautoka Mill - 2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Avg.
Monthly rainfall	169	436	279	434	7	19	6	210	3	153	87	269	2072	319
No. of rain days	12	18	13	10	5	1	1	10	1	7	7	16	101	16
47 yrs. avg. (1970-2016)	367	321	318	195	88	70	52	72	76	100	136	196	1993	307
% of avg.	46	136	88	223	8	27	12	290	4	152	64	137	104	99
Rarawai Mill - 2016	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**	**Avg.**
Monthly rainfall	196	412	134	487	14	29	6	148	10	128	17	327	1908	294
No. of rain days	17	16	14	7	5	1	1	8	1	6	7	13	96	15
47 yrs. avg. (1970-2016)	379	352	358	199	93	79	40	66	75	106	151	240	2138	329
% of avg.	52	117	37	245	15	37	15	224	13	120	11	136	89	86
Penang Mill - 2016	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**	**Avg.**
Monthly rainfall	84	634	120	370	58	57	13		1	73	126	550	2086	348
No. of rain days	19	22	23	19	14	12	14	-	4	6	12	17	162	27
47 yrs. avg. (1970-2016)	419	356	360	257	151	95	50	68	86	110	151	266	2370	365
% of avg.	20	178	33	144	38	60	26	0	1	66	83	206	88	73
Labasa Mill - 2016	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**	**Avg.**
Monthly rainfall	4	0	257	560	1	22	1	203	0	104	111	510	1773	273
No. of rain days	2	0	15	16	2	2	1	12	0	6	9	17	82	13
47 yrs. avg. (1970-2016)	395	356	364	242	106	75	50	54	74	121	181	260	2278	350
% of avg.	1	0	71	232	1	29	2	378	0	86	61	196	78	87

Tables 1.1.2 to 1.1.5 below provides monthly rainfall figures for each sector per district wise in the sugarcane belt area for the past 5 years.

Table 1.1.2: Rainfall (mm) data for Lautoka Mill (2012 – 2016)														
Sectors	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Drasa	2012	1025	674	781	236	114	220	6	57	298	114	71	9	3605
	2013	221	1249	1495	34	104	151	18	35	48	75	363	356	4149
	2014	320	264	237	189	173	2	Nil	Nil	27	63	31	284	1590
	2015	242	357	212	109	1	2	21	60	77	2	-	-	1082
	2016	356	613	286	674	7	25	47	305	Nil	262	136	396	3106
Saweni	2012	547	255	131	87	54	207	63	41	213	95	25	118	1836
	2013	82	306	214	23	119	59	5	4	61	40	288	330	1531
	2014	355	228	163	238	201	Nil	Nil	Nil	20	46	86	237	1574
	2015	220	475	433	100	Nil	10	18	81	62	25	-	-	1423
	2016	149	834	428	937	8	37	5	313	23	202	91	485	3512
Natova	2012	875	428	248	224	142	285	72	41	210	96	119	333	3073
	2013	134	510	363	63	164	74	6	12	70	68	394	272	2130
	2014	446	241	200	122	157	2	4	Nil	10	48	124	124	1478
	2015	183	328	184	125	Nil	14	25	69	57	27	-	-	1012
	2016	229	396	460	539	4	22	10	238	22	186	-	286	2392
Legalega	2012	858	517	430	222	9	252	13	65	178	65	121	140	2870
	2013	67	468	391	101	84	124	12	7	170	124	262	256	2066
	2014	437	303	80	124	144	Nil	10	Nil	6	48	105	66	1323
	2015	187	420	214	99	Nil	16	26	54	75	34	-	-	1125
	2016	170	603	243	452	9	32	13	193	7	164	-	284	2170
Meigunyah	2012	885	545	483	223	25	320	17	49	190	68	127	119	3051
	2013	107	422	389	95	96	120	8	7	151	130	216	250	1991
	2014	418	305	99	114	131	Nil	10	Nil	6	26	103	54	1266
	2015	223	366	133	74	Nil	12	24	49	76	17	-	-	972
	2016	213	374	275	445	14	27	10	204	13	159	-	241	1974
Malolo	2012	1270	856	908	315	130	340	40	106	289	62	158	103	4577
	2013	184	593	570	235	150	140	8	27	156	126	393	480	3062
	2014	438	280	144	207	176	Nil	8	Nil	11	87	134	88	1573
	2015	305	410	299	119	Nil	8	35	64	103	18	-	-	1359
	2016	246	408	432	606	10	30	28	394	39	209	-	314	2713
Nawaicoba	2012	922	686	939	317	65	216	54	111	258	49	114	210	3941
	2013	183	481	429	114	107	66	8	14	78	68	293	375	2216
	2014	318	335	212	200	127	Nil	13	Nil	15	17	174	37	1448
	2015	195	215	123	84	Nil	4	46	83	75	24	-	-	849
	2016	274	345	213	519	14	43	16	244	9	123	-	219	2019
Yako	2012	761	532	779	215	23	337	35	93	246	57	98	42	3218
	2013	Nil	490	449	92	160	81	3	20	83	81	241	248	1948
	2014	220	253	81	267	114	Nil	Nil	Nil	15	40	54	280	1324
	2015	259	277	165	118	Nil	10	115	92	64	3	-	-	1104
	2016	151	343	177	518	2	23	28	221	18	200	-	174	1853
Lomawai	2012	399	385	331	273	38	174	53	47	220	65	131	222	2338
	2013	63	369	463	126	95	96	4	36	89	92	191	319	1943
	2014	433	257	150	116	123	Nil	10	Nil	28	70	146	37	1370
	2015	122	234	238	52	5	28	24	37	106	4	-	-	850
	2016	80	347	91	300	10	51	64	248	13	143	-	150	1495
Cuvu	2012	612	479	404	166	51	91	94	97	213	98	88	251	2644
	2013	138	324	503	50	74	69	13	49	96	92	182	274	1864
	2014	312	288	210	127	183	4	14	9	22	51	150	38	1408
	2015	121	342	121	44	32	65	32	66	114	10	-	-	947
	2016	131	212	93	327	44	27	37	224	10	95	-	122	1322

Table 1.1.2: Rainfall (mm) data for Lautoka Mill (2012 – 2016) – CONT'D														
Sectors	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Olosara	2012	90	481	396	348	45	190	143	80	181	100	105	249	2408
	2013	12	308	508	45	75	91	31	71	101	89	163	250	1744
	2014	330	310	296	145	71	Nil	Nil	Nil	20	48	122	22	1364
	2015	89	343	136	Nil	Nil	Nil	Nil	51	94	3	-	-	717
	2016	93	109	48	320	21	42	28	178	10	121	-	84	1054

Table 1.1.3: Rainfall (mm) data for Rarawai Mill (2012- 2016)														
Sectors	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Varoko	2012	1418	1278	773	465	39	171	Nil	37	253	85	51	236	4806
	2013	175	396	544	161	133	92	Nil	27	41	116	327	461	2473
	2014	270	203	182	160	159	Nil	Nil	Nil	4	42	50	86	1156
	2015	107	224	154	90	9	2	14	24	60	40	-	-	724
	2016	107	547	193	531	73	30	2	228	4	180	20	363	2278
Mota	2012	1209	729	533	298	36	185	Nil	94	230	92	96	143	3645
	2013	356	560	664	133	110	91	10	51	55	119	179	411	2739
	2014	356	262	115	61	92	Nil	Nil	Nil	Nil	28	30	163	1107
	2015	359	334	201	101	10	Nil	3	27	48	Nil	-	-	1083
	2016	359	404	178	553	60	53	3	299	30	263	106	450	2758
Koronubu	2012	1516	704	1038	525	60	186	Nil	57	207	116	98	226	4733
	2013	172	535	571	107	98	128	11	19	20	133	157	389	2340
	2014	331	275	147	107	157	Nil	Nil	Nil	4	60	26	118	1225
	2015	312	519	261	86	7	1	22	31	76	16	-	-	1331
	2016	312	787	209	504	25	33	3	225	7	218	118	344	2785
Rarawai	2012	825	710	275	4	80	173	Nil	46	238	173	100	164	2788
	2013	210	481	468	135	170	81	8	31	31	90	237	409	2351
	2014	417	234	152	166	130	Nil	Nil	Nil	6	41	51	137	1334
	2015	196	246	143	82	13	8	5	22	53	43	-	-	812
	2016	196	412	134	487	14	29	6	148	10	128	17	327	1908
Veisaru	2012	1123	427	584	266	23	169	3	18	198	118	96	97	3122
	2013	155	408	504	112	117	97	6	11	23	128	203	397	2161
	2014	228	166	140	115	121	Nil	Nil	Nil	9	51	33	55	918
	2015	169	208	141	45	23	15	5	38	65	20	-	-	729
	2016	169	300	169	352	65	24	4	168	10	145	56	268	1730
Varavu	2012	1048	271	600	345	5	133	Nil	18	222	57	67	64	2830
	2013	127	377	463	103	86	72	2	25	21	68	115	386	1845
	2014	303	138	60	178	185	Nil	Nil	Nil	Nil	32	10	36	942
	2015	209	231	156	31	15	11	15	12	73	18	-	-	771
	2016	209	311	117	432	37	25	4	176	8	202	34	273	1828
Naloto	2012	1282	947	562	401	50	186	Nil	106	218	167	179	157	4255
	2013	479	476	552	104	94	135	8	79	50	84	176	559	2796
	2014	525	265	176	74	115	Nil	Nil	Nil	3	38	37	164	1397
	2015	377	303	208	120	22	Nil	5	38	53	Nil	-	-	1126
	2016	377	483	217	593	73	65	3	345	3	300	170	496	3125
Tagitagi	2012	1364	593	818	262	39	175	Nil	38	246	57	41	179	3812
	2013	196	394	697	100	163	132	9	30	34	63	145	283	2246
	2014	164	216	111	240	264	Nil	Nil	Nil	Nil	29	24	92	1140
	2015	190	379	151	33	9	Nil	16	29	82	27	-	-	916
	2016	190	540	77	373	9	30	6	219	4	115	68	354	1985

Table 1.1.3: Rainfall (mm) data for Rarawai Mill (2012- 2016) – CONT'D														
Sectors	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Drumasi	2012	1404	634	1015	476	25	147	Nil	39	146	109	82	196	4273
	2013	241	409	607	102	156	107	5	28	32	66	119	268	2140
	2014	203	312	190	180	189	Nil	Nil	Nil	Nil	40	36	128	1278
	2015	312	311	145	57	2	Nil	11	34	77	25	-	-	974
	2016	312	615	91	505	44	70	4	251	Nil	114	122	366	2494
Yaladro	2012	1250	503	608	347	42	159	Nil	34	157	30	33	190	3353
	2013	199	350	552	79	163	102	6	26	29	57	171	179	1913
	2014	143	279	157	186	179	Nil	Nil	Nil	Nil	36	49	85	1114
	2015	179	242	179	17	17	Nil	13	24	59	19	-	-	749
	2016	179	601	84	410	31	42	4	248	Nil	115	54	340	2108

Table 1.1.4: Rainfall (mm) data for Penang Mill (2012- 2016)														
Sectors	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Ellington I	2012	92	271	202	379	17	87	17	14	69	78	35	230	1491
	2013	94	152	124	73	92	72	28	16	38	92	-	-	781
	2014	187	141	98	28	184	26	24	9	8	114	N/R	N/R	819
	2015	Nil	9	107	96	30	27	19	48	70	30	6	0	440
	2016	34	98	28	Nil	11	16	9	Nil	Nil	72	N/R	N/R	268
Malau	2012	990	477	235	576	41	165	19	75	215	147	60	430	3430
	2013	311	461	419	257	124	145	67	19	49	122	116	253	2343
	2014	354	483	242	124	207	42	24	16	Nil	99	65	520	2176
	2015	150	364	143	102	72	15	5	53	59	124	28	196	1310
	2016	84	634	120	370	58	57	13		1	73	126	550	2086
Nanuku	2012	665	665	594	306	15	198	15	54	153	26	45	213	2949
	2013	48	417	416	109	147	79	30	12	53	48	69	284	1712
	2014	297	384	90	128	168	Nil	14	2	Nil	36	45	149	1313
	2015	110	365	129	49	8	12	5	23	71	27	-	24	823
	2016	190	585	70	Nil	Nil	49	2	-	Nil	110	40	639	1685
Ellington II	2012	652	537	535	263	57	82	43	40	160	235	63	560	3227
	2013	263	330	240	217	113	305	86	34	88	126	149	425	2376
	2014	289	256	285	63	274	21	14	47	2	174	62	381	1868
	2015	211	212	241	150	69	49	21	21	60	47	35	132	1247
	2016	687	706	136	607	25	104	19	-	9	123	150	760	3326

Table 1.1.5: Rainfall (mm) data for Labasa Mill (2012 – 2016)														
Sectors	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Waiqele	2012	822	706	447	178	38	38	18	Nil	241	210	179	289	3166
	2013	372	340	785	48	45	89	30	150	110	138	243	312	2662
	2014	518	520	281	116	84	13	4	Nil	4	143	82	120	1885
	2015	259	712	216	116	67	Nil	Nil	83	17	41	54	19	1584
	2016	28	Nil	241	639	1	37	11	300	5	161	71	481	1972
Wailevu	2012	494	731	377	208	56	15	1	Nil	238	109	181	310	2720
	2013	397	380	994	94	62	61	17	49	104	193	252	310	2913
	2014	319	475	318	76	88	11	5	2	3	217	137	241	1892
	2015	277	421	172	70	52	23	2	98	28	5	29	50	1227
	2016	16	Nil	272	756	9	21	13	356	11	146	107	427	2132

Table 1.1.5: Rainfall (mm) data for Labasa Mill (2012 – 2016) – CONT'D														
Sectors	**Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Vunimoli	2012	798	697	445	223	45	72	9	Nil	244	206	137	321	3197
	2013	341	366	1040	90	130	163	19	111	90	268	140	290	3048
	2014	382	612	311	73	138	31	20	6	6	170	260	124	2133
	2015	369	515	209	158	93	4	Nil	98	50	4	21	102	1623
	2016	10	Nil	222	740	3	57	21	223	5	126	152	539	2099
Korowiri (Labasa)	2012	567	754	411	229	37	99	12	38	175	189	167	276	2954
	2013	271	407	1026	112	67	60	33	93	139	234	165	232	2839
	2014	600	457	279	50	168	8	14	4	2	201	180	152	2115
	2015	185	404	175	105	59	2	Nil	82	36	7	27	86	1168
	2016	4	Nil	257	560	1	22	1	203	Nil	104	111	510	1773
Nagigi (Bucaisau)	2012	727	830	453	288	61	29	5	Nil	250	260	204	279	3386
	2013	315	413	985	118	100	20	42	74	157	225	97	219	2765
	2014	314	480	385	79	147	8	33	Nil	2	126	106	256	1936
	2015	187	487	194	101	76	59	2	164	41	37	19	79	1446
	2016	8	Nil	206	710	4	25	8	234	9	132	78	532	1946
Wainikoro	2012	745	572	433	203	72	52	9	Nil	141	229	153	390	2999
	2013	345	353	796	187	142	109	37	88	127	312	165	273	2934
	2014	223	404	172	65	183	14	12	1	13	93	156	147	1483
	2015	210	438	248	140	108	27	Nil	100	78	30	44	21	1444
	2016	21	Nil	220	789	4	41	10	196	5	141	148	438	2012
Daku	2012	989	594	446	309	179	33	6	Nil	160	232	195	247	3390
	2013	294	425	632	88	974	85	78	53	162	82	Nil	121	2994
	2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2015	44	39	117	18	26	8	26	7	11	*	*	*	295
	2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Natua (Seaqaqa)	2012	458	507	511	186	33	28	22	Nil	146	138	112	364	2505
	2013	322	410	904	153	95	57	49	71	114	197	263	377	3012
	2014	284	567	285	121	131	11	4	34	14	224	169	305	2149
	2015	338	525	245	126	22	4	10	77	81	54	138	413	2033
	2016	11	Nil	264	789	19	35	14	201	12	174	138	667	2323
Rokosalase (Solove)	2012	551	627	629	395	54	97	10	Nil	280	227	205	546	3621
	2013	330	347	1028	185	149	Nil	46	35	160	341	471	462	3554
	2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2015	105	506	277	122	NA	NA	Nil	NA	NA	175	117	NA	1291
	2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naravuka (Bulivou)	2012	720	720	436	399	43	48	17	Nil	168	205	151	430	3337
	2013	259	441	733	189	103	82	14	7	140	232	409	Nil	2609
	2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2015	24	346	150	168	58	50	NIL	NA	4	52	73	NA	924
	2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seaqaqa Sub. St.	2012	748	863	621	247	48	39	30	Nil	256	305	163	294	3614
	2013	324	407	905	156	95	58	50	70	115	93	261	377	2911
	2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2015	338	525	245	126	22	4	10	77	81	54	138	413	2033
	2016	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: NA - **N**o information **A**vailable (rain gauge damaged)

Table 1.1.6 and figure 1.1.13 below provides annual rainfall figures for each mill for the past 20 years.

