# 2015 Annual Report


PARLIAMENT OF FIJI
PARLIAMENTARY PAPER NO. 52 OF 2018

## FOREWORD

The weather conditions in 2015 was similar to previous year with lower than average rainfall received in the cane belt that contributed to below expected cane production. The government has been providing continual support to the industry to improve productivity and the use of science and technology at the farm level could be the two most important parameters to mitigate declining cane and sugar yields. The Institute continues to focus on its key strategic areas of cane improvement, crop protection and management through various research projects. Supplementing these projects is the technology transfer drive that is considered as an integral part of crop production.

The Institute aspires to provide the industry with high performing varieties that are well adapted to the conditions in Fiji. Breeding of sugarcane varieties is a complex lengthy process involving many intricate and difficult procedures that is spread over a 12-15 year cycle. Each step and different stage of the breeding program plays an important role and, during the year a number of varieties from various stages of selection were progressed to the next stage of selection. The release of varieties for commercial planting is based mainly on high sugar yield per unit area, longer ratoon ability and resistance to diseases. Sugarcane seeds (fuzz) from 13 crosses was imported from West Indies and this will be evaluated to identify breeding material that will help in broadening the genetic base for the future breeding.

The protection of the industry against diseases and pest incursions is a high priority task for the Institute and warrants a proactive approach. The Institute has so far managed to keep the industry reasonably free of most of the major pests and diseases that are in Fiji. However, to continue to enjoy the same protection will require advances in biotechnology and manpower resources for which financial support is necessary. Routine screening of Fiji leaf gall (FLG) disease continued during the year and some preliminary survey works was done on plant parasitic nematodes where soil samples were analysed from Penang mill area to determine the occurrence of the nematodes. A survey was also carried out to ascertain the presence of cane grubs in the cane belt and initial findings indicate the presence of this emerging pest in the cane farms that has been sent abroad for identification. The rouging unit inspected 4587 hectares and eradicated 482 diseased FLG stools. The Institute needs to remain focused to become a centre of excellence and disseminate information through the technology transfer program. Under this program on field demonstrations on key issues that will improve production are conducted. In 2015 18 grower demonstration trials were visited by 670 growers who had the opportunity to see the advancements in mechanization.

The EU support for the research activities is available through the Accompanying Measures for the Sugar Protocol Programme (AMSP Programme). The Sugar Research Institute of Fiji has benefitted significantly from the support of European Union through the Annual Action Programs (AAP) 2011-2013. The total of € 3.5M has been made available to SRIF through the Annual Action Programs AAP2011, AAP2012 and AAP2013.
This year I would like to put on record thanks and appreciation to staff from all categories in our substations and the head office for their support and commitment to the Institute.
The SRIF staff work collectively by providing technical guidance to protect and advance the sugar industry on issues affecting its ability to be sustainable and profitable. I would also like to thank the new Chairman and other board members for their useful contribution and guidance.

**Chief Executive Officer**

## 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.

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**PARLIAMENT OF FIJI**
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# PLANT BREEDING

## PLANT BREEDING

Plant Breeding consisted of 6 projects that were under study in 2015 namely:

- Germplasm,
- Sugarcane Crossing,
- Stage 1,
- Stage 2,
- Stage 3 and
- Stage 4.

### *Germplasm*

The sugarcane germplasm is a collection of clones that has recorded desirable traits and will be utilized for further genetic combinations. One of the key characteristics of the germplasm is to be genetically diverse through the inclusion of clones with diverse genetic background. This can be accomplished by importing varieties as well as sourcing varieties from the selection phase and parental development phase of the current breeding programs.