Table 1.1.6: Annual historical rainfall (past 20 years)				
Year	Lautoka	Rarawai	Penang	Labasa
1996	2242	2704	2404	2716
1997	2319	2648	3174	2734
1998	1213	1266	1274	1585
1999	3457	3354	3848	3141
2000	3017	3464	3750	3655
2001	2041	2121	2114	2147
2002	1704	1741	1819	2418
2003	1459	2033	1886	1834
2004	1488	1955	1573	1568
2005	1580	1749	1517	1794
2006	1844	2194	1824	1429
2007	2337	2805	2616	2786
2008	2502	3052	3380	2612
2009	2870	3556	3041	2480
2010	1228	1686	1644	2321
2011	3028	3140	3239	2831
2012	3744	3265	3957	2894
2013	2501	2353	2343	2757
2014	1199	1318	2110	1654
2015	1043	1158	1310	1168
2016	2098	1883	2126	1773

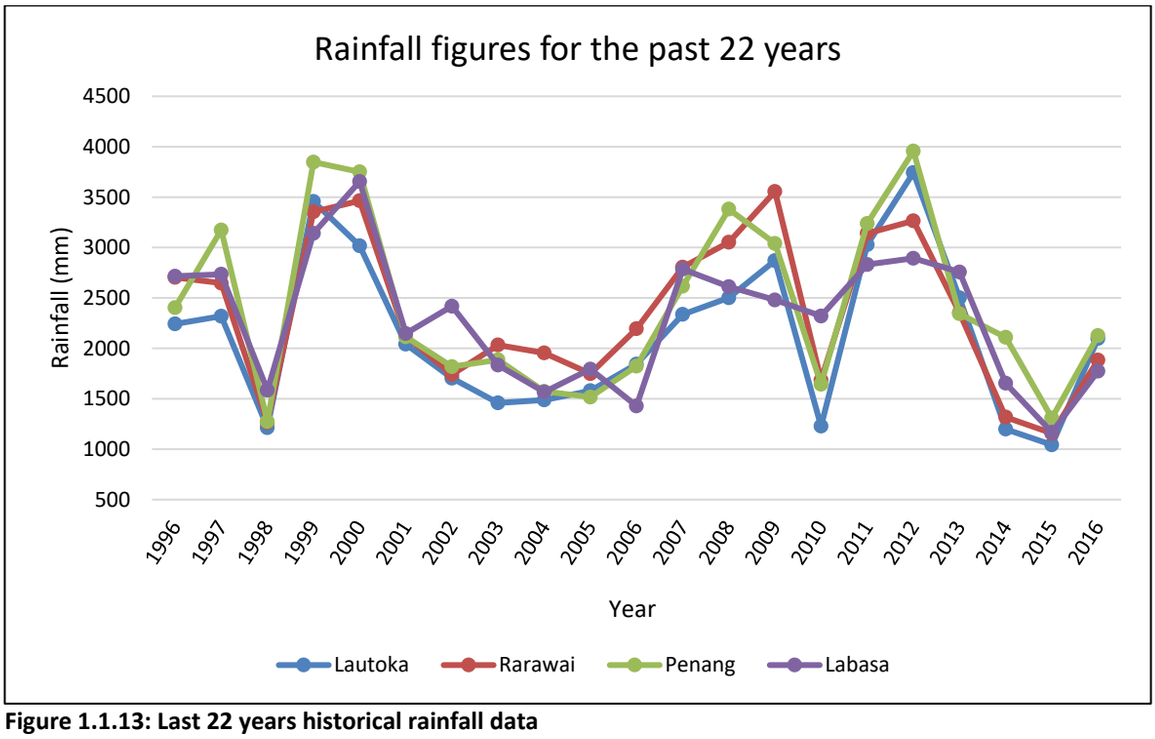

Figure 1.1.13: Last 22 years historical rainfall data

Based on figure 1.1.13 above, the year 2015 was the driest of all times with the least amount of rainfall in all the mills. The effects of such conditions tend to manifest in the following crop season, i.e. 2016.

Table 1.1.7: Meteorological data for Sugar Research Institute of Fiji, Lautoka 2016													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avg.**
Relative Humidity (%)	75	75	0	68	66	65	63	75	68	72	67	67	63
47 yrs. avg.	75	77	75	75	74	72	69	68	69	66	70	72	72
Air Temperature													
Mean Maximum	31	32	32	31	31	29	29	28	29	30	31	32	31
47 yrs. avg.	32	31	31	31	30	28	28	28	29	31	31	31	30
Mean minimum	24	25	25	23	21	20	19	20	20	22	22	24	22
47 yrs. avg.	24	24	24	24	22	20	20	20	21	26	23	23	23
Mean	28	27	27	27	26	24	24	24	25	28	27	27	26
Highest maximum	34	34	33	34	33	32	32	31	32	33	33	34	33
Lowest minimum	23	22	24	17	19	17	16	17	17	19	19	22	19
Evaporation													
Raised pan	193	194					Damaged Pan	26	177	203	154	245	170
4 yr. avg. (2013-2016)	96	84	43	106	111	89	103	101	170	188	201	199	124
Earth thermometers													
5cm	28	29	29	0	0	0	26	0	26	28	28	0	16
47 yrs. avg.	28	28	28	26	25	0	24	22	25	0	28	27	22
10cm	29	29	29	27	26	25	25	24	25	27	27	28	27
47 yrs. avg.	28	27	27	26	25	0	24	24	25	0	28	28	22
50cm	30	30	30	0	0	0	27	0	27	28	28	0	17

Earth Thermometers

The earth thermometers at SRIF are at depths of 5cm, 10cm and 50cm. The 47 years average of thermometers at depths 5cm and 10cm, equated to both at 22°C. Calculating the 50cm depth average temperature was not possible since, in previous years, there were no data kept for record purposes.

Evaporation

The raised pan average for this year was 170mm but the 4 years average equated to 124mm and this indicates there has been above average evaporation recorded for 2016.

Relative Humidity

This year's evaporation equated to 63%, but the 47 years average of 72% indicates that 2016 was below average mark.

Aftermath of Cyclone Winston

1.2 Crop Improvement

Plant Breeding

Stage 1 Trial

Stage 1 trial is the seedling stage of the plant-breeding program. The seedlings from the crosses are planted side by side in the field with the standards in rows of 100 seedlings. The selection criterion is limited to the most basic inherited character i.e. sugar which is estimated on the basis of the brix which is a measure of total soluble solids in cane juice which includes sucrose in greater component. In some cases, the clone appeal is taken into consideration in terms of physical appeal and agronomic desirability. The clones are selected against the brix of the standards (commercial varieties) and advanced as Stage 2 i.e. the clones that have brix close to or greater than the standards are selected. In some cases, clones with lower brix are considered based on its appeal i.e. agronomic desirability in terms of stalk height, thickness, tillering, and vigour. This year, LF2015 series was evaluated (brixed) and the selected clones were advanced and planted as LF2015 Stage 2 in Rarawai. On the other hand, LF2014 series Stage 1 seedlings was slashed to ratooned and evaluation to be carried in 2017. The following is a detailed account on these projects.

LF2014 Stage 1

This trial was located in Field 6 (Rarawai Estate) and was planted in 2015 and earmarked for evaluation in 2016. However, due to the devastating effect of cyclone Winston in February 2016, the trial was heavily lodge and it was harvested and taken to the mill. The ratoon will be used for evaluation in 2017.

LF2015 Stage 1

Ten thousands seedlings were planted as LF2015 Stage 1 at Rarawai Estate field 6 and field 7 from 13 – 11 November 2015. Despite to the effect of cyclone Winston the trial was evaluated. Based on the brixed obtained and field observation, 599 clones were selected for LF2015 Stage 2. Clone from selected varieties were harvested and planted as LF2015 Stage 2 trial field 6 bed 2.

Stage 2 Trial

Stage 2 trial is the first clonal stage after selection from the seedlings. The selected clones from the crosses in Stage 1 are advanced to this trial and given an index that becomes its identity for the rest of the breeding program. All data is recorded in the VAX database. The selection and evaluation is carried out in the Plant crop. The selected varieties are then sampled with the standards and brought to the small mill where bio-chemical analysis is done. Final selection is based on comparison of the bio-chemical data (Brix, POCS, and Fibre) and the field observations noted during brixing in field of the sampled varieties with the standards. These selected varieties are then advance to the observation plots.

Plant breeding trial planting

LF2015 Stage 2

Five hundred and ninety nine (599) clones were planted at field 6 bed 2 in Rarawai Estate as LF2015 Stage 2. The trial was planted on 26 of November and was well irrigated simultaneously before 2016 annual leave break.

Stage 3 Trial

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

LF2012 Stage 3

The LF2012 Stage 3 selection for stage 4 seed bed was supposed to be carried out in 2015 but was not possible due to trial subjected to indiscriminate burning. Therefore, this has to be delay again for another year since the trial was slashed with the intension of seed cane to be ready by November but due to the unfavorable weather condition it has to be carried out in January 2017.

Effect of cyclone Winston

Frayed leaves and lodging were the most common problems for LF2012 stage 3 which affects 100% of all selected varieties for stage 4 seed bed. In response to these problems, most varieties with lodging and broken cane tops have side shoots. However, sign of recovery shown in terms of frayed leaves.

Seed cane for Stage 4 seed bed.

LF2012 stage 3 has been screened and small mill evaluated and 20 varieties were already selected for stage 4 seed. Unfortunately, last year's fire burnt all Field 6 and Field 7 including LF2012 stage 3. The seedbed was intended to be planted on April. But due to the current condition, planting can be shifted to second planting period on October and November.

According to the assessment only seven varieties are capable for producing seed cane for stage 4 seed bed i.e. having more than 100 stocks of cane unbroken. Lodging cane consistently in contact with soil may provide favorable condition for adventitious *roots* to emerge from stem and may deteriorate seed cane quality.

LF2013 Stage 3

LF2013 STAGE 3 was one of the best trials prior to cyclone as far as husbandry practices were concern. However, cyclone Winston changes everything due to its devastation effect in terms of frayed leaves, lodging, broken tops and side shoots emerge.

During the meeting with Science Auditing Committee it was decided that this trial to be slashed and evaluations to be carried out in 2017.

STAGE 4

The final breeding phase consists of establishing the worth of any new genotype over the existing varieties, bulking up sufficient quality seed for distribution to farmers and, finally, release of the new variety. The last phase also consumes significant breeding resources since, although only a small number of advanced lines remain in the program each year, they have to be evaluated in an extensive field trial program at many locations, and large seed quantities produced.

LF2009 Stage 4
This trial was planted in 2013 and all 72 samples from this trial were send to small mill as second ratoon for biochemical analysis. The trial was heavy affected by cyclone Winston in terms of lodging, broken tops and frayed leaves. However, recovery ability for all varieties was closely observe and monitored which the Data was also used for the selection of the 5 promising varieties.

LF2010 Stage 4
The LF2010 Stage 4 trial was planted in 2014, which consists of 20 advance varieties and 5 commercial varieties that are used as standard such as Mana, Beqa, Kiuva, Naidiri and Menudin. Total of 80 samples were harvest and send to small mill as first ratoon crop for bio chemical analysis.

LF2011 Stage 4
Total of 10 varieties and 2 commercial varieties as standard contain by LF2011 series. This trial is located in Bed 1, Field 9 in Rarawai. Total of 48 samples were send to small mill as plant for bio chemical analysis. Field observation and assessment was continuously exercised to identify and monitor outstanding phenotypical features. The Data from small mill and field observation play a vital role in identifying prominent varieties

Promising varieties
Based on the biochemical analysis and field observation Data of 2009 series and 2010 series, 5 varieties from 2009 series and 7 varieties from 2010 series were selected and planted in field 6 Bed 1 for propagation propose which will be given to farmers for feel effect. These varieties were outstanding in terms of their phenotypically features, biochemical Data history and survival abilities post Winston.

Germplasm collection at Drasa
The core germplasm collections as well as Stage 4 trials are located at this station however no Plant breeding staff is based at this office. All the small mill samples from Rarawai and Penang Mill are crushed and analysed here as well as disease screening for Stage 4 clones are also conducted here. The report on core germplasm collection and Stage 4 trials will be discussed here whereas update on small mill and disease screening aspects will be discussed by respective section reports.

The germplasm and the Stage 4 trials have recorded similar damages as Rarawai and Penang Trials and a through plot by plot assessment will be carried out to assess varieties sustaining more damages and varieties withstanding less damage will be identified. Similarly clones from the germplasm will be identified for similar traits.

Seedling germinating from planted fuzz

1.3 Crop Management

Agronomy

Effect of lime on soil properties and sugarcane yield in Fiji

Location: Drasa, Lautoka
Variety: Aiwa
Trial Design: Randomized Complete Block Design
Replications: 4
Plot size: 6 rows x 10 m x 1.37 m
Date Planted: 16 April 2014

Table 1.3.1: Details of treatments

Treatment No.	Lime application
Treatment 1	No lime was applied
Treatment 2	0.7 tonnes per hectare of lime was applied in furrows
Treatment 3	1.4 tonnes per hectare of lime was applied in furrows
Treatment 4	2.1 tonnes per hectare of lime was applied in furrows

In the view of the fact that the soils of sugarcane belt in Fiji is acidic, it was decided to conduct research on applying lime and studying its effect on soil chemical composition, crop productivity. The objective of this study is to determine the effects of applying lime on soil properties, sugar and cane yield. The trial was continued to first ratoon after harvest of plant crop. However, the trial was damaged by tropical cyclone Winston in February 2016. The cane tops were broken due to strong winds. The cane was slashed to avoid side shooting from the cane. The trial will be harvested in 2017.

Efficacy of a new herbicide Glufosinate-ammonium for the control of weeds in sugarcane

Location: Drasa, Lautoka
Variety: Naidiri
Trial Design: Randomized Complete Block Design
Replications: 4
Plot size: 6 rows x 10 m x 1.37 m
Date Planted: 10 March 2016

A weed free environment is essential for sugarcane to make best use of the key production factors like nutrients, moisture and other natural resources that in turn enhances efficient and economical harvesting and processing of sugarcane. In Fiji, the reported cane yield losses range from 10 to 25 percent. The losses would be higher if weeds are not controlled in the initial stages of sugarcane. Weed control in sugarcane fields from germination until vegetative phase is essential to avoid yield loss of millable cane (4 to 5 months). Weeds affect sugarcane yield that affects sucrose content of the cane.

The new herbicide Glufosinate-ammonium 200 g/L SL is a non-selective contact weedicide with systemic action that can be used as post-emergent to control weeds. Its active ingredients contain 200 g/L Glufosinate as ammonium in the form of aqueous solution. Glufosinate is known to control a wide range of annual and perennial broad-leaved weeds and grasses in various crops.

A trial was established at Drasa estate, Lautoka to test the effect of spraying Glufosinate–ammonium on weeds in the sugarcane field. The trial was planted on 10 March 2016 with Naidiri variety. Four randomized replicates were used per treatment. Plant cane treatments are detailed in table 1.4. The control treatment is T1, which is 0 L/Ha that was used for comparison of results. Cultivation works were followed as normal agronomy practices to maintain the trial. The cane was supplied with 3 bags/ha of Blend A at the time of planting. Blend B fertilizer at a rate of 15 bags/ha was applied after obtaining trial data.

Table 1.3.2: Plant cane treatments

Treatment ID	Treatments
T1	0 L/Ha
T2	2.5 L/ha
T3	3.0 L/ha
T4	3.5 L/ha
T5	4.0 L/ha

1 m x 1 m plots were marked in the field for the assessment. Weed population counts was carried out to determine the number of weeds present and were classified as grasses, broad leaf, and creepers. Another survey was carried out to determine the population of the weeds left after spraying Glufosinate-ammonium survey was conducted.

Post survey of the weed population revealed Glufosinate-ammonium is highly effective in controlling all types of grasses. Grass population were reduced by 95 percent in all treatments. From the data obtained, it was observed that grasses responds well with Glufosinate-ammonium treatment and is found effectively controlling weeds with in all treatments (2.5 – 4.0 L/ha).

Broad leaf weeds were reduced by 70 percent. It was observed that treatment 3 and 4 (3.5 and 4.0 L/ha) were more effective compared to other treatments resulting to 100 percent reduction of broad leaf weeds in some plots. Creepers were controlled by 45 percent. Glufosinate-ammonium had a much lower impact on creepers when compared with grasses and broad leaf weeds. Glufosinate-ammonium was observed to have a good control over weeds. Dosages as low as 2.5 L/ha revealed to be effective in weed control.

Efficacy of 2, 4-D amine as post-emergence

Location: Drasa, Lautoka
Variety: Naidiri
Trial Design: Randomized Complete Block Design
Replications: 4
Plot size: 6 rows x 10 m x 1.37 m
Date Planted: 10 March 2016

A trial was carried out upon request of Koronivia Research Station to test effectiveness of 2, 4-D amine on controlling weeds in sugarcane field. Fiji's weather and soil conditions are favorable for vigorous weed growth. A comprehensive weed control programmes is required in order to reduce the declining

yields due to weeds. Chemical weed control provides an opportunity to reduce cost and increase production as it also reduces labor input, is effective, and efficient.

The trial was established at Drasa estate, Lautoka to test the effect of spraying 2, 4 D amine on weeds in the sugarcane field. The trial was planted on 10 March 2016 with Naidiri variety. Four randomized replicates were used per treatment. Plant cane treatments are detailed in the following table.

Table 1.3.3: Plant cane treatments

Treatment ID	Treatments
T1	0 L/Ha
T2	2.5 L/ha
T3	3.0 L/ha
T4	3.5 L/ha
T5	4.0 L/ha

The control treatment is T1 which is 0 L/Ha that was used for comparison of results. Cultivation works were followed as normal agronomy practices to maintain the trial. The cane was supplied with 3 bags/ha of Blend A at the time of planting. Blend B fertilizer at a rate of 15 bags/ha was applied after obtaining trial data. 1 m x 1 m plots were marked in the field for the assessment. Weed population counts was carried out to determine the number of weeds present and were classified as grasses, broad leaf, and creepers. Another survey was carried out to determine the population of the weeds left after spraying 2, 4-D amine survey was conducted.

Post survey of the weed population revealed 2; 4-D amine is effective in controlling weeds. Grass population was reduced by 85 – 95 per cent in all treatments. Broad leaves were reduced by 65 percent. Treatment 4 (3.5 L/ha) was most effective in controlling broad leaves. Creepers were controlled by 100 percent. The quantity of chemical supplied was not enough to conduct comparison trials. It is recommended to conduct trials in larger areas before the recommendation can be utilized for sugarcane.

Analytical laboratory

Biochemical Analysis for sugar traits

The small mill aims to provide necessary information on cane such as %pol, %brix, %fiber and %POCS to respective personnel in the institute regarding various ongoing trials. Moreover, it is a vital aspect for determination of variety selection from the initial stages till the final selection of breeding trials. A total of 560 cane samples were crushed for the year which was 40% less compared to last year.

The small mill and laboratory had forecasted to analyze a total of 2000 samples which was not successful due to the damages caused by T.C Winston on almost 80% of the forecasted crop. Thus samples were only received from a few of the Rarawai and Lautoka research trials, while the remaining consisted of samples analysed for the cane deterioration trial. Majority of the samples crushed were received from the variety selection program as displayed in figure 1.3.1.

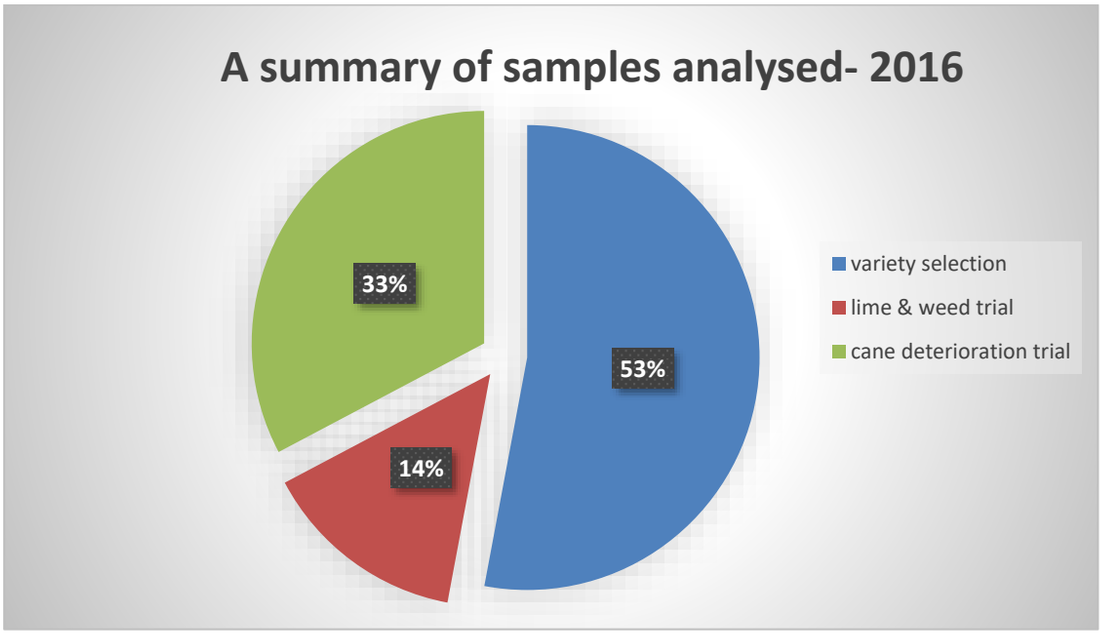

Figure 1.3.1: Percentage of samples received for 2016.

During the season, all samples were analysed by the conventional method, whereby the Jeffco cutter grinder was used.

Cane deterioration project

The impacts of cyclone Winston on cane quality in Fiji - A cane deterioration trial on Penang cane supply. As the Fiji sugar industry embarks on rejuvenation, concern lies not only on the tonnes of cane crushed but more importantly on the quality of the sugarcane received to make maximum amounts of quality sugar which was contradicted by the detrimental effects of T.C Winston. The scars had not healed quickly enough particularly at the Penang mill, the most affected by Winston.

Research staff carrying out laboratory analysis

Due to the temporary closure of Penang mill all the sugarcane harvested at this mill area were forwarded to the Rarawai mill, resulting in an undeniable effect on the normal operations of the mill. The sugarcane received from Penang mill has been exposed to various damages as a result of the previous drought and most recent devastating cyclone Winston.

Thus in addition to the abnormal growing period of these crops, it was further affected by the delay of cut to crush upon carting from Penang to Rarawai or Lautoka mill. Sugar Research Institute of Fiji (SRIF) being assigned to monitor and improve the quality of sugarcane, sugar and by-products (SRIF ACT, 2005) conducted a study on the quality of the sugarcane received from Penang mill for crushing at Rarawai mill. The study was conducted in collaboration with

Fiji Sugar Corporation (FSC) and Sugar Industry Tribunal (SIT). The cane deterioration project commenced on the 3rd of October, whereby setting up of the in-field sucrose analyser at Rakiraki and mill visits were made by the technical staff. The project was scheduled to be carried out over 4 weeks at the Rarawai and Penang mill but was extended to 6 weeks to accommodate for the unforeseen circumstances - unfavourable weather conditions, mill stops, and holidays. A total of 3 samples of 6 stalks were sampled daily from each lorry delivered to Penang mill during the project period and a similar number of samples were collected from the Penang stockpile at the Rarawai mill yard. Out of the 3 samples from each lorry, one sample was analysed on the same day of sampling while the remaining two were analysed after the required number of delay days. A total of 349 samples were collected for analysis.

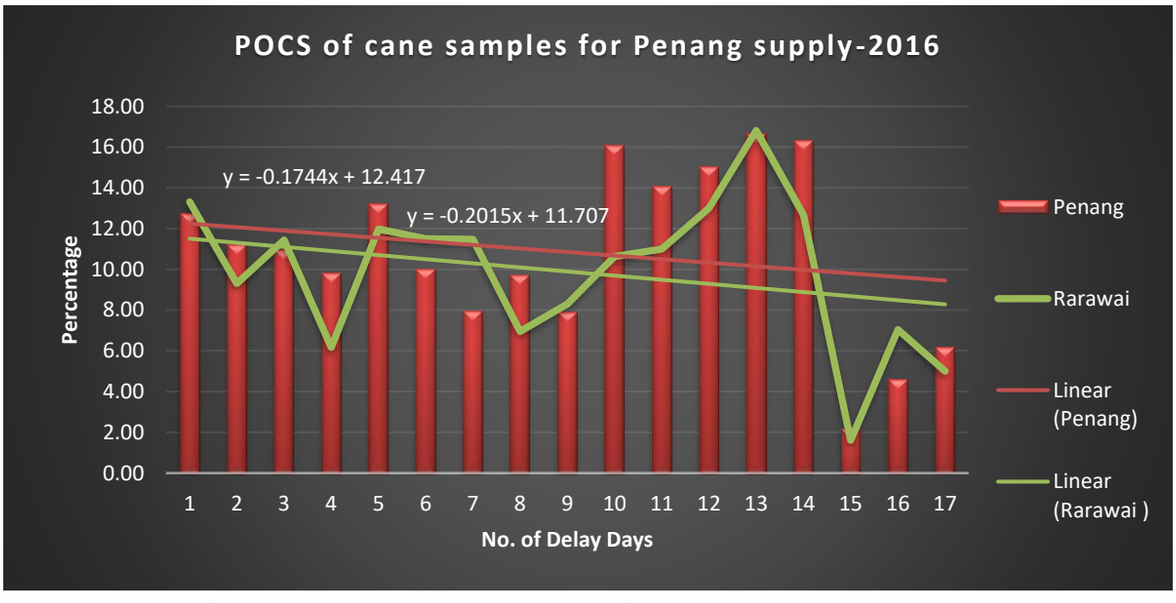

Figure 1.3.2: A graph of the percentage POCS for Penang district

A gradual decrease of %POCS at the rate of 0.17 for the samples from Penang mill is observed in figure 1.3.2 while there is a slightly more decrease of 0.20 for the samples from Rarawai mill. The illustration shows a difference of 0.03 POCS of the same group of samples at the respective mill. Yet it should be noted that the values illustrating quality could be treated in isolation in various sets of cane samples. This is due to the varying weather conditions, number of samples collected each day, and the short span of time for which the study was conducted to represent the 2016 crushing season.

Table 1.3.4: Changes in (purity) that occur with cane staling.

No. of Delay Days	0	1	2	3	4	5	6	8	10	12	14	16
Penang	86.5	75.9	72.6	70.9	86.4	80	64	65.4	88	91.2	40.5	57.3
accumulative drop (Penang)		10.6	13.9	15.6	0.12	6.49	22.5	21.1	-1.5	-4.7	46	29.2
Rarawai	75.3	72.3	78.3	45.3	84.8	75.6	59.4	67.6	75	91.2	39.2	57
accumulative drop (Rarawai)		2.95	-3	30	-9.5	-0.3	15.8	7.62	0.26	-16	36	18.3

Delays in delivering harvested cane to the factory lead to deterioration in the quality of the juice that can be extracted. This in turn impacts on the quality of the sugar produced. Table1.3.4 illustrates the accumulation of purity drop over a period of 16 days, whereby the purity on the 16th day is almost half of the initial cane purity. The general overview of the study indicates there is decrease in cane quality

over the period of cut to crush delay. Thus it is recommended that the study is repeated in 2017 whereby areas of variation could be verified to better illustrate the drop in the quality of cane which has been averaged in this study. Along with the purity drop, staling of cane becomes quite obvious, including the development of rot on the cane stalks. The role of environment is the predominant factor in post-harvest deterioration, so that control of sucrose loss becomes one of regional management.

Quality Based Cane Payment Scheme – Audit

The activity has been postponed due to damages caused to the sugar mills by T.C Winston. The Penang mill was temporarily closed for the entire 2016 season, which may remain closed in 2017. Thus the schedule to conduct a trial audit in Penang mill during the year was not possible. The Rarawai mill that was also scheduled for a trial audit during the season was cancelled due to milling interferences with the NIR operations thus resulting in the by-pass of the NIR analysis for the entire season.

Fertilizer Advisory Services

Soil Analysis

Two thousand three hundred and seventy eight soil samples were received for analysis comprising of one thousand eight hundred and eighty two advisory and four hundred and ninety six research. The soil analysis data are converted into a recommendation report that is dispatched by email as soon as they become available from the laboratory to the FSC extension staffs.

Table 1.3.5: Summary of soil samples for 2016

Mill	Advisory	Research	Total
Lautoka	764	276	1040
Rarawai	421	119	540
Penang	63	5	68
Labasa	634	96	730
Total	**1882**	**496**	**2378**

Table 1.3.6: Summary of Advisory Soil Samples per District per Sector for 2016

District	Sector Name	No of soil samples	Total
Lautoka	Drasa	176	450
	Lovu	106	
	Lautoka	34	
	Saweni	51	
	Natova	83	
Nadi	Legalega	24	172
	Meigunyah	36	
	Qeleloa	21	
	Yako	14	
	Malolo	31	
	Nawaicoba	37	
	Waqadra Estate	9	
Sigatoka	Lomawai	70	142
	Cuvu	65	
	Olosara	7	

Table 1.3.6: Summary of Advisory Soil Samples per District per Sector for 2016 – CONT'D			
District	**Sector Name**	**No of soil samples**	**Total**
Rarawai	Varoko	39	367
	Mota	41	
	Koronubu	84	
	Rarawai	14	
	Veisaru	80	
	Varavu	77	
	Naloto	32	
Tavua	Tagitagi	23	54
	Drumasi	9	
	Yaladro	22	
Labasa	Waiqele	47	513
	Wailevu	110	
	Vunimoli	89	
	Labasa	37	
	Bucaisau	81	
	Wainikoro	73	
	Daku	76	
Seaqaqa	Natua	34	121
	Solove	60	
	Bulivou	27	
Penang	Ellington 1	7	63
	Malau	7	
	Nanuku	19	
	Ellington 2	14	
	Penang Estate	16	

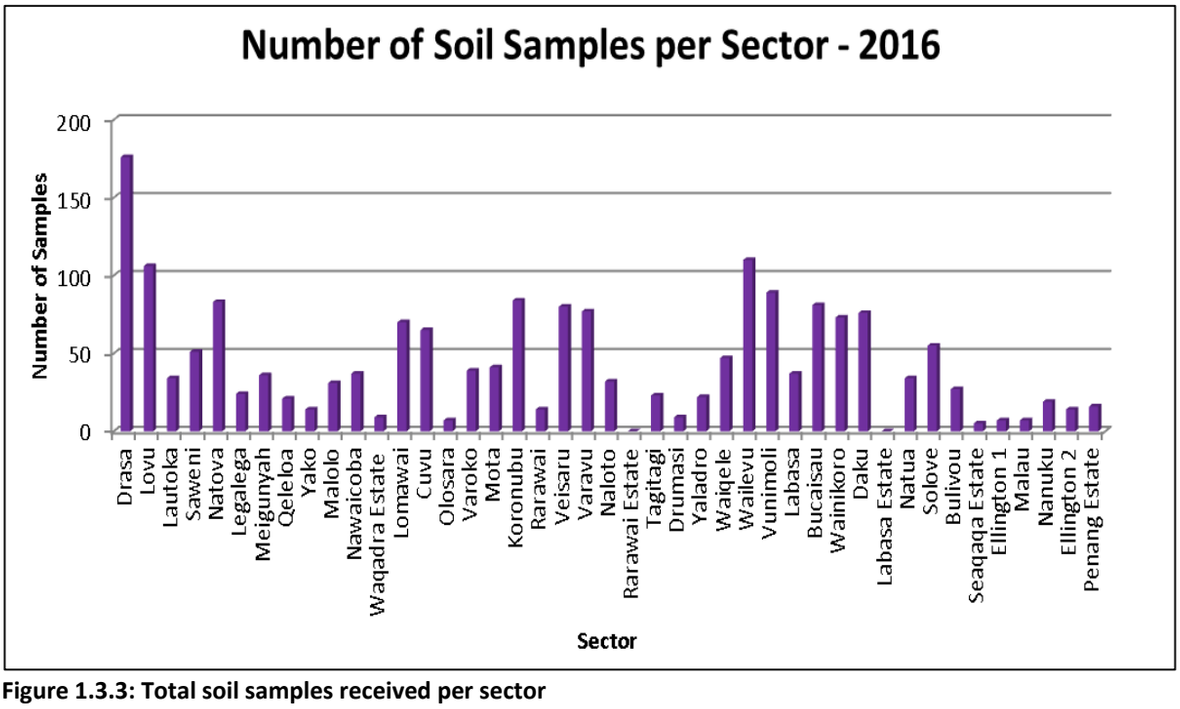

Figure 1.3.3: Total soil samples received per sector

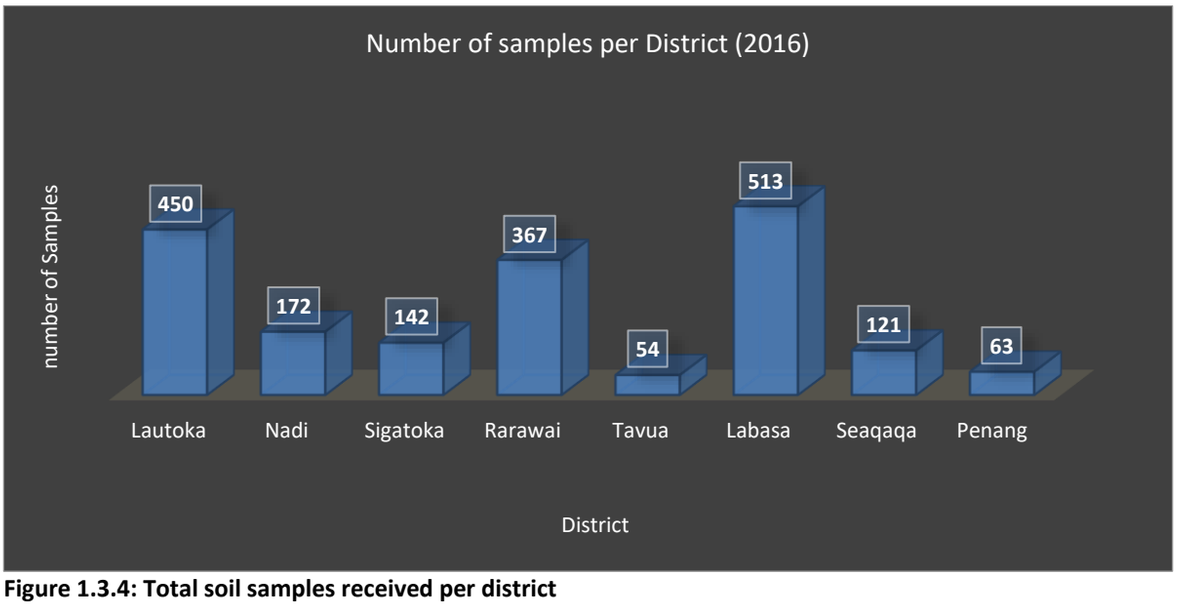

Figure 1.3.4: Total soil samples received per district

Plant Analysis

The analytical laboratory received 25 plant samples from research trials.