Sugar Research Institute of Fiji (SRIF) has got its germplasm located at Drasa in Lautoka, at Wairuku in Penang and at Dobuilevu in the Ra Province. The Drasa collection is undergoing verification and re-planting while Wairuku and Dobuilevu collections are being maintained through timely harvest and cultivation. Portions of the Dobuilevu collection is still in a farmer's field which is being shifted to the new crossing site. Along with the germplasm currently being maintained, SRIF has consistently been importing varieties to expand its current collection as well as inducing diversification. In 2012, 9 varieties from Vietnam and 8 varieties from BSES were imported, the details of which will be discussed under respective headings below. The varieties imported in 2010-2011 have already been incorporated in the breeding plots (flowering beds). Overall, the SRIF germplasm is being maintained well with consistent assessments being carried out.

Drasa Collection – in Drasa Estate

Core collection in Field 11 which was planted in the 1990's (exact date unknown) was abandoned and attention was placed on the restored clones that was planted in Field 24 in 2011. It has a mix of local and overseas hybrids as well as pure species of noble and wild canes. Routine maintenance of the collection and upkeep was carried out this year.

Dobuilevu Collection – at SRIF crossing facility

Dobuilevu collection consists of clones for immediate use in sugarcane crossing. This is reviewed every year as to prevent use of same set of genetic materials over and over again. Clones from the Drasa germplasm, Plant breeding Selection trials are considered for inclusion as well as the overseas varieties and clones from the parental line development crosses such as Erianthus crosses. The collections were shifted into nearby Farmer's field to accommodate planned landscaping of the SRIF farms. No new varieties were planted this year.

Overseas varieties

The inclusion of the overseas varieties promotes diversity to the present collection as new genetic materials are being added into the existing gene pool. Historically, this had been a normal practice and this has been pursued again after a lapse of 2 decades during which no such initiatives were undertaken. In 2015, 13 crosses from West Indies were imported and

sown in Rarawai whereas a MoU was signed with Visacane Quarantine facility at CIRAD in France to import new sugarcane varieties for the next 3 years.

### *Sugarcane crossing*

Sugarcane crossing is carried out every year to bring in the genetic diversity into the selection systems. The flowers from various sugarcane clones are classed as male and female which then are inter-crossed based on sugar, fibre and parentage. The products of these genetic combinations are then taken through rigorous selection methods to achieve near commercial clones which are then taken for release or reverted back to germplasm for use as parent material.

The following table summarizes the total crosses carried out in 2015.

**Table 1: Summary of all crosses for 2015**

| TYPE | | | | # CROSSES | % |
|---|---|---|---|---|---|
| COMMERCIAL | COMMERCIAL HYBRIDS | POLY | FIELD | 136 | 29% |
| | | | HAND POLLINATED - FIELD | 61 | |
| | | BI-PARENTAL | LANTERN | 258 | 60% |
| | | | HAND POLLINATED - LANTERN | 143 | |
| | | | HAND POLLINATED - LANTERN | 24 | |
| EXPERIMENTAL | ERIANTHUS | BI-PARENTAL | FIELD | 8 | 6% |
| | | | HAND POLLINATED - FIELD | 10 | |
| | | | LANTERN | 10 | |
| | OFFICINARUM | BI-PARENTAL | HAND POLLINATED - LANTERN | 3 | 2% |
| | | | FIELD | 3 | |
| | IJ/IK HYBRIDS | POLY | FIELD | 16 | 2% |
| **TOTAL** | | | | **672** | |

Poor seed sett from crosses was addressed by the consultant Dr. Nils Berding and it was found that the crossing solution did not have the right mix to sustain flowered stalks for 21 days. Steps are being undertaken to correct this for the 2016 season.

### *Stage 1*

Stage 1 is the progeny testing stage whereby the seedlings established from current and past year crosses are established for new trial and the seedlings that had been transplanted in the field in the previous year are evaluated. The assessment is based on sucrose (brix) of the clones with the ones having brix higher than the average of standards (commercial varieties) are selected for stage 2. In some cases, clones with good vigour/ appeal are also considered although they may have less brix. Both the LF2014 and LF2015 series were in Stage 1 this year.