Quality Assurance

The analytical laboratory took part in ASPAC proficiency programs. The laboratory continues to adhere to quality control checks in every analysis. A new quality control sample was made in 2016 (location – Drasa) which was used for quality checks in analysis. The laboratory conducts the QC checks by comparing results of commercial standards against the QC samples. The QC samples is analysed in 30 replicates for all analysis done in the lab and the results are used to formulate the acceptable data range within which all results should fall. Any value out of the range is investigated and corrective measures are undertaken to ensure the criteria set for quality assurance is followed. The laboratory also carries out its internal quality assurance on calibration of laboratory equipment and instruments, training and documentation. All quality control measures adopted is to ensure that the results from the lab are reliable.

Seed Production Potential of Cover Crop Mucuna Pruriens

A trial was conducted to ascertain the seed production potential of Mucuna that was planted in two different treatments – on trellis and freely on the ground

Soil Analysis

Soil samples were taken following the standard sampling procedure. Analysis were carried out in the SRIF analytical laboratory. Major macronutrients such as magnesium, potassium, calcium, phosphorous, nitrogen and pH was be done.

Husbandry of Mucuna Trial

Two times after sowing weeding was done to ensure the trial is clean. Hand weeding was done followed by pre- and post-emergence herbicides were applied effectively. The trial was irrigated due to long dry period after 3 months of planting. During the first quarter of the planting that was February to March, field observation was done. The plant grows as a vine so for support trellis was setup. The plant reached at height of 15-20 feet. Purplish flowers appeared in second quarter of the year. Soil sampling was done to determine the nutrient level in soil during flowering stage. The pod formation

occurred in the late second quarter of the year and matured during the third quarter of the year. The pods swell quickly and were dark green covered in black fuzzy hairs. The plant required a 6-9 month growing season to mature the seeds.

Figure 1.3.5: Plants on trellis – flowering stage

Figure 1.3.6: Mucuna trial on ground as cover crop

Harvesting

The optimum time for harvesting mucuna bean was when the seeds were fully dried. Pods were harvested by hand. The pods were weighed and dried in the oven for pod biomass determination. The pods were kept separately to determine the total seed production using the two planting methods. The seed produced from the trellis was 42.5kg and 32.5kg using the ground method making of total of 75kg. Dried pods are threshed with a regular grain thresher or by hand. Threshing was done by beating the pods put in sacks.

Pre and post Soil Analysis

Soil samples were collected at three stages before planting (fallow), flowering stage and after ploughing-in. Soil analysis was carried out in the Sugar Research Institute of Fiji analytical laboratory. Major macronutrients such as magnesium, potassium, calcium, phosphorous, nitrogen, and organic carbon were calculated along with pH of soil. Equipment's such as Flow Injection Analysis and Atomic absorption spectrophotometer was used to determine the nutrient status.

Table 1.3.7: Soil Analysis Results

Trial Stage	pH	Modified	Exchangeable (mg/kg)		
	(water)	Truog P (mg/kg)	Ca	Mg	K
Mucuna trial BP	4.5	34.0	1587	221	214
Mucuna trial BP	6.1	25.0	1597	214	422
Mucuna trial BP	6.3	66.0	2414	248	471
Mucuna trial BP	4.8	36.0	2318	281	277
Avg. BP	**5.4**	**40.3**	**1979**	**241**	**346**
Mucuna trial FS	5.0	20.0	817	197	94
Mucuna trial FS	5.0	110.0	1053	271	104
Mucuna trial FS	5.0	40.0	1111	235	79
Mucuna trial FS	5.0	88.0	1139	286	117
Avg. FS	**5.0**	**64.5**	**1030**	**247**	**99**
Mucuna trial AP	5.1	43.0	2405	234	175
Mucuna trial AP	7.6	65.0	2664	219	192
Mucuna trial AP	7.1	32.0	2130	294	217
Mucuna trial AP	4.5	107.0	2195	331	217
Avg. AP	**6.1**	**61.8**	**2349**	**270**	**200**

Note BP – Before planting, AP- After planting and FS-Flowering stage

The results showed that there was gradual increase in pH values from 5.0 to 6.1 from fallow to after ploughing-in the crop. The data above shows that there is a gradual increase of phosphorous from 40mg/kg to 61.8mg/kg.

There was very high residual effect of the cover crops in terms of building up organic matter in soil. The soil analysis at decomposition stage will be done in March 2017. The data analysis will be done after the soil analysis has been completed.

Results

A total of 75kg seeds were produced and kept in a cool environment. Approximately 5kg of seeds were inoculated with Rhizobium bacteria and replanted in collaboration with other project. Soil nutrient

testing before and after seed production has been done while soil test after decomposition will be carried out in three months' time. Work was carried out as planned. The growth characteristics of mucuna plant were determined and the observations were recorded.

Green Manuring - Legumes

Green manuring involves growing a crop that will be worked into the soil later and is an old agricultural practice. It is used as a soil building practice that adds organic residues, conserves and recycles plant nutrients and protects the soil from erosion. The addition of organic material improves soil tilth.

At the same time, the nutrients used in plant growth are conserved and returned to the soil to enhance its fertility. The role of nitrogen-fixing plants in cropping systems diminished in the 1970s when the cane belt extension was introduced and abundant nitrogen fertilizers became available. The use of legumes in crop rotations reduces input costs and reduces the application of commercially produced chemicals such as fertilizers and herbicides.

Benefits of Legume Green Manuring

Legumes fix nitrogen from the atmosphere and convert it into a form that is available to plants and it forms a symbiotic association with certain soil bacteria called rhizobia. These bacteria colonize the root hairs of the legumes and multiply causing swellings, which become nodules. The bacteria benefit from the relationship by obtaining carbohydrates (plant sugars) from the legume.

The growing legume benefits from the nitrogen that is captured from the air and converted into ammonium within the nodules. The incorporated legume residues are a biological source of nitrogen that reduces the amount of fertilizer required for the following crop. The amount of nitrogen fixed by a legume depends on the legume variety, the effectiveness of the legume-bacteria association in root nodules, soil fertility and climatic conditions.

Legume green manuring does not supply all the nitrogen for optimum crop growth but can reduce the amount of nitrogen fertilizer required. The increase in soil organic matter increases nutrient availability and improves the physical qualities of soil such as water infiltration and moisture storage capacity. Soil organic matter decomposes and releases significant amounts of plant nutrients.

Type of legume

A legume used for green manure should meet the following basic requirements:

- provide adequate ground cover
- have a high rate of nitrogen fixation and good biomass production,
- have high water-use efficiency when used in drier regions.
- the legume should use as little water as possible while still producing substantial quantities of top-growth,
- compete well with weeds especially broadleaves

Inoculation

Since nitrogen fixation is one of the main benefits of using legumes as green manures, it is important to maximize this effect through proper inoculation.

Different legumes require specific species of rhizobia for the symbiotic relationship to work. To ensure that effective nodules are formed, the legume seeds have to be inoculated with the correct rhizobia.

In 2016 a green manuring trial was planted in Drasa Lautoka with green and black gram. Unfavorable weather conditions (excess rain followed by long dry spell) prevailed after planting and during the vegetative growth of the crop.

The crop was not as expected but at the flowering stage both the grams were ploughed into the soil and allowed to decompose. During the decomposition phase the soil was turned in several times.

The land was left idle for 3 months after the last ploughing. Soil samples were taken before planting the grams and after incorporation. There was no major changes in soil analysis but within the profile of the soil bore pieces of black clods was observed that is believed to be the decomposing plants. Decomposition of the ploughed plants is very slow and can take several years. It also depends on soil moisture and size of shredded plants. Ample moisture and small shredded plants decompose faster. Benefits of green manuring can be realized in the second or third year after incorporation while in the first year the crop planted will benefit from the Nitrogen that is fixed by the plants.

Figure 1.3.7: Flowering stage to plough into soil

Figure 1.3.8: Root Nodules storing Nitrogen

1.4 Crop Protection

Pathology - Varietal Screening of Downy Mildew on Sugarcane

The pathogen has two forms of sporulation; asexual conidia produced under high humidity on leaf surfaces and sexual oospores which are produced in infected leaves during the cooler months. Conidia are the primary infective propagule and constitute one of the important transmission mechanisms. The conidia are very fragile and not long lasting.

Conidia are produced on humid nights but they lose viability within a matter of hours after sunrise. Studies suggest the conidia are dispersed by air currents and that they rarely move more than 400m from an infested crop. The conidia of downy mildew are unlikely to be spread by harvesters or other machinery unless they are operating at night time. Infected stalk material or leaves that remain turgid in protected parts of machinery could potentially release spores at night time but it is unlikely that this would occur for more than one or two days. This would be a very low risk of spreading the disease. Fiji has been successful in eliminating the disease from commercial crops and the disease is now restricted to experimental plots.

Activities undertaken

Seed multiplication of downy mildew infected cane was done at Tavakubu in the beginning of 2016. There was lack of infected seed cane. There were no clones supplied by the breeding department for screening due to poor seed quality post cyclone Winston so a research trial was carried out to screen commercial varieties to depict its disease ratings. According to previous SRIF reports, DOM screening is normally carried out from November to March but a trial was carried out in May to detect spore concentration at that time of the year. That trial was not successful due to theft of planting materials such as pots.

A second trial was undertaken and maize and sugarcane varieties were planted. Downy mildew spores were successfully spread to sugarcane plants and symptoms were observed on both maize and sugarcane. All commercial varieties that had to be tested were not available due unavailability of seed cane. The old site (FSC, Lautoka) contained some of the varieties while some varieties were not labeled which made it difficult to identify them. However, some commercial varieties were found at Rakiraki station and old site.

The trial was continued and screening of these commercial varieties was carried out. The screening period was from November and is currently ongoing. In January, the test clones were damaged by cattle. These pots had to be removed because labels were lost and the plants were drying out. There are certain drawbacks such as bad road condition, unavailability of resources, manning issues, damage by cattle and bad weather conditions. On rainy days it is difficult to travel to the site because of its bad road condition and the spores are not visible as they are washed away. It is advised to take readings when the leaf is dry so that percentage of spores present is visible.

Figure 1.4.1: Downy Mildew fungal spores on sugarcane leaf

Figure 1.4.2: Downy Mildew trial site

Nematology

Plant Parasitic Nematodes

A nematode survey of the cane lands was initiated on October 2015 and will end in 2018. A total of 180 soil samples were collected and analyzed from Rarawai, Lautoka and Nadi district. The Sigatoka, Labasa and Seaqaqa district is left to samples, total of 130 samples left to analysis. Total of 40 soil samples was collected and analysed for Rakiraki district.

Ten samples from each sector (form ten different active cane growing farms). 10 samples from each sector were taken out.10 nematodes genera were identified and counted. The most common plant parasitic nematodes found in Fiji's sugarcane fields are; Lesion, Reniform, Spiral, Ring, Dagger, Stubby, Stunt, Rootknot, Lance and Pin. The table 1 shows the level of nematode occurrence in 180 farms in Rarawai and Lautoka mill regions.

Table 1.4.1: Nematodes found in 180 sugarcane fields in Rarawai and Lautoka district. (Survey Areas)							
Nematodes		Nematodes/200ml of soil					
Common name	Species	Relative Density (%)			Absolute Frequency (%)		
		Ba/ Tavua	Lautoka	Nadi	Ba/ Tavua	Lautoka	Nadi
Lesion	*Pratylenchus spp*	18.4	21.5	16.7	86	81.7	84
Spiral	*Helicotylenchuc spp*	28.8	20.4	30.8	92	90	80
Ring	*Criconemella spp*	6.1	6.0	7.6	53	55	46
Dagger	*Xiphinema spp*	3.8	6.1	3	45	53.3	32
Stubby root	*Trichodorus spp*	0.9	1.1	2.2	17	20	22
Root knot	*Meloidogyne spp*	12	25.8	20.5	90	85	74
Stunt	*Tylenchorhynchus spp*	1.3	0.1	0.9	15	3.3	16
Reniform	*Rotylenchulus spp*	26.4	18	17.5	81	66.7	54
Lance	*Hoplolaimus spp*	2.2	1	0.7	17	18.3	10
Pin	*Paratylenchus spp*	0.2	0	0	15	0	0
FLN	*Free Living Nematode*	39.6	33.6	34.3	100	100	100

Absolute frequency = Number of sample containing a species X 100
Number of samples collected

Relative density = Number of individuals of species in a sample X 100
Total of all individuals in a sample

In a long term monoculture, the PPN/FLN ratio is 2:1 which means when there is no break cropping increase the population of PPN.

Pathology - Disease Control Unit

The system used in the protection of crops against diseases and pests remains the same as that of previous years. The disease control unit is involved in intensive rouging programme to eradicate all traces of Fiji disease from commercial fields.

The roguing of disease fields and intensive checking of all farms within a mile radius of the known diseased fields and intensive checking of all farms within a mile radius of the known diseased farms. However the disease remains endemic in wild canes and ***Saccharum edule*** (Duruka) in the neighborhood of commercial plantings and is always transmitted to the cultivated crop by the Fijian sugarcane leaf hopper, *Perkensiella vitiensis*.

Therefore the disease control unit has emphasized all roguers to inspect all plant and ratoon crop since in some cases this disease is latent and shows signs in early ratoon stage. Some work was also done on digging out Mana stools. The roguing gangs covered an area of 7,273.83 ha during their crop inspection. Of this total 1541.21 ha plant crops and 5732.62 ha were ratoon cane.

Table 1.4.2: Rouging Report from January-December 2016 area (Ha)						
Month	**Lautoka**		**Nadi**		**Labasa**	
	Plant	**Ratoon**	**Plant**	**Ratoon**	**Plant**	**Ratoon**
Jan	0	58.19	2.19	97.92	9.15	77.28
Feb	20.07	58.21	0	166.87	15.7	156.09
Mar	8.14	68.34	9.32	213.18	109.33	148.57
Apr	6.08	78.3	26.31	153.3	181.95	26.95
May	3.45	113.3	16.46	178.81	126.27	95.24
Jun	1.52	123.99	15.35	203.48	108.03	117.9
Jul	4.91	127.67	16.34	227.91	93.13	99.97
Aug	3.68	84.08	0.54	197.33	80.40	178.68
Sept	19.28	149.07	28.21	81.58	79.48	198.35
Oct	18.5	33.01	27.02	139.51	61.92	183.74
Nov	9.75	128.66	45.29	112.34		
Total	**95.38**	**1022.8**	**187**	**1772.23**	**865.36**	**1282.8**

Table 1.4.2 Cont'd: Rouging Report from January-December 2016 area (Ha)						
Month	Sigatoka		Ba/Tavua		Penang	
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
Jan	8.7	37.67	1.9	30.83	0.2	22.23
Feb	7.48	48.49	0.35	72.81	10.58	3.64
Mar	8.18	56.28	0	0	0	12.09
Apr	11.6	63.29	0	0	13.1	12.84
May	18.39	53.55	0	69.6	8.06	91.53
Jun	15.89	50.07	16.1	64.21	8.32	40.51
Jul	19.34	45.66	22	84.5	14.48	85.1
Aug	35.68	29.94	22.7	59.68	12.21	57.55
Sept	20.82	46.15	8.14	27.09	43.8	40.94
Oct	13.1	61.91	19.2	51.43	13.59	92.76
Nov	7.78	76.76	5.43	74.39	6.32	91.3
Total	**167**	**569.77**	**95.8**	**534.54**	**130.66**	**550.49**

The trend on which Fiji Leaf Gall Disease is increasing in the sugarcane farms is an indication that the disease can spread rapidly and become epidemic 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 1.4.3: Summarized Rouging Report from January-December 2016				
Mill District	**No. of Farms Inspected**	**Area Rouged (Ha)**		**No. of FLGD stools Rouged**
		Plant	**Ratoon**	
Lautoka	343	95.38	1022.82	95
Nadi	571	187.03	1772.23	88
Labasa	812	865.36	1282.77	0
Sigatoka	303	166.96	569.77	425
Ba/Tavua	266	95.82	534.54	401
Penang	514	130.66	550.49	147
Total	2809	1541.21	5732.62	1156

Data shows that Fiji Leaf Gall disease is well managed. 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 have the most stools infected in 2016. Out of the total 2809 farms inspected 1156 stools were rouged.

Entomology – Termites, CWB & N-Fixing Bacteria

Termites Project

Asian Subterranean Termites pest is a major concern to the Fiji Sugar industry, which can become the next key pest in sugarcane after the sugarcane weevil borer (*R. obscurus*).

Desired outcome

Termite survey will be done to find out the incidence of pests and its severity. Other factors such as land type, topography, crop age, electricity and water availability will also include in survey. These will determine how management practices will be carried out in different farms.

Work profile

Current management of AST is through bait box traps which are comprised of sugarcane billets of Mana. After a period of 14 days, the boxes are checked for termite incidence and sprayed with Fipronil (Termidore) powder by Biosecurity Authority of Fiji Officers.

The project also includes

- Laboratory analysis of termites where termites in each sample will be identified to the furthest possible taxon under a low power stereo-microscope at suitable magnifications. Thus, training in termite identification is essential to study at species level.
- Intercropping trial design will be set up using where treatments will be the leguminous crops. Such crops are long bean, cow pea, urd, and peanuts.
- Neutralizing soil pH- field infested by termites will be applied with Ag lime and Vinase to neutralize the pH of soil. Studies on neutralizing soil pH and its impact on termites will be determined.
- Trial design / pesticides applications- The experiments will be conducted in farmers' field in the area of termite infestation. Comparative efficacy of some Insecticide will be evaluated in different application methods using different chemical formulations.

The Bait boxes were placed in 58 farms and removed during harvesting season from 54 farms to avoid damage and the boxes were replaced during October to December. During this period, baits in the boxes were changed and termidore powder was applied to infested boxes. With the application of termidore powder, neem plants are distributed to farmer to plant on the boundaries of their farm.

Integrated Pest Management of Cane Weevil Borer

The sugarcane weevil borer, Rhabdoscelus obscurus (Boisd.) has been a matter of concern for many years for the Fiji sugar industry. Cane weevil borer is an introduced pest of sugarcane in Fiji. CWB infestations can considerably reduce the amounts of commercial cane sugar from crops while also increasing levels of dextran in cane juice. Increased dextran in cane juice causes difficulty in crystal sugar separation during milling.

Work profile

Pheromone traps in combination with host material are used as a type of population control where pest is prevalent. Using split cane traps, bundles of six to eight split length of sugarcane wrapped in black plastic with the ends open are also used to access the adult borer population.

Most fungi used for the control of insects' pests belong to the group hyphomycetes. In addition; there is another commonly encountered group of fungi called the entomopathgens. Fungi in this group can cause natural outbreaks in the populations of their insect hosts, but they are difficult to mass produce and as yet are not in commercial production. Fungi that infect cane weevil borer are found in the environment as spores. CWB can become infected when they come into contact with spores on the surface of the plants, in the soil, in the air as wind borne particles, or on the bodies of already dead CWB. Spores attached to the surface of the CWB and infect by penetrating through the CWB cuticle, often at joints or creases where the insects' protective covering is thinner.

Figure 1.4.3: Split bait traps for Cane Weevil Borer

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

The source of soil nitrogen is the atmosphere where nitrogen gas occupies about 79% of the total atmospheric gases. Living organisms that are present in the soil have profound effect on transformation, which provides food and fibre for an expanding world population. Although nitrogen is very abundant in nature, it often limits plant productivity because atmospheric nitrogen is only available to a very range of organisms symbiotically associates with higher plants and non-symbiotically.

Work profile

This project determines a detailed procedure for identification of a viable nitrogen fixing bacteria for fixing nitrogen in sugarcane and possible cash crops. In this study diazotrophs of several genera from surface-sterilized roots of many kinds of legumes will be isolated. After a full complete experiment, nursery and field trial will describe the effect of inoculated diazotrophic isolates on the nitrogen of sugarcane plants. Isolations of N- fixing bacteria were successful on solid and liquid media. Selected isolates were further isolated for liquid culture and inoculated into Moong, Urd and Mucuna seeds.

Figure 1.4.4: Root nodules of a leguminous plant containing nitrogen fixing bacteria.

Figure 1.4.5: Isolation of nitrogen fixing bacteria.

Figure 1.4.6: Mass produced nitrogen fixing bacteria.

Figure 1.4.7: Testing efficiency of nitrogen fixing bacteria.

TECHNOLOGY TRANSFER

2.1 Technology Transfer – Demonstration trials and Field days

The Technology Transfer Program continued in 2016 and demonstration plots were set in each mill area. The focus of the demonstration plots were Weed Control, Use of Clean Seed, Adoption of Sugar Cane Varieties, Recommended rates of Fertiliser usage and Intercropping. The lessons learnt from the demonstration plots provides the opportunity to the farmers to adopt practices that will help in improving their production, acquire additional revenue and provide food security.

Field days were held in the demonstration plots that allows the farmers to see hands on practices that is useful in improving their productivity. All the stakeholder representatives were invited to address the growers and emphasized that field days are one of the initiatives through which a larger number of growers can be reached and the collective message of all industry stakeholders can be conveyed to the growers.

Demonstration on following topics were covered during the field days

- well prepared land,
- quality seedcane,
- Mechanical planting with single row cutter planter that could also apply blend A (basal phosphorous) and lime simultaneously.
- Spraying of pre-emergence weedicide with a knapsack using different nozzles that is designed for different modes of spraying - band application to just cover the width of the furrow and broadcast application that covers the width of the furrow and inter row.
- Mechanical spraying using a boom sprayer was also demonstrated.
- Timeliness of operations

Row spacing

Theme banner

Promoting new variety Qamea on hilly land


Rate of fertilizer application


Correct way of chopping seedcane

Farmers participate in Information day

Farmers participate in Field day

Farmers participate in Field day

Promoting varietal spread during Field day
Early maturing variety: LF91-1925

2.2 Grower Demonstration trials at Labasa

Eight demonstration trials were planted in Labasa in 2016. Two Field days were held after crop stand and 8 Field information days held during planting. Two seed beds established on farmer's field planted with cost borne by farmer under the Government sponsored Cane Planting Grant (CPG). Farmer feedback has been positive for SRIF and requests have been made for SRIF location to be closer to town or mill area for farmers' convenient access. A field day was held on the GDT (Grower Demonstration Trial) that had a new variety planted. This trial was to promote new varieties. The result of this trial was very encouraging. The plant cane yield of this new variety was 130 tpha (65 tonnes was harvested from 0.5 ha).

Table 2.2.1: Summary of GD trials 2016 and relevant activities Lautoka mill

No	Location/Sector	District	Topics	Theme/ Attendance
1	Surendran's farm	Drasa sector 15/09/2016	Mechanical planting Pre-emergence boom sprayer Disc harrow Trash incorporation Soil sampling Leaf sampling Bed formation Pulse planter Dual row planting on raised bed Dual row planting on flat bed Single row planter (Coulter) Stool ripper	Mechanization 99
2	Legalega Research Station	Legalega sector 20/01/2016	Soil sampling Green manure crop (mucuna planting) Trash incorporation in ratoon cane Supplying Tumtum (filling gaps in plant cane) Weedicide application Sugarcane Varieties (vigorous growth phase)	Demonstrations 40
3	Gopal Goundar	Lomawai sector 05/10/2016	Land Preparation Soil sampling Lime application Sugarcane Varieties Weed control	Varietal spread Demonstrations 38
4	Tahir Ali	Saweni sector 12/05/2016	Soil sampling Intercropping Sugarcane Varieties Weed control	Varietal spread Demonstrations 53
5	Mohan & Gyan Singh's	Veisaru 16/06/2016	Demo Plot on Dual Row Spacing Use of good seed cane Irrigation Demonstration Lime Application and incorporation	launching of planting & varietal spread 50
6	Meg Nadan	Yako 15/06/2016	Good Land Preparation Good quality seedcane Importance of blend A application Distribution of seedcane, chopping and covering of soil Pre-emergence weedicide application	launching of planting & varietal spread 59

2.3 Crop Production

Sugarcane has traditionally been propagated by vegetative means and is subject to many kinds of diseases that lower yields. In vitro cultivation methods been used successfully to select new high yielding varieties and disease resistant clones but they also serve to propagate best plant material for controlled clone production. There is risk of contamination in aseptic techniques which hinders plantlet development.

Activities undertaken

Some tissue culture plants survived despite unavailability of a greenhouse. Setbacks due to cyclone Winston. The tissue culture plants will be used in the plant breeding programme. Approximately 950 calluses were cultured but not all survived due to lack of training. Due to high level of contamination some seedlings didn't germinate. Few seedlings have been transferred to the soil and have shown healthy germination. Setbacks due to cyclone Winston. The germinated plants will be incorporated and used in the plant breeding programme. The clones that have survived and shown healthy germination will be used in the plant breeding programme to produce disease free and resistant varieties which will benefit farmers. These disease free clones will be multiplied and used in other research trials.

Figure: 2.3.1: Callus shoot and root formation

2.4 Media Publication

Media & Publication

This project involves in shooting videos and taking pictures to help SRIF in marketing, providing farmers and stakeholders with relevant information on activities carried out by SRIF. Pictures and footage taking occurs only daily/monthly basis and depending on which projects are ongoing and staff requests. To update and keep the library of footage, all videos must be copyright protected. List of videos (Volume 1) that were produced in-house by SRIF:

- ✓ Intercropping
- ✓ Soil sampling
- ✓ Weed control
- ✓ Best cane practices
- ✓ Termites
- ✓ Seedcane

Distribution of volume 1 DVD has been active and included recipients such as farmers, stakeholders and even some schools that visited SRIF head office on school excursion.

Distrubtion of DVD copies

The distrubtion of the DVD are normally done when a field day is carried out but is not limited to events such as visits from EU, industry stakeholders meetings etc, copies of DVDs are also presented to them. Along with making awareness to farmers on farming guides and best management practices, DVD distribution provides SRIF with the opportunity to market itself and create visiblity.

Table 2.4.1: Number of DVD's distributed in 2016

Sector	No. of DVD	No. of farmers	Reason/comments
Legalega	30	30	farmers field day
Rakiraki	20	20	information/knowledge
Lautoka	20	others	information/knowledge
Saweni	100	100	farmer information Day
Drasa	160	160	farm information day
Legalega/Nadi	100	100	booth display
Labasa	30	30	field day
Lautoka	60	others	booth display

Social media update

SRIF has a YouTube® channel for uploading videos produced on various topics. The purpose of the channel is to educate as well as promote SRIF's research work. Along with the YouTube® channel, SRIF also maintains its Facebook® as well as Twitter® accounts.

2.5 GIS

GIS mapping was done for all trials funded by EU, which included Grower Demonstration (GD) trials as well as seedcane source. The area of research for which GIS also proved important included pest mapping such as Cane Grubs.

Figure 2.5.1: GD trial locations

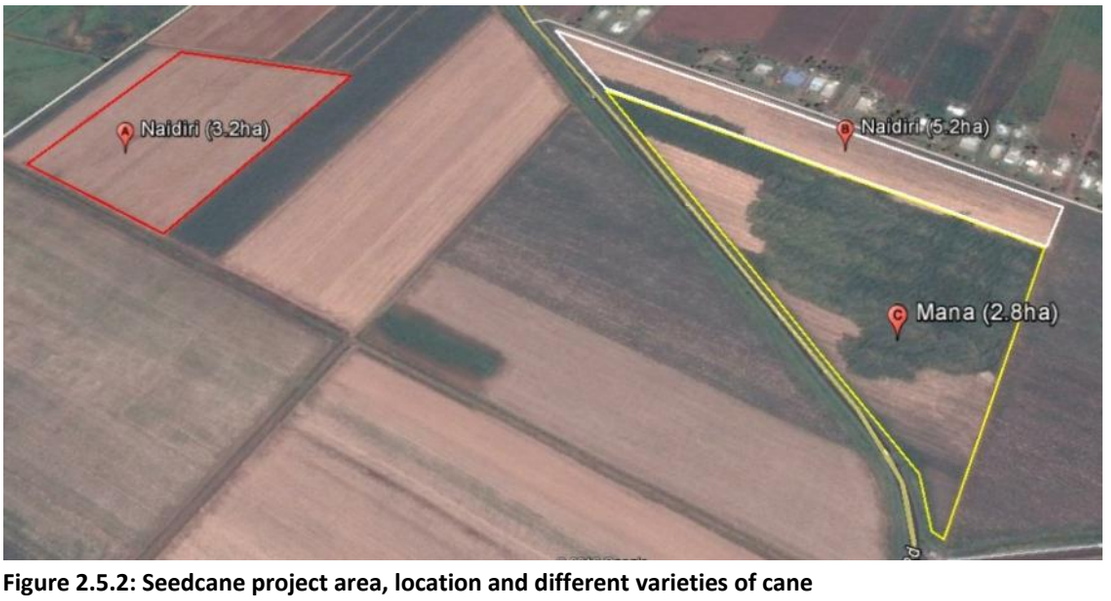

Figure 2.5.2: Seedcane project area, location and different varieties of cane

2.6 FACP tables

Appendix 1: Main features of 2016 season compared with 2015

	Lautoka		Rarawai		Labasa		Penang		All mills	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Total registrations (Numbers)	5388	5398	5268	5306	4017	5129	1714	1728	16387	17561
Total farm basic allotments (tonnes)	936592	942611	935815	950812	895990	903305	261552	270131	2116040	3066859
Total registered area (hectares)	22810	22840	21907	22270	18771	18897	7785	7983	71273	71990
Total area cultivated (hectares)	11516	11326	13062	12259	13245	14039	3883	3557	41705	41181
Total area harvested (hectares)	10882	10122	11849	10013	12972	13450	3588	3209	39291	36794
Total farm harvest quotas (tonnes)	open		open		open		open		open	
Sugar make actual (tonnes)	61463	39057	62570	27266	79797	73181	18103	N/A	221933	139504
Tonnes 94 N.T sugar	63784	40595	61083	25979	82744	76466	18731	N/A	226342	143040
Yield tonnes 94 N.T.sugar per hectare	5.9	4.0	5.5	2.6	8.3	5.7	5.2	N/A	6.2	3.9
Tonnes cane per tonnes sugar 94 N.T.	8.2	10.1	8.1	12.4	8.5	8.5	9.0	N/A	8.4	10.3
%POCS	12.4	10.8	12.6	9.8	12.1	11.7	11.9	N/A	12.3	10.8
Cane purity average for season	83.4	81.8	82.9	78.5	83.3	84.6	81.7	N/A	82.8	81.6
Tonnes cane harvested	521065	372288	490765	269800	662600	653353	170129	91806	1844559	1387247
Tonnes cane crushed	502327	395646	510322	338038	662600	653353	169317	NIL	1844566	1387037