LF2014 series

The cane stalks were still in semi internode stage due to late planting in March. There are high chances this trial may not be evaluated in 2016 as prevailing dry weather conditions post transplanting also contributed to the slow growth of the varieties.

LF2015 series

A total of 1076 fuzz packets was sown in 2015, details of which are shown in the table below. All the seedlings were potted and transplanted to the field in December.

**Table 2: LF2015 series fuzz sowing summary**

| | | Commercial Crosses | | | Experimental Crosses | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | ***Details** | **Poly** | **Bi-parental** | **Unknown** | **Robustum** | **Erianthus** | **IJ/IK hybrids** | **Officinarum** | Total |
| | **Sown** | 1 | 49 | - | - | - | - | - | 50 |
| **2004** | **Germ** | 0 | 5 | - | - | - | - | - | 5 |
| | **%** | - | 10% | - | - | - | - | - | 10% |
| | **Sown** | - | 113 | 4 | - | - | - | - | 117 |
| **2005** | **Germ** | - | 5 | - | - | - | - | - | 5 |
| | **%** | - | 4% | - | - | - | - | - | 4% |
| | **Sown** | - | 242 | - | - | - | - | - | 242 |
| **2006** | **Germ** | - | 48 | - | - | - | - | - | 48 |
| | **%** | - | 20% | - | - | - | - | - | 20% |
| | **Sown** | - | 23 | - | - | - | - | - | 23 |
| **2007** | **Germ** | - | - | - | - | - | - | - | 0 |
| | **%** | - | - | - | - | - | - | - | 0% |
| | **Sown** | - | - | - | - | 23 | - | - | 23 |
| **2008** | **Germ** | - | - | - | - | 1 | - | - | 1 |
| | **%** | - | - | - | - | 4% | - | - | 4% |
| | **Sown** | 30 | 44 | - | - | - | - | - | 74 |
| **2009** | **Germ** | 9 | 22 | - | - | - | - | - | 31 |
| | **%** | 30% | 50% | - | - | - | - | - | 42% |
| | **Sown** | 186 | 11 | - | 22 | 4 | 99 | 4 | 326 |
| **2010** | **Germ** | 111 | 5 | - | 11 | 3 | 78 | 3 | 211 |
| | **%** | 60% | 45% | - | 50% | 75% | 79% | 75% | 65% |
| | **Sown** | 78 | 16 | - | - | - | - | - | 94 |
| **2011** | **Germ** | 76 | 10 | - | - | - | - | - | 86 |
| | **%** | 97% | 6% | - | - | - | - | - | 91% |
| | **Sown** | 16 | 37 | - | - | - | 1 | - | 54 |
| **2012** | **Germ** | 4 | 22 | - | - | - | - | - | 26 |
| | **%** | 25% | 59% | - | - | - | - | - | 48% |

**Table 2: Cont'd**

| Year | *Details | Commercial Crosses | | | Experimental Crosses | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Poly | Bi-parental | Unknown | Robustum | Erianthus | IJ/IK hybrids | Officinarum | |
| 2013 | Sown | 9 | 33 | - | - | 2 | 9 | - | 53 |
| | Germ | - | 2 | - | - | - | 1 | - | 3 |
| | % | - | 6% | | - | - | 11% | - | 6% |
| 2014 | Sown | 2 | 17 | - | - | 1 | - | - | 20 |
| | Germ | - | - | - | - | - | - | - | 0 |
| | % | - | - | - | - | - | - | - | 0% |
| WEST INDIES | Sown | 2 | 17 | - | - | 1 | - | - | 20 |
| | Germ | - | - | - | - | - | - | - | 0 |
| | % | - | - | - | - | - | - | - | 0% |
| Totals | Sown | **322** | **585** | **4** | **22** | **30** | **109** | **4** | **1076** |
| | Germ | **200** | **119** | **0** | **11** | **4** | **79** | **3** | **416** |
| | % | **62%** | **20%** | **0%** | **50%** | **13%** | **72%** | **75%** | **39%** |
| | | **All Commercials** | | | **All Experimental** | | | | |
| | Sown | **911** | | | **165** | | | | **1076** |
| | Germ | **319** | | | **97** | | | | **416** |
| | % | **35%** | | | **59%** | | | | **39%** |