Appendix 2: Monthly rainfall(mm) for 2016 compared with long term average

Mills	No. of years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lautoka	2016 actual	169	436	279	434	7	19	6	210	3	153	87	269	2072
	107 yrs avg. to 2016	307	324	321	185	97	65	51	69	73	91	126	190	1899
Rarawai	2016 actual	196	413	134	487	14	29	6	148	10	128	17	327	1908
	130 yrs avg. to 2016	356	358	358	286	79	38	29	95	102	144	218	239	2302
Labasa	2016 actual	4	0	257	560	1	22	1	203	0	104	111	510	1773
	127 yrs avg. to 2016	362	359	378	235	109	65	47	52	101	102	203	254	2267
Penang	2016 actual	84	634	120	370	58	57	13	199	1	73	126	550	2086
	118 yrs avg. to 2016	434	357	401	378	123	70	52	91	85	144	153	248	2445

Appendix 3: Crop production details										
	Lautoka		Rarawai		Labasa		Penang		All mills	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Areas harvested (hectares)										
Plant	1006	515	1095	403	1756	1027	580	302	4437	2247
First ratoon	653	924	799	919	1219	1772	238	474	2908	4089
2nd ratoon	513	577	761	648	1573	1252	232	191	3079	2668
Other ratoons	8710	8105	9194	8044	8424	9399	2538	2243	28867	27790
Total	10882	10121	11849	10014	12972	13450	3588	3210	39291	36794
Cane harvested										
Plant	55820	25214	54325	14298	103332	56637	30250	9714	243727	615863
First ratoon	36231	42834	39760	30791	79412	101907	11995	13105	167398	188637
2nd ratoon	27064	24100	34170	19765	82683	61477	10812	4257	154729	109599
Other ratoons	401950	280140	362510	204946	397173	433332	117072	64730	1278705	983148
Total	521065	372288	490765	269800	662600	653353	170129	91806	1844559	1897247
Yield tonnes cane per hectare (tch)										
Plant	55.5	48.9	49.6	49.6	58.9	55.1	52.2	32.2	54.9	46.5
First ratoon	55.5	46.3	49.8	49.8	65.2	57.5	50.3	27.6	57.6	45.3
2nd ratoon	52.7	41.7	44.9	30.5	52.6	49.1	46.7	22.3	50.3	35.9
Other ratoons	46.1	34.6	39.4	25.5	47.1	46.1	46.1	28.9	44.3	33.8
Avg. yield/ha	47.9	36.8	41.4	26.9	51.1	48.6	47.4	28.6	46.9	35.2
Varieties crushed (% of total cane harvested)										
Ragnar	0.9	0.7	0.9	0.7	24.8	23.5	0.7	0.1	9.5	8.8
Aiwa	0.5	0.7	0.3	0.3	0.2	0.3	0.1	0.8	0.3	0.5
Beqa	0.1	0.1	nil	nil	0.1	nil	nil	nil	0.1	0
Galoa	0.2	0.2	nil	nil	5.5	7.0	0.4	0.7	2.0	2.6
Kaba	2.7	3.2	6.2	6.1	0.4	0.5	0.9	0.8	2.6	2.7
Mali	nil	nil	1.1	0.6	12.2	11.1	0.1	nil	4.7	4.2
Mana	90.5	90.0	88.9	89.5	nil	nil	90.1	89.0	57.5	57.2
Naidiri	2.1	2.3	1.2	1.1	31.7	33.9	6.5	8.1	12.9	13.2
Vatu	0.1	nil	nil	nil	16.3	14.6	0.2	0.1	5.9	6.1
Waya	nil	nil	0.3	0.3	6.8	6.4	0.4	0.5	2.6	2.8
LF91-1925	1.5	1.8	0.9	0.9	1.3	1.8	0.2	0.5	1.1	1.3
Kiuva	1.1	0.9	nil	nil	0.5	0.7	0.3	0.3	0.5	0.5
Expt./Others	nil	0.3	0.2	0.5	0.2	0.3	0.1	0.1	0.3	0.3
Total	100	100	100	100	100	100	100	101	100	100

Appendix 4: Rainfall (mm) at mill centres										
Mill	For 12 months ended 31st December					For 12 months ended 30th September				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Lautoka	3563	2438	1541	974	2072	3384	1570	1250	991	1666
Rarawai	2640	2268	1250	1101	1908	2351	1469	1009	998	1768
Labasa	2679	2752	1679	1167	1773	2322	2066	1134	1519	1167
Penang	3000	2342	2179	1310	2086	2793	1850	1490	5452	1685

Appendix 5: Rainfall distribution affecting 2016 crop(mm)					
Month	**Period**	**Lautoka**	**Rarawai**	**Labasa**	**Penang**
Jul-15	Early	26.6	5.4	0.0	3.0
	Mid	0.0	0.0	0.0	1.2
	Late	0.0	0.0	0.0	0.6
Aug-15	Early	28.0	16.8	81.8	48.6
	Mid	5.5	2.8	0.0	0.6
	Late	1.9	2.5	0.0	3.8
Sep-15	Early	34.6	37.4	11.2	22.0
	Mid	0.6	0.5	0.0	5.0
	Late	8.2	15.0	24.7	31.3
Oct-15	Early	0.0	0.0	0.0	0.0
	Mid	10.8	43.4	6.8	123.6
	Late	7.7	0.0	0.0	0.2
Nov-15	Early	0.0	0.0	0.0	0.0
	Mid	0.0	0.0	9.5	2.5
	Late	2.4	6.7	17.1	25.2
Dec-15	Early	1.6	5.4	5.2	6.3
	Mid	38.6	8.5	0.0	27.3
	Late	4.2	269.0	80.5	161.9
Jan-16	Early	127.1	130.0	4.2	52.8
	Mid	41.0	87.6	0.0	17.3
	Late	0.9	9.9	0.0	14.2
Feb-16	Early	63.8	105.9	0.0	176.8
	Mid	147.8	141.0	0.0	101.3
	Late	224.6	165.4	0.0	355.8
Mar-16	Early	9.6	2.3	75.0	6.9
	Mid	96.2	68.5	5.6	29.4
	Late	172.7	62.9	176.5	83.8
Apr-16	Early	397.4	474.6	202.3	209.9
	Mid	4.7	12.6	357.6	143.5
	Late	32.3	0.0	0.3	16.8
May-16	Early	5.7	12.3	0.0	47.0
	Mid	0.6	0.0	0.5	9.6
	Late	0.9	1.3	0.0	1.4
Jun-16	Early	18.9	29.0	21.6	52.0
	Mid	0.0	0.0	0.0	0.4
	Late	0.0	0.0	0.0	4.5
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	Crop	Average for period of five seasons					Last four seasons individually			
		1991/ 1995	1996/ 2000	2001/ 2005	2006/ 2010	2011/ 2015	2013	2014	2015	2016
Lautoka	P	3634	2944	1042	788	775	566	681	1006	515
	R	20580	19701	19730	14614	10630	10403	10337	9876	8105
	Total	24214	22645	20772	15402	11405	10969	11018	10882	10122
Rarawai	P	2899	3164	1055	1127	953	833	803	1095	403
	R	17360	14613	17585	14553	11367	11415	11170	10754	9610
	Total	20259	17777	18640	15680	12320	12248	11973	11849	10013
Labasa	P	3120	2597	1269	1116	1403	1598	1035	1756	1027
	R	19604	18348	15911	14039	11500	10054	11044	11216	12423
	Total	22724	20945	17180	15155	12903	11652	12079	12972	13450
Penang	P	1386	1120	542	339	368	318	260	580	302
	R	4958	4674	4568	3991	3142	2973	3098	3008	2907
	Total	6344	5794	5110	4330	3510	3291	3358	3588	3209
All mills	P	11039	9825	3908	3369	3499	3315	2780	4437	2247
	R	62502	57336	57794	47197	36640	34845	35647	34854	35292
	Total	73541	67161	61702	50567	40139	38160	38427	39291	36794

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	2013	2014	2015	2016
Lautoka	1283569	1216597	971454	763321	516159	405652	520264	521065	372288
Rarawai	1017374	957507	878509	738316	551682	498881	596350	490765	269800
Labasa	1166055	1017061	840388	695728	547372	546156	544353	662600	653353
Penang	291206	309205	239044	213253	170698	159720	171214	170129	91806
All mills	3758204	3500370	2929395	2410619	1785912	1610409	1832181	1844559	1387247

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	2013	2014	2015	2016
Lautoka	P	64.7	64.2	63.9	67.2	57.7	51.2	59.8	55.5	48.9
	R	51.2	51.4	45.9	47.6	44.3	36.2	46.4	47.1	35.0
	Total	52.4	53.7	46.8	49.1	45.2	37.0	47.2	47.9	36.8
Rarawai	P	61.2	62.1	59.6	58.8	56.7	56.6	61.6	49.6	49.6
	R	48.1	52.9	46.4	44.8	43.8	39.6	49.0	40.6	26.6
	Total	50.1	53.9	47.1	46.5	44.8	40.7	49.8	41.4	26.9
Labasa	P	59.3	56.5	59.7	56.7	53.4	59.4	58.3	58.9	55.1
	R	50.4	47.4	47.6	43.5	41.4	44.8	43.8	49.9	46.1
	Total	51.3	48.6	48.9	45.8	42.7	46.9	45.1	51.1	48.6
Penang	P	57.2	62.6	54.2	56.3	50.6	40.8	60.4	52.2	32.2
	R	43.1	51.2	46.4	48.3	48.4	49.3	50.2	46.5	28.9
	Total	46.0	53.3	46.8	49.1	48.6	48.5	51.0	47.4	28.6
All	P	61.2	61.8	58.3	59.5	55.3	55.5	59.8	54.9	46.5
Mills	R	48.1	50.0	46.0	45.8	43.5	40.9	46.7	45.9	37.1
	Total	50.2	52.1	47.5	47.3	44.5	42.2	47.7	46.9	35.2

Appendix 9 : Hectares harvested in relation to registered area and cultivated area (ha)

Mills	2016 hectares (A)			Hectares harvested as % of various categories "A"	
	Registered (1)	Cultivated (2)	Harvested	(1)	(2)
Lautoka	22840	11326	10122	44.3	89.4
Rarawai	22270	12259	10013	45.0	81.7
Labasa	18897	14039	13450	71.2	95.8
Penang	7983	3557	3209	40.2	90.2
Total	71990	41181	36794	51.1	89.3

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	2013	2014	2015	2016
Lautoka	15.0	13.0	5.0	5.5	8.5	7.1	7.8	10.7	6.8
Rarawai	14.0	18.0	6.0	8.2	9.7	9.4	8.3	11.1	5.3
Labasa	14.0	12.0	7.0	8.2	13.4	17.4	11.1	15.6	8.7
Penang	23.0	19.0	11.0	8.2	10.7	8.1	9.2	17.8	10.6
All mills	16.0	15.0	7.0	7.4	10.5	10.5	9.1	13.2	6.1

Appendix 11: Plant, ratoon yields and percentage of total area harvested - 2016 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	48.9	515	22.9	46.3	924	22.6	8682	8682	28.5	36.8	10122
Rarawai	49.6	403	17.9	49.8	919	22.5	8692	8670	28.5	26.9	10013
Labasa	55.1	1027	45.7	57.5	1772	43.3	10651	10651	35.0	48.6	13450
Penang	32.2	302	13.4	27.6	474	11.6	2434	2434	8.0	28.6	3209
All Mills	46.5	2247	100.0	45.3	4089	100.0	30458	30437	100.0	35.2	36794

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	2013	2014	2015	2016
Lautoka	12.5	11.4	11.5	10.8	11.4	11.6	12.9	12.4	10.7
Rarawai	12.9	11.4	11.9	10.9	11.3	11.5	12.0	12.6	9.7
Labasa	12.1	11.1	11.5	10.7	11.5	11.2	12.3	12.1	11.7
Penang	12.6	11.1	11.9	11.1	11.1	10.6	11.9	11.9	NIL
All Mill Avg.	12.5	11.2	11.7	11.0	11.4	11.3	12.3	12.3	10.6

Appendix 13: Weekly POCS in cane 2016 season					
week	Lautoka	Rarawai	Labasa	Penang	Week average
1	11.47	9.11	10.82	PENANG MILL CLOSED DUE TO DAMAGES SUSTATINED DURING CYCLONE WINSTON	10.47
2	11.90	10.16	10.89		10.98
3	11.52	9.99	11.04		10.85
4	11.85	8.27	10.99		10.37
5	11.65	9.87	11.06		10.86
6	11.76	9.27	11.49		10.84
7	11.36	9.71	11.64		10.90
8	11.04	9.71	12.06		10.94
9	11.38	10.10	12.37		11.28
10	11.53	10.20	12.32		11.35
11	11.35	9.86	12.29		11.17
12	11.74	10.21	12.22		11.39
13	11.03	10.19	12.33		11.18
14	10.50	10.11	12.10		10.90
15	11.10	10.29	12.25		11.21
16	10.62	10.06	12.20		10.96
17	9.61	10.00	11.92		10.51
18	9.29	9.24	11.71		10.08
19	9.78	9.48	11.27		10.18
20	8.49	9.01	11.03		9.51
21	8.63				8.63
22	7.91				7.91
Average	10.71	9.74	11.70		10.57

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**								
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Lautoka	77311	53313	43384	50306	48129	41874	76456	63784	40595
Rarawai	63954	42222	31580	61028	45732	60039	68277	61083	25979
Labasa	53160	57548	40943	45146	45398	63423	69647	82744	76466
Penang	23231	22818	18530	16838	19908	19258	21684	18731	NIL
All mills	217656	175901	134436	173318	159166	184594	236065	226342	143040

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**	**2012**	**2013**	**2014**	**2015**	**201 6**
Lautoka	6.2	5.6	4.9	4.4	4.9	3.8	3.8	6.9	5.9	4.0
Rarawai	6.3	5.6	5.4	4.0	4.9	3.8	4.7	5.6	5.2	2.6
Labasa	6.0	5.0	5.0	4.0	5.1	3.4	5.3	5.6	6.4	5.7
Penang	5.5	5.4	4.7	5.4	5.5	5.6	5.9	6.5	5.2	NIL
Average	6.1	5.4	5.1	4.3	5.1	4.2	4.9	6.1	5.8	3.9

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**	**2013**	**2014**	**2015**	**2016**
Lautoka	28.0	29.7	27.6	27.0	27.9	19.0 02/06/13 To 03/11/13	19 01/07/14 To 08/11/14	21 02/07/15 To 24/11/15	21 20/06/16 To 16/11/16
Rarawai	25.3	26.5	24.2	28.0	22.1	20 26/06/13 To 13/11/13	21.5 19/06/14 To 17/11/14	19.4 23/06/15 To 28/10/15	19 20/07/16 To 31/11/16
Labasa	29.4	30.7	24.1	25.9	18.7	19 27/06/13 To 09/11/13	16.5 17/06/14 To 11/10/14	19.2 17/06/15 To 28/10/15	20.4 16/06/16 To 06/11/16
Penang	21.5	26.2	20.4	22.5	18.1	17 25/06/13 To 20/10/13	16.9 27/06/14 To 11/10/14	15.9 29/06/15 To 19/10/15	No crushing
All mills	26.1	28.2	24.1	25.9		18.7	18.5	18.9	20.1

Appendix 17 : Varieties Percent of hectares harvested										
	Lautoka		**Rarawai**		**Labasa**		**Penang**		**All Mills**	
Varieties	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Ragnar	0.7	0.73	0.7	0.7	24.4	23.5	0.7	0.2	8.5	6.3
Waya			0.3	0.4	7.3	6.4	0.4	0.5	2.5	1.8
Mali			1.2	0.6	11.8	11.1	0.1		4.3	2.9
Galoa	0.2	0.2			5.3	7.0	0.3	0.7	1.8	2.0
Aiwa	0.4	0.7	0.3	0.3	0.3	0.3	0.1	0.2	0.3	0.4
Kiuva	0.9	0.8			0.5	0.7	0.3	0.3	0.5	0.5
Mana	92.1	89.8	89.9	89.5			90.9	88.6	60.9	67.0
LF91-1925	1.2	1.7	0.6	0.9	1.3	1.8	0.2	0.5	1.0	1.2
Kaba	2.3	3.2	5.6	6.1	0.4	0.5	0.9	0.8	2.6	2.7
Vatu	0.1				16.9	14.6	0.2	0.1	5.6	3.7
Beqa	0.1	0.1			0.1					
Naidiri	1.6	2.3	1	1.1	31.7	34	5.9	8.1	11.8	11.4
Exp.		0.3								0.1
Other var.	0.1	0.2	0.3	0.8	0.2	0.3		0.1	0.2	0.4

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**		
	2014	**2015**	**2016**	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
Lautoka	1116.7	574.0	753.3	4.9	2.5	3.3	9.5	5.0	6.7
Rarawai	1276.6	546.4	1450.4	5.9	3.0	6.6	9.1	4.4	12.4
Labasa	1979.2	1255.5	1566.5	10.2	6.7	11.1	14.8	9.4	11.3
Penang	509.0	354.8	247.7	6.6	4.4	3.1	9.5	8.9	7.0
Total	4881.5	2730.7	4017.9	6.8	3.8	5.6	11.0	6.5	9.8

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
2014		0.6	61.6	0.5	55.2	23.9	2790.0	0.1	3.9	7.5	2910.7
2015	Ragnar	0.7	3.8	2.8	15.3	25.0	313.9	0.1	0.4	12.2	333.1
2016		-	-	0.3	3.8	-	-	-	-	-	-
2014		-	2.5	0.4	48.3	6.7	979.5	0.1	2.6	2.1	1032.9
2015	Waya	-	-	0.9	4.8	5.6	70.9	-	-	2.8	75.7
2016		-	-	1.1	15.8	-	-	-	-	-	-
2014		91.8	10193.8	90.9	10883.7	-	-	95.4	3207.0	64.3	24284.5
2015	Mana	80.8	464.0	60.0	328.0	-	-	62.3	221.2	37.1	1013.2
2016				85.5	1240.7						
2014		0.1	8.4	-	-	6.2	799.5	0.1	4.2	1.9	812.1
2015	Galoa	0.3	2.0	-	-	8.2	102.5	2.9	10.4	4.2	114.9
2016		-	-	-	-	-	-	-	-	-	-
2014		-	-	-	-	16.6	2026.3	-	0.6	4.9	2027.2
2015	Vatu	-	-	-	-	7.9	98.7	-	-	3.6	98.7
2016		-	-	-	-	-	-	-	-	-	-
2014		0.1	18.4		0.3	10.3	1277.2	0.1	-	3.1	1301.3
2015	Mali					6.2	77.9	0.1	0.4	2.9	78.3
2016		-	-	-	-	-	-	-	-	-	-
2014		0.4	43.0	0.3	40.4	0.2	25.0			0.3	108.4
2015	Aiwa	1.4	8.0	0.5	2.8	0.1	1.4	0.7	2.4	0.5	14.6
2016				0.6	8.3						
2014		0.3	27.9				4.9			0.1	32.8
2015	Beqa										
2016											
2014		2.3	252.3	5.0	598.8	0.4	68.8	0.3	14.1	2.6	934.0
2015	Kaba	7.1	41.0	16.1	88.1	0.4	4.7	2.5	8.8	5.2	142.6
2016				8.4	121.8						
2014		1.7	160.5	0.9	104.2	33.8	3922.9	3.4	106.8	11.2	4294.4
2015	Naidiri	4.0	23.0	5.0	27.2	37.4	470.1	29.1	103.1	22.8	623.4
2016				1.9	28.0						
2014		1.3	129.4	1.1	132.4	0.8	82.4	0.3	10.7	1.0	354.9
2015	Kiuva			1.4	7.6	0.5	6.9	0.1	0.4	0.5	14.9
2016											
2014		1.0	57.5	0.3	34.2	0.9	93.2	0.1	2.8	0.6	187.7
2015	LF91-1925	3.8	22.0	11.0	60.1	6.9	86.8	2.1	7.6	6.5	176.5
2016				1.3	19.0						
2014	Experiment	0.1	10.9	0.6	75.0	0.1	9.1			0.3	95.0
2015	Other			2.3	12.4	1.8	22.1			1.3	34.5
2016	Varieties			0.9	13.0						

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	2008	15915	2.0	179905	24.0	574754	74.0	770567	100
	2009	12464	2.0	168852	23.0	544730	75.0	726046	100
	2010	3964	1.0	129410	25.0	394094	75.0	527468	100
	2011	9491	1.5	144569	22.2	498273	76.4	652333	100
	2012	2065	0.4	113819	23.6	365599	75.9	481483	100
	2013	12464	1.7	168852	23.3	544730	75.0	726046	100
	2014	1436	0.3	116328	22.4	402500	77.4	520264	100
	2015	nil	nil	111036	21.3	410029	78.7	521065	100
	2016	50	.01	85410	22.9	286831	77.0	372291	100
Rarawai	2008	38797	5.0	184094	25.0	509470	70.0	732165	100
	2009	23827	4.0	164490	25.0	471034	71.0	659351	100
	2010	25106	5.0	126450	24.0	370460	71.0	522016	100
	2011	23586	3.6	332792	50.1	307396	46.3	663774	100
	2012	14772	3.6	106393	24.9	387485	71.4	508650	100
	2013	22054	6.3	104779	30.2	220584	64.0	347417	100
	2014	14006	2.2	113691	18.0	468653	79.8	596350	100
	2015	12032	2.5	93635	19.1	385098	78.5	490765	100
	2016	8189	3.0	45598	16.6	221077	80.4	274864	100
Labasa	2008	1275		179815	30.0	423224	70.0	604314	100
	2009			230735	34.0	448849	66.0	679584	100
	2010			171042	34.0	383485	66.0	554527	100
	2011	nil	nil	162856	29.0	407610	71.0	570466	100
	2012	840	0.2	117543	28.4	294902	71.4	413285	100
	2013	nil	nil	137018	25.1	409138	75.0	546156	100
	2014	nil	nil	149353	27.4	395000	72.6	544353	100
	2015	nil	nil	181420	27.4	481180	72.6	662600	100
	2016	nil	nil	178355	26.0	508736	74.0	687091	100
Penang	2008	3026	1.0	48285	23.0	163261	76.0	214572	100
	2009	11145	6.0	30977	17.0	139528	77.0	181650	100
	2010			44447	25.0	131254	75.0	175701	100
	2011	nil	nil	55422	26.5	153438	73.5	208860	100
	2012	nil	nil	38712	27.0	104856	73.0	143568	100
	2013	nil	nil	40797	26.0	118923	75.0	159720	100
	2014	nil	nil	36454	21.3	134760	78.7	171214	100
	2015	nil	nil	31707	18.6	138422	81.4	170129	100
	2016	nil	nil	nil	nil	91806	100.0	91806	100
All mills	2008	59013	3.0	592099	26.0	1670704	72.0	2321620	100
	2009	47436	2.0	595054	26.0	1604141	71.0	2246631	100
	2010	29070	1.6	471349	26.5	1279293	72.0	1779712	100
	2011	33077	1.6	695639	33.2	1366717	65.2	2095433	100
	2012	17677	1.1	376467	24.3	1152842	74.5	1546986	100
	2013	8630	2.0	451446	26.2	1293375	74.1	1779339	100
	2014	15442	0.8	415826	22.7	1400913	76.5	1832181	100
	2015	12032	0.7	417798	22.7	1414729	76.6	1844559	100
	2016	8239	0.5	309363	21.7	1108450	77.7	1426052	100

Appendix 21: Percentage burnt cane of total tonnes crushed										
Year	Lautoka		Rarawai		Labasa		Penang		Average	
	%	Total	%	Total	%	Total	%	Total	%	Total
1981	17.6	1444504	21.2	1248910	19.4	930265	17.0	307753	18.8	3,931,432
1982	23.2	1507831	24.8	1100133	13.6	1140552	13.2	326348	18.7	4,074,864
1983	18.3	639823	18.4	561774	18.0	761454	12.0	239482	16.7	2,202,533
1984	25.1	1731580	8.2	1146140	12.9	1136737	10.0	382030	14.1	4,396,487
1985	28.6	947593	25.2	864264	22.4	934166	16.2	296418	23.1	3,042,441
1986	29.5	1526648	15.1	1204661	15.1	1017372	11.3	360284	17.8	4,108,965
1987	23.8	1090111	34.2	685994	20.9	877652	19.0	306706	24.5	2,960,463
1988	37.7	1116916	15.2	742128	16.0	1034788	19.2	291440	22.0	3,185,272
1989	20.6	1537337	13.6	1250977	12.7	974201	10.0	336418	14.2	4,098,933
1990	24.3	1347531	30.4	1148070	13.7	1171817	14.6	348110	20.8	4,015,528
1991	42.5	1112957	46.4	961961	32.0	1029223	27.6	276261	37.1	3,380,402
1992	52.5	1109778	52.1	962936	44.4	1162108	41.1	297818	47.5	3,532,640
1993	35.6	1341537	33.4	1013627	29.2	1124357	19.4	224383	29.4	3,703,904
1994	39.0	1337977	36.0	1104246	27.0	1298285	19.8	323743	30.5	4,064,251
1995	43.4	1515880	42.5	1044098	37.6	1216290	28.7	333790	38.1	4,110,058
1996	54.8	1561446	48.1	1229978	39.9	1238443	33.2	349348	44.0	4,379,215
1997	50.7	1160879	49.1	906495	33.5	910137	34.8	302095	42.0	3,279,606
1998	67.0	625763	67.7	406811	54.5	832622	44.6	232825	58.5	2,098,021
1999	41.6	1433143	39.8	992968	17.0	1192735	26.3	339292	32.4	3,958,138
2000	56.1	1301752	54.6	1251282	37.8	911370	49.0	322475	50.6	3,786,879
2001	56.7	906743	50.3	844411	18.9	845444	49.5	208183	42.9	2,804,781
2002	46.8	1137123	41.8	1071579	21.4	938450	33.9	275431	37.1	3,422,583
2003	40.1	890499	32.8	836728	29.3	638851	22.0	243602	33.4	2,609,680
2004	42.7	1032127	39.5	878121	18.3	848533	35.5	242408	34.3	3,001,189
2005	44.4	890779	38.4	761704	25.0	910663	34.9	225594	35.7	2,788,740
2006	60.5	1051097	58.5	1039474	34.4	871031	46.5	264498	51.7	3,226,100
2007	39.0	741231	40.5	738478	39.1	769138	53.5	229844	40.8	2,478,691
2008	50.9	770569	53.6	732165	49.1	604314	48.5	214572	51.1	2,321,620
2009	43.5	726046	33.3	659351	18.6	679584	28.8	181650	31.8	2,246,631
2010	30.4	527663	33.6	522114	18.6	554575	16.3	175701	25.0	1,780,053
2011	28.5	652333	28.2	663774	17.9	570468	26.6	208860	25.3	2,095,435
2012	43.8	481483	44.7	508638	18.7	413285	28.3	143568	35.9	1,546,974
2013	77.8	726046	31.9	347417	14.2	546156	27.0	159720	37.7	1,779,339
2014	50.7	520264	49.9	596350	22.0	544353	28.0	171214	39.9	1,832,181
2015	47.0	521065	48.5	490765	27.7	662600	31.0	170129	39.0	1,844,559
2016	75.7	372288	89.7	269800	81.6	653353	50.2	91806	74.3	1,387,247

3.0 APPROVED VARIETIES

Recommendation of varieties to growers are based on their soil types. 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
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
Lautoka/Saweni	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Sandy soils	LF91-1925	Kaba, Mana, Galoa

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

Mill/Sectors	Soil types	Varieties recommended on maturity trends	
		Early – mid maturing	Mid – late maturing
Labasa/Vunimoli	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
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Bucaisau	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Wainikoro	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
	Saline soils	Naidiri, LF91-1925	Galoa, Vatu, Mali
Labasa/Daku	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Waya, Viwa
	Poor soils	Naidiri, LF91-1925, Qamea	Kaba, Waya, Mali, Viwa
Labasa/Natua	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Labasa/Solove	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Labasa/Bulivou	Poor soils	Aiwa, Naidiri, LF91-1925, Qamea	Ragnar, Kaba, Mali, Viwa
Penang/Nanuku	Flat Fertile soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Salt affected areas	Naidiri, LF91-1925	Galoa
	Viti Vanua area	Naidiri, LF91-1925, Qamea	Mana, Kaba, Kiuva, Mali, Viwa
Penang/Malau	Rich alluvial soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Kiuva, Viwa
	Medium soils	Aiwa, Beqa, Naidiri, LF91-1925	Ragnar, Kaba, Vatu, Kiuva, Mali, Viwa
	Poor soils	LF91-1925, Qamea	Kaba, Mana, Viwa
	Saline soils	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
	Saline soils	Naidiri, LF91-1925	Galoa

5.0 GLOSSARY

Term	*Explanation*
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 fertilisers being tested at SRIF.
Spectra-Cane	High-speed fully automated sugarcane analyser 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
Polarisation (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
Truog	Method for measuring the availability of soil phosphate

FINANCIAL REPORT

Sugar Research Institute of Fiji

Financial Statements

For the year ended 31 December 2016

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 2016 and the related statement of profit or loss and other comprehensive income and statement of cash flows for the year ended on that date and report as follows:

Directors
The Directors in office during the year end and 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)
Professor Paras Nath (resigned on 7 December 2017)
Mr Daniel Elisha (term expired on 1 March 2018)
Mr Abdul Khan (term expired on 1 March 2018)
Mr Sundresh Chetty (term expired on 1 March 2018)
Mr Manasa Tagicakibau (resigned on 18 July 2017)
Mr Graham Clark (appointed on 18 July 2017)
Ms Reshmi Kumari (appointed on 18 July 2017)
Dr Sanjay Anand (appointed on 7 December 2017)
Professor Ravendra Naidu (appointed on 13 March 2018)
Mr Raj Sharma (appointed on 12 June 2018)
Mr Ashween Nischal Ram (appointed on 18 June 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 2016 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 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.

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 $6,560,210 after excluding deferred income of $10,552,785 (2015: $6,429,224 after excluding deferred income of $10,448,540).

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.

Events subsequent to balance date
There is a draft Sugar Industry Bill before the parliament that is proposing major changes in the functioning of Sugar Research Institute of Fiji and until this bill is passed, the Board cannot give assurance about the future of Sugar Research Institute of Fiji in its present form.

Apart from the above, 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 _____ day of _____ 2018 .

Signed in accordance with a resolution of the Board.

Chairman **Board member**

KPMG

Independent Auditors' Report

To the Board Members of Sugar Research Institute of Fiji

Report on the Audit of the Financial Statements

Qualified 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 2016, 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 17.

In our opinion, except for the effect on the financial statements of the matter described in the Basis for Qualified Opinion section of our report, the accompanying financial statements give a true and fair view of the financial position of the Institute as at 31 December 2016, and of its financial performance and its cash flows for the year then ended in accordance with International Financial Reporting Standards (IFRS).

Basis for Qualified Opinion

The financial statements currently show an amount of Value Added tax (VAT) receivable from Fiji Revenue and Customs Services of $213,374. There is lack of proper reconciliation and/or supporting documents to substantiate this amount. We are therefore unable to ascertain the completeness, existence and accuracy of VAT receivable balance. The impact on the amount recorded in the financial statements is incapable of determination, and accordingly, we are not able to determine what adjustments, if any, might be necessary to the amounts recorded in the financial statements.

We conducted our audit in accordance with 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 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.

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

Management is responsible for the preparation of the financial statements that give a true and fair view in accordance with IFRS, 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.

Report on the Audit of the Financial Statements (continued)

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.
- 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 we identify during our audit.

KPMG

Independent Auditors' Report

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

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.

KPMG

26 September, 2018

Nadi, Fiji

Sharvek

Sharvek Naidu

Partner

Sugar Research Institute of Fiji
Statement of profit or loss and other comprehensive income
For the year ended 31 December 2016

	Note	2016 $	2015 $
Contributions and grants	5	3,426,764	3,743,559
Estate income		111,705	224,413
Other income		5,794	2,537
Total income		3,544,263	3,970,509
Cost of operations	6	(1,375,798)	(1,678,857)
Administrative expenses	7 (a)	(2,205,802)	(2,330,957)
Deficit from operations		(37,337)	(39,305)
Finance income		37,337	39,305
Deficit before tax		-	-
Income tax benefit	8	-	-
Balance at the beginning of the year			-
Deficit for the year		-	-

The notes on pages 10 to 22 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Statement of financial position
For the year ended 31 December 2016

	Note	2016 $	2015 $
Assets			
Current assets			
Cash and cash equivalents	10	2,995,486	4,000,895
Receivables and prepayments	11	238,232	157,104
Receivable from related parties	15 (b)	5,724,999	5,224,999
Total current assets		8,958,717	9,382,998
Non-current assets			
Property, plant and equipment	9	3,992,575	4,019,316
Total non-current assets		3,992,575	4,019,316
Total assets		12,951,292	13,402,314
Liabilities			
Current liabilities			
Deferred income	12	10,552,785	10,448,540
Payable to related parties	15 (c)	2,265,685	2,260,537
Employee benefits	13	11,162	45,933
Trade and other payables	14	121,660	647,304
Total current liabilities		12,951,292	13,402,314
Total liabilities		12,951,292	13,402,314

Signed on behalf of the Board

Chairman **Board Member**

The notes on pages 10 to 22 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Statement of cash flows
For the year ended 31 December 2016

	Note	2016 $	2015 $
Operating Activities			
Receipts from stakeholders and donors		1,252,535	4,335,523
Payment to suppliers and employees		(2,416,834)	(3,631,442)
Interest received		37,337	39,305
Cash flows (used in) / from operating activities		(1,126,962)	743,386
Investing Activities			
Acquisition of property, plant and equipment	9	(278,447)	(116,598)
Received from related parties		400,000	700,000
Cash flows from investing sctivities		121,553	583,402
Net (decrease) / increase in cash and cash equivalents		(1,005,409)	1,326,788
Cash and cash equivalents at the beginning of the year		4,000,895	2,674,107
Cash and cash equivalents at end of the year	10	2,995,486	4,000,895

The notes on pages 10 to 22 are an integral part of these financial statements.