*Sown – Number of fuzz packets sown, Germ – Number germinated, % - Percent germination

### *Stage 2*

Stage 2 is the first clonal stage whereby the selections from the seedling stage are planted and evaluated. Stalk samples are taken from the trial and sent for small mill laboratory analysis. The field notes on variety are also taken into consideration before making the final set of selections for advancement to Stage 3. In 2015, the LF2014 and LF2013 series were in Stage 2.

LF2014 series

This series could not be planted due to delay in Stage 1 selection that could not be carried out due to late planting of seedlings in the same year followed by drought that led to poor establishment of stalks.

LF2013 series

A total of 565 clones were sampled and the field notes on all varieties were taken. Out of the 565 clones sampled, 71 varieties were selected for advancement to Stage 3.

### *Stage 3*

Stage 3 is the second clonal stage whereby the clones from Stage 2 are planted and evaluated. Stalk samples are taken from the trial and sent for small mill laboratory analysis. The field notes on varieties are also taken into consideration before making the final set of selected

clones to progress to Stage 4. The clones are also sent for disease resistance screening at this stage. In 2015 the LF2012 and LF2013 series were in Stage 3.

LF2012 series

A total of 80 clones were sampled and field assessment completed. The final selection was conducted and a total of 17 clones were selected for advancement to Stage 4.

**Table 3: LF2012 Stage 3 – Selection for stage 4 clones**

| Variety | Female | Male | %Fibre | %Pocs | Stand | Lodged | Trash | Flower | SS | Growth | Height | Stalk | Appeal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF12-276 | LF00-584 | POLY 11 | 9.3 | 18.4 | A | S | S.C | | | M | M | T.M | C |
| LF12-63 | LF02-721 | POLY 61 | 10.9 | 17.2 | A | S | S.C | | | G | T | M | C+ |
| LF12-2 | LF05-746 | POLY 89 | 9.6 | 16.6 | A | - | F | | | S | M | TH | C+ |
| LF12-22 | LF02-887 | POLY 60 | 12.8 | 16.4 | A | S | S.C | | | M | M | T-M | C |
| LF12-40 | LF05-1025 | POLY 23 | 13.4 | 16.4 | G | S | S.C | F | M | M | M | T-M | C |
| LF12-114 | LF05-200 | POLY 3 | 11.9 | 16.3 | G | S | C | NO | | G | M-T | M | C |
| LF12-34 | LF03-163 | POLY 20 | 12.5 | 16.3 | P | S | S.C | | | M | M | M | C+ |
| LF12-31 | LF00-584 | POLY 2 | 10.8 | 16.1 | A | S | F | | | OK | M | T-M | C |
| LF12-282 | LF03-24 | POLY 62 | 12.2 | 16.1 | A | S | F | | F | OK | M | TH | C+ |
| LF12-255 | LF03-24 | POLY 29 | 14.0 | 16.1 | A | S | S.C | | | M | M-T | M-TH | C |
| LF12-154 | LF02-864 | POLY 53 | 11.1 | 15.9 | A | L | F | | S | S | S-M | M-T/H | C- |
| LF12-112 | LF00-1082 | POLY 18 | 10.8 | 15.9 | A | S | S.C | F | | G | M | M-TH | C+ |
| LF12-76 | LF00-1082 | POLY 9 | 11.2 | 15.7 | A | S | F | | | OK | M | TH-M | C+ |
| LF12-253 | LF03-24 | POLY 29 | 13.9 | 15.7 | A | S | F | F | | M | T | M-TH | C+ |
| LF12-74 | LF05-302 | POLY 23 | 14.2 | 13.4 | A | S | F | | | M | M-T | M-TH | C |
| LF12-153 | LF99-2430 | POLY 142 | 10.8 | 14.2 | A | S | S.C | | | M | M | M-TH | C+ |
| LF12-233 | NAIDIRI | POLY 139 | 11.9 | 14.5 | A | S | F | F | F | G | T | M-TH | C+ |
| MANA | | | 9.4 | 16.1 | | | | | | | | | |
| NAIDIRI | | | 11.1 | 15.9 | | | | | | | | | |

**KEY:**
Stand G/ A/ P – good/ average/ poor
Lodged S/L/H – slightly/ lodged/ heavy
Trash SC/C/F – slightly clinging/ clinging/ free trashing
Flower F/ P – flowered/ profuse
SS (SIDE SHOOTS) F/ M/ E – few/ moderate/ extreme
Growth S/ M/ V – stunted/ moderate/ vigorous
Height S/ M/ T – short/ moderate/ tall
Stalk T/ M/ TH – thin/ moderate/ thick.
Appeal A/C+/C/ C- - advance/ consider advance/ consider/ consider or discard.

A total of 12 varieties were selected on having %pocs better than the standards Naidiri and Mana whereas LF12-76, LF12-153 and LF12-233 selected based on having good physical attributes matching that of commercial cane and its sugar yield will be monitored in Stage 4. LF12-74 and LF12-253 have been selected for high fibre as well as good physical attributes.

The seed cane for selected clones were sent to Labasa for propagation however the seed bed could not be established for Penang, Lautoka and Rarawai Stage 4 since Stage 3 trial got

burnt together with the seed cane harvested for planting. The seed bed is re-scheduled to be planted in April 2016 whereas stage 4 planting will be delayed to October-November 2016.

LF2013 series
A total of 69 varieties was selected and planted for this trial on 29.10.15. All the cultivation work in this trial has been done and would be evaluated in 2016.

***Stage 4***

Stage 4 is the final stage whereby the selections from Stage 3 are planted at all mill areas (multi-location G X E trials) and evaluated for 3 crop cycles – Plant, 1st Ratoon and 2nd Ratoon. Stalk samples are taken from the trial and sent for small mill laboratory analysis. The field notes on varieties are also taken into consideration and varieties are identified (if having desired commercial attributes) in the first ratoon for Farmer Feel Effect (FFE) programme whereby seed cane of these varieties are propagated and given out to identified growers (at least 1 per sector) to plant for feedback purposes. In 2015, the LF2011, LF2010, LF2009 and LF2008 series were in Stage 4.

LF2011 series
A total of 10 varieties in 4 replicates were planted in all mills and will be evaluated in 2016.

LF2010 series
This trial was in Plant crop in Drasa, Rarawai and Labasa. The Drasa trial was abandoned later due to excessive gaps and lack of seed material for 'supply'. Labasa trial was also affected by drought but evaluation was done. Rarawai trials established well and were sampled, harvested and weighed. The trials will be maintained and proper husbandry practices carried out for evaluation in 2016.

LF2009 series
This trial was in 1st ratoon and also present in all mills and has been sampled, harvested and weighed. The data was compiled and recommendation for varieties for FFE will be done by 2016 after observing the propagation plots. The trials are maintained and proper husbandry practices carried out for evaluation in 2016.

LF2008 series
This trial was in 2nd ratoon and was present at all mills and has been harvested and weighed. The data was compiled for analysis and recommendation for varieties for FFE Program in 2016. This trial has officially been completed and will not be pursued in 2016.

***Recommendations***

The Plant Breeding program needs at least 4 full time staff to oversee all the projects. There was only 1 full time staff at the beginning and 2 more staff joining in August who were under study. At least 3-4 full-time support staff is also needed for all project field work. This is to upkeep consistency and proper monitoring and implementation of all the activities in a timely manner and to avoid repetition of training and mistakes

# AGRONOMY

# AGRONOMY

## Summary

Organic fertilizer promotes rich, fertile soil and supplies the nutrients to the plants when needed by the plant. Cane yield obtained from Farmorganix (SumaGrow) trial conducted at Drasa, showed that by applying organic fertilizer (SumaGrow) in combination with commercial fertilizers can increase cane and sugar yield significantly. Organic fertilizer produced 90 – 97 tonnes per hectare when used alone. However, the effect is enhanced when used in combination with commercial fertilizer producing 121 tonnes per hectare of cane. The effects of organic fertilizer (SumaGrow) need to be studied on plant and ratoon stages of sugarcane on different soil types and different sugarcane varieties to be able to recommend organic fertilizer (SumaGrow) for sugarcane.

The potassium trial that was planted in 2012 was evaluated for second ratoon in 2015. The results of this study indicated that there was no adverse effect of Muriate of potash on pocs, cane yield and sugar yield for plant crop. The trial will be evaluated once more in the third ratoon stage. The variety trial was evaluated for second ratoon. The result of this study indicated that late harvesting had an impact on cane pocs. Early maturing variety such as Naidiri should be planted and harvested early in the harvesting season. The other three trials (Nitrogen, Lime & Legume) which were planted in 2013 season in Labasa were evaluated for the first ratoon crop in 2015. For the nitrogen trial, it was observed that 120kg N/ha gave an economical yield which is desired by the farmers. Therefore, it is recommended that farmers can apply nitrogen from 120kg N/ha but this is yet to be confirmed after analyzing the second ratoon data next season. The value is a general recommendation but farmers should adhere to lab recommendation where possible.

As for the Lime trial, its application did not give any significant difference between the treatments in first ratoon crop. This can be due to Lime being a slow reacting component therefore, it is expected that a significance between the treatments can be visually observed after second ratoon evaluation. Based on the first set of data, it shows that Diuron if applied at the rate of 6 kg per hectare gives phytotoxic effect to the sugar cane plant. The growth is affected and scotching occurs on the leaf of the plant when sprayed. Similar trend was observed in the first ratoon crop whereas the result will be confirmed after the second ratoon crop is evaluated in 2016.

Planting legume has beneficial effects on the soil health and fixes nitrogen in the soil. This reduces the N fertiliser use which will eventually reduce the cost for farmers. It was observed that cowpea sprayed during flowering stage gave higher yield to cane planted in that treatment.

## TRIAL 1: Effect of Farm Organic on Cane and Sugar Yields in Comparison with Recommended rates of chemical fertilization

| | |
|---|---|
| Trial code: | LA1301P9 |
| Location: | F/24 Drasa, Lautoka |
| Variety: | Naidiri |
| Trial Design: | Randomized Complete Block Design |
| Replications/Treatment: | 6/4 |
| Plot size: | 6 rows x 10m x 1.37m |
| Date Planted: | 26 November 2013 |
| Date harvested**:** | 26 August 2014 |

**Details of treatments applied**

Treatment 1: NPK
Blend A at planting: 2 bags/ha = 0.82 kg/plot = 0.137 kg/row of 10m
Blend B: 6-8 weeks after planting-Blend B=14 bags/ha

Treatment 2: NPK 50% + Farmorganix 50%
Chemical Fertilsers-50%
Blend A at planting: 1 bag/ha = 0.41 kg/plot = 0.07kg/row of 10m
Blend B (50% of recommended rate): 7 bags/ha ; 6-8 weeks after planting
Farmorganix-50%
Application 1: Farmorganix at 2.5 L/ha = 20.55ml/plot = 3.43ml/row of 10m
Application 2: 6-8 weeks after planting;Farmorganix at 2.5 L/ha =20.55ml/plot =3.43ml/row of 10m

Treatment 3: Farmorganix 100%
Application 1 = 50% at planting = 5L/ha = 41.1ml/plot = 6.85ml/row of 10m
Application 2 = 50% 6-8 weeks after planting = 5L/ha = 41.1ml/plot = 6.85ml/row of 10m

Treatment 4: Dip in 2.5% solution for 5-8 minutes.
Application 1 = 50% at planting = 5L/ha = 41.1ml/plot = 6.85ml/row of 10m
Application 2 = 50% 6-8 weeks after planting = 5L/ha = 41.1ml/plot = 6.85ml/row of 10m

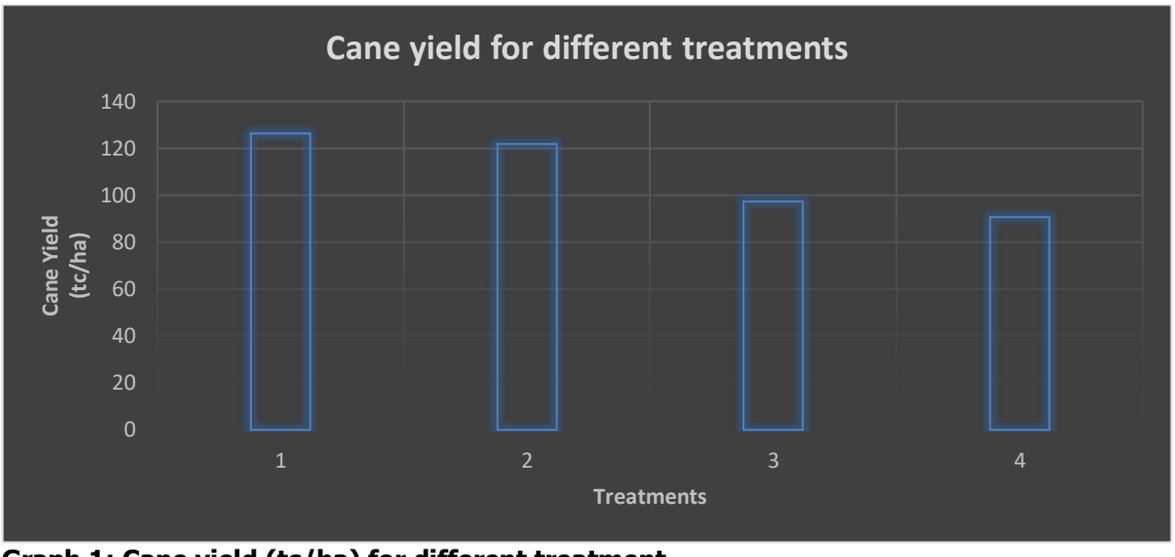
The purpose of this trial was to study the effect of Farmorganix/Stand Up on cane and sugar yields in comparison with recommended rates of chemical fertilizer. The trial was planted manually with 3 eye bud setts and covered with soil using a hoe. Pre-emergent herbicide (diuron 80 @ a rate of 5kg/ha) was applied. Germination of seed cane was counted and recorded. The young plants of Naidiri were affected by leaf scald. Percent infection ranged from 4 – 13 percent. Growth measurements were taken at 4 and 6 months after planting. The trial was harvested in August. The cane and sugar yield per hectare in each treatment is given below. The trial data were collated and analyzed statistically.

**Table 1: Cane production in different rates of fertilizer – Organomix (tc/ha)**

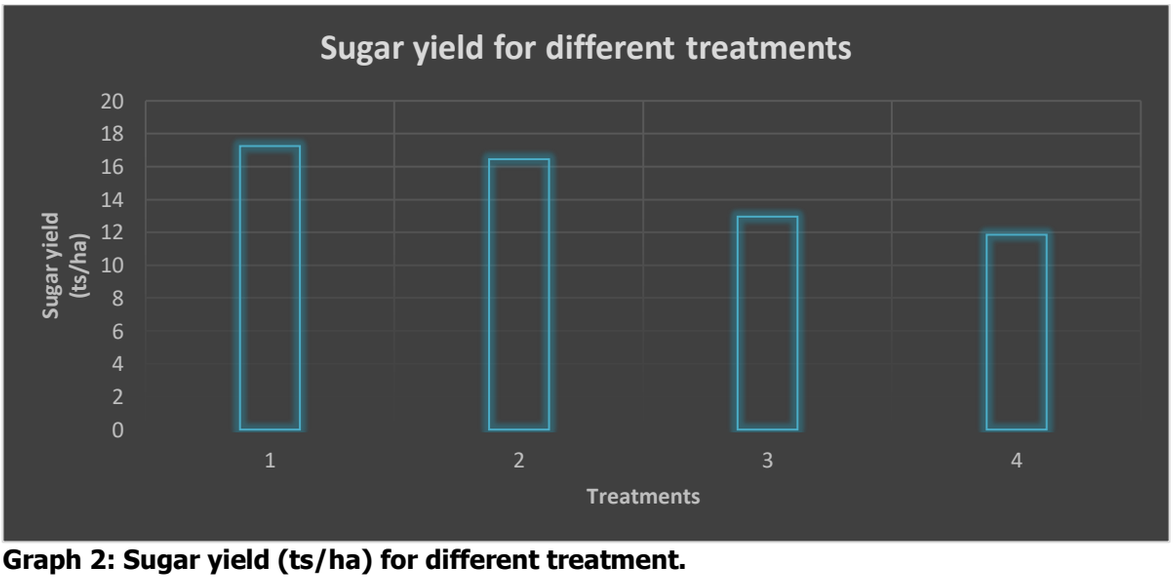
| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| **1** | 118.4 | 106.0 | 126.3 | 140.5 | 135.2 | 130.7 | 757.1 | 126.2 |
| **2** | 119.7 | 106.8 | 143.4 | 123.7 | 121.5 | 115.9 | 731.0 | 121.8 |
| **3** | 84.5 | 96.7 | 111.3 | 104.6 | 79.9 | 106.8 | 583.8 | 97.3 |
| **4** | 75.9 | 105.1 | 111.7 | 76.1 | 88.3 | 86.9 | 544.0 | 90.7 |

**Table 2: Sugar production in different rates of fertilizer – Organomix (ts/ha)**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| **1** | 15.5 | 14.5 | 17.2 | 19.2 | 18.2 | 18.9 | 103.5 | 17.3 |
| **2** | 16.4 | 14.8 | 18.7 | 16.5 | 17.0 | 15.6 | 98.8 | 16.5 |
| **3** | 11.3 | 12.5 | 15.2 | 14.3 | 10.6 | 14.0 | 77.8 | 13.0 |
| **4** | 10.2 | 13.2 | 14.7 | 9.9 | 11.8 | 11.5 | 71.2 | 11.9 |




**Graph 1: Cane yield (tc/ha) for different treatment**




**Graph 2: Sugar yield (ts/ha) for different treatment.**

**Table 3: Analysis of variance for tc/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 5 | 1323.3 | 264.7 | | |
| Treatment | 3 | 5601.0 | 1867.0 | 13.4 | 0.0002 |
| Error | 15 | 2092.7 | 139.5 | | |
| Total | 23 | | | | |

**Table 4: Analysis of variance for ts/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 5 | 24.0 | 4.8 | | |
| Treatment | 3 | 124.0 | 41.3 | 17.5 | 0.0000 |
| Error | 15 | 35.4 | 2.4 | | |
| Total | 23 | | | | |

It is evident from the data (graph 1) that the yield of cane is significantly different at 1% significance level (p=0.0002) (Table 3) within treatments. The data shows that SumaGrow is capable of producing good tonnage, producing 90 - 97 tonnes per hectare (treatment 3 and treatment 4) of cane when used alone. However, the effect is enhanced when used in

combination with commercial fertilizer producing 121 tonnes per hectare of cane (treatment 2). Likewise, the tonnes sugar produced is significantly different within each treatment at 1% significance level (p= 0.0000) (table 4). However, the plots that had only commercial fertilizer Treatment