Sugar Research Institute of Fiji
Notes to the financial statements
For the year ended 31 December 2016

1. Reporting entity

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 for related matters.

2. Basis of preparation

(a) Statement of compliance

The financial statements have been prepared in accordance with International Financial Reporting Standards (IFRS) as adopted by the International Accounting Standards Board (IASB).

The financial statements were authorised for issue by the Board of Directors on 26 September 2018.

(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 $6,560,210 after excluding deferred income of $10,552,785 (2015: $6,429,224 after excluding deferred income of $10,448,540).

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.

(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.

2. Basis of preparation (continued)

(e) Use of estimates and judgments

The preparation of financial statements in conformity with IFRS requires management to make judgments, estimates and assumptions that affect the application of accounting policies and the reported amount of assets, liabilities, income and expenses. Actual results may differ from these estimates.

Estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognised in the period in which the estimate is revised and in any future period affected.

3. Significant accounting policies

The accounting policies set out below have been applied consistently to all periods presented in these financial statement.

(a) 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.

(b) Property, plant and equipment

Recognition and measurement

Items of property, plant and equipment are measured at cost less accumulated depreciation and impairment losses. Costs includes expenditure that is directly attributable to the acquisition of the asset. Any gain or loss on disposal of an item of property, plant and equipment are determined by comparing the proceeds from disposal with the carrying amount of property, plant and equipment, and 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

3. Significant accounting policies (continued)

(b) Property, plant and equipment (continued)

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

(c) Financial instruments

(i) Non-derivative financial assets
The Institute initially recognises receivables on the date that they originate. All other financial assets are recognised initially on the trade date at which the Institute becomes a party to the contractual provisions of the instrument.

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

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

The Institute classifies non-derivative financial assets into loans and receivables.

Receivables
Receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. Such assets are recognised initially at fair value plus any directly attributable transaction costs. Subsequent to initial recognition receivables are measured at amortised cost using the effective interest method, less any impairment losses.

Receivables comprise receivables from related party, staff loans and deposits.

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

(ii) Non-derivative financial liabilities
Financial liabilities are initially recognised on the trade date when the Institute becomes a party to the contractual provisions of the instrument. The institute derecognises a financial liability when its contractual obligations are discharged or cancelled or expire. Financial liabilities are initially measured at fair value less any directly attributable transaction costs. Subsequent to initial recognition these liabilities are measured at amortised cost using the effective interest method.

The Institute has the following non-derivate financial liabilities: trade and other payables and payable to related parties.

3. Significant accounting policies (continued)

(d) Impairment

(i) Non-derivative financial assets

A financial asset not carried at fair value through profit or loss is assessed at each reporting date to determine whether there is objective evidence that it is impaired. A financial asset is impaired if objective evidence indicates that a loss event has occurred after the initial recognition of the asset, and that the loss event had a negative effect on the estimated future cash flows of that asset that can be estimated reliably.

Objective evidence that financial assets are impaired includes default or delinquency by a debtor, restructuring of an amount due to the Institute on terms that the Institute would not consider otherwise, indications that a debtor or issuer will entre bankruptcy or the disappearance of an active market for a security because of financial difficulties.

(ii) Non-financial assets

At each reporting date non financial assets are reviewed to determine whether there is any indication of impairment. If any such indication exists, then the asset's recoverable amount is estimated. If estimated recoverable amount is lower, the carrying amount is reduced to its estimated recoverable amount, and an impairment loss is recognised immediately in profit or loss.

(e) Contributions and grant

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.

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.

(f) 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 obligation can be measured reliably.

3. Significant accounting policies (continued)

(g) Receivable from related parties

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

(h) Standards issued but not yet effective

A number of new standards and amendments to standards are effective for annual periods beginning after 1 January 2016 and earlier application is permitted, however, the Institute has not early adopted the following new standards in preparing these financial statements.

IFRS 9 *Financial Instruments*

IFRS 9 is effective for annual periods beginning on or after 1 January 2018, with early adoption permitted. The standard partly replaces IAS 39 and introduces requirements for classifying and measuring financial assets and liabilities; it also includes an expected credit losses model that replaces the current incurred loss impairment model.

IFRS 15 *Revenue from Contracts with Customers*

IFRS 15 is effective for annual periods beginning on or after 1 January 2018, with early adoption permitted. The standard will provide a single source of requirements for accounting for all contracts with customers (except for some specific exceptions, such as lease contracts, insurance contracts and financial instruments) and will replace all current accounting pronouncements on revenue. New revenue disclosures are also introduced.

IFRS 16 *Leases*

IFRS 16 is effective for annual periods beginning on or after 1 January 2019. Early adoption is permitted if IFRS 15 *Revenue from Contracts with Customers* is applied at or before the date of initial application of IFRS 16. The standard removes the classification of leases as either operating leases or finance leases – for the lessee – effectively treating all leases as finance leases. Short term leases (less than 12 months) and leases of low-value assets are exempt from the lease accounting requirements. There are also changes in accounting over the life of the lease. In particular, companies will now recognise a front-loaded pattern of expense for most leases, even when they pay constant annual rentals. Lessor accounting remains similar to current practice i.e. lessors continue to classify leases as finance and operating lease.

The Institute has not performed a preliminary assessment of the potential impact of adoption of the above standards on these financial statements.

4. Financial risk management

Overview

The Institute has exposure to the following financial risks:

(i) Credit risk
(ii) Liquidity risk
(iii) Market risk

4. Financial risk management (continued)

Overview (continued)

This note presents information about the Institute's exposure to each of the above risks, the Institute's objectives, policies and processes for measuring and managing risk. Further quantitative disclosures are included throughout these financial statements.

The Institute's overall risk management programme focuses on having sufficient liquidity to achieve the Institute's objectives. Risk management is carried out by the Directors. Directors identify, evaluate and monitor financial risks in close cooperation with management. The Institute operates in the Sugar Industry for the research and development of the Sugar Industry. Consequently, regardless of the impact of the risks below, the risks are largely managed by the Ministry of Sugar. However, Directors exercise due care in dealing with these risks so as to minimise their impact on the Institute.

(i) Credit risk

Credit risk is the risk of financial loss to the Institute if a customer or counterparty to a financial instrument fails to meet its contractual obligations, and arises principally from the Institute's cash at bank, trade and other receivables, and receivable from related parties.

Exposure to credit risk

The carrying amount of financial assets represents the maximum credit exposure. The maximum exposure to credit risk at the reporting date was:

	2016 $	2015 $
Cash at bank	2,995,476	4,000,885
Staff loan and deposits	24,858	23,408
VAT receivable	213,374	-
Receivable from related parties (see Note 15(b))	5,724,999	5,224,999
	8,958,707	9,249,292

The aging of receivable from related parties at the reporting date that were not impaired was as follows:

	2016 $	2015 $
Current - within 1 year	900,000	900,000
Between 1 and 4 years	2,700,000	2,700,000
Between 4 and 5 years	900,000	900,000
Greater than 5 years	1,224,999	724,999
	5,724,999	5,224,999

4. Financial risk management (continued)

(i) Credit risk (continued)

The above receivable is from Fiji Sugar Corporation. Management believes that the amounts past due by more than 1 year is still collectible in full as in the case of default the Institute would be able to call upon the Ministry of Sugar to provide directive to FSC to pay the outstanding balance.

(ii) Liquidity risk

Liquidity risk is the risk that the Institute will not be able to meet its financial obligations as they fall due. The Institute's approach to managing liquidity is to ensure, as far as possible, that it will always have sufficient liquidity to meet its liabilities when due, under both normal and stressed conditions.

The following are the contractual maturities of financial liabilities of the Institute:

	2016	2015
	$	$
Payable to related parties	2,265,685	2,260,537
Trade and other payables	121,660	105,981
VAT payable	-	541,323
	2,387,345	2,907,841

The above are payable within a year and largely dependent on cash inflows from donor agencies in meeting the financial commitments.

Market risk

The Institute's exposure to market risk is not material .

5. Contributions and grants

Contributions from stakeholders and grants that compensate the Institute for revenue and capital

	2016	2015
	$	$
Contribution from the Fiji Government	980,734	1,097,645
European Union	484,562	450,624
Fiji Sugar Corporation (FSC)	980,734	1,097,645
Sugar Cane Growers	980,734	1,097,645
	3,426,764	3,743,559

		2016	2015
6.	**Cost of operations**	**$**	**$**
	Advertising	4,168	3,176
	Bank charges	3,039	2,764
	Consultancy fees	13,419	41,209
	Depreciation	305,188	307,033
	Electricity	44,150	39,236
	EU cost	232,200	183,630
	Communication expenses	27,297	20,910
	Material costs	129,551	43,728
	Motor vehicle running expenses	198,100	203,253
	Repair and maintenance	18,531	13,953
	Subcontract expenses	48,972	198,995
	Travel	27,782	183,728
	Wages and salaries (refer note 7(b))	323,401	437,242
		1,375,798	1,678,857
7.	**Expenses**		
(a)	**Administrative expenses**		
	Auditors remuneration - audit	9,000	1,241
	- other services	10,675	8,202
	Accommodation and meals	12,101	56,694
	ACP cost	26,234	173,260
	Security for CEO	8,210	444
	Doubtful debts	825,688	782,609
	Fiji National Provident Fund contributions	116,546	95,123
	Freight	32,212	50,005
	Fringe benefit tax	10,989	-
	General expenses	225,416	115,443
	Hire of services	79,957	88,897
	ICT consumables	16,335	13,064
	Insurance	42,940	47,180
	Legal fees	10,000	3,250
	Other expenses	71,297	25,049
	Repair and maintenance	1,220	24,252
	Staff expenses	9,200	6,099
	Stationery	2,797	25,039
	Training and Productivity Authority of Fiji	9,136	9,650
	Travel	18,343	34,951
	Tuition fees	10,325	13,441
	Uniforms	7,166	11,738
	Utilities	3,213	13,364
	Wages and salaries (refer note 7(b))	646,802	731,962
		2,205,802	2,330,957

7. Expenses (continued)

(b) Personnel expenses	2016 $	2015 $
Fiji National Provident Fund contributions	116,546	95,123
Training and Productivity Authority of Fiji	9,136	9,650
Key management compensation - short term benefits	87,432	87,432
Wages and salaries	882,771	1,081,772
Other staff related costs	16,366	17,837
	1,112,251	1,291,814

8. Income tax

In 2012, the Fiji Revenue and Customs Authority confirmed that the Institute is not subject to income tax.

9. Property, plant and equipment

	Land & building	Fixtures & fittings	Plant & equipment	Motor vehicles	Computers	Work in progress	Total
	$	$	$	$	$	$	$
Cost							
Balance at 1 January 2015	2,809,132	43,932	1,825,341	1,203,909	311,445	-	6,193,759
Acquisitions	-	-	74,646	-	19,230	22,722	116,598
Transferred to profit or loss	-	-	(15,556)	-	-		(15,556)
Balance as at 31 December 2015	2,809,132	43,932	1,884,431	1,203,909	330,675	22,722	6,294,801
Acquisitions	45,968	87,007	118,513	-	26,959	-	278,447
Transferred during the year	22,722	-	-	-	-	(22,722)	-
Balance as at 31 December 2016	2,877,822	130,939	2,002,944	1,203,909	357,634	-	6,573,248
Depreciation							
Balance at 1 January 2015	101,790	23,768	597,226	994,893	250,775	-	1,968,452
Depreciation charge	31,365	4,393	181,588	74,489	15,198	-	307,033
Balance at 31 December 2015	133,155	28,161	778,814	1,069,382	265,973	-	2,275,485
Depreciation charge	32,223	12,369	196,419	44,770	19,407	-	305,188
Balance at 31 December 2016	165,378	40,530	975,233	1,114,152	285,380	-	2,580,672
Carrying amount							
At 1 January 2015	2,707,342	20,164	1,228,115	209,016	60,670	-	4,225,307
At 31 December 2015	2,675,977	15,772	1,105,617	134,527	64,702	22,722	4,019,316
At 31 December 2016	2,712,444	90,409	1,027,711	89,757	72,254	-	3,992,575

	2016	2015
10. Cash and cash equivalents	**$**	**$**
Cash at bank	2,995,476	4,000,885
Cash on hand	10	10
	2,995,486	4,000,895

11. Receivables and prepayments		
Staff advances	22,108	20,658
Prepayments	-	133,696
Deposits	2,750	2,750
VAT receivable	213,374	-
	238,232	157,104

Staff advances are recovered through payroll deductions.

12. 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:

	2016	2015
	$	**$**
Balance at the beginning of the year	10,448,540	10,083,526
Funds received or receivable during the period	2,903,911	4,366,973
Utilised during the period	(2,799,666)	(4,001,959)
Balance at end of the year	10,552,785	10,448,540
This is comprised as follows:		
Fiji Government	122,991	1,557,986
Fiji Sugar Corporation (FSC)	6,100,292	1,495,473
Sugar Cane Growers	1,800,000	1,544,613
European Union grant	2,388,832	4,425,346
African Caribbean and Pacific Group of States (ACP)	-	1,162,670
Mauritius Sugar Research Institute (MISRI)	-	81,095
Fiji Sugar Tribunal		181,257
Estate income	140,670	-
	10,552,785	10,448,440

13. Employee benefits		
Balance at 1 January	45,933	45,933
Provision created / utilised during the year	(34,771)	-
Balance at 31 December	11,162	45,933

14. Trade and other payables	**2016**	**2015**
	$	**$**
Trade payables	39,293	51,806
Other payables	82,367	54,175
VAT payable	-	541,323
	121,660	647,304

15. 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 Directors in office during the year end and 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)
Professor Paras Nath (resigned on 7 December 2017)
Mr Daniel Elisha (term expired on 1 March 2018)
Mr Abdul Khan (term expired on 1 March 2018)
Mr Sundresh Chetty (term expired on 1 March 2018)
Mr Manasa Tagicakibau (resigned on 18 July 2017)
Mr Graham Clark (appointed on 18 July 2017)
Ms Reshmi Kumari (appointed on 18 July 2017)
Dr Sanjay Anand (appointed on 7 December 2017)
Professor Ravendra Naidu (appointed on 13 March 2018)
Mr Raj Sharma (appointed on 12 June 2018)
Mr Ashween Nischal Ram (appointed on 18 June 2018)

(b) Amounts receivable from related parties	**2016**	**2015**
	$	**$**
Fiji Sugar Corporation	5,724,999	3,424,999
Sugar Cane Growers	1,800,000	2,700,000
Allowance for uncollectability - Sugar Cane Growers	(1,800,000)	(900,000)
	5,724,999	5,224,999
Reconciliation of Allowance for Uncollectability		
Balance at the beginning of the month	900,000	-
Provision created during the year	900,000	900,000
Balance at the end of the year	1,800,000	900,000

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

15. Related parties (continued)	**2016**	**2015**
	$	**$**
(c) Amounts payable to related parties		
Fiji Sugar Corporation	2,265,685	2,260,537

Payable to related parties are interest free and payable on demand.

(d) Transactions with related parties

Deferred income		
Grant income - Fiji Sugar Corporation - receivable	825,688	782,609
Grant income - Fiji Government - cash received	825,688	782,609
Grant income - Sugar Cane Growers - receivable	825,688	782,609
Estate income - Fiji Sugar Corporation - cash received	252,375	224,412
	2,729,439	2,572,239
Impairment Loss		
Sugar Cane Growers	825,688	782,609

(e) Key management personnel

Key management personnel include the Chief Executive Officer and Finance and Administration Manager of the Institute. Key management compensation is disclosed in Note 8(b).

16. Capital commitments and contingencies

Capital commitments and contingent liabilities as at 31 December 2016 amounted to $Nil (2015: $Nil).

17. Events subsequent to balance date

There is a draft Sugar Industry Bill before the parliament that is proposing major changes in the functioning of Sugar Research Institute of Fiji and until this bill is passed, the Board cannot give assurance about the future of Sugar Research Institute of Fiji in its present form.

Apart from the above, 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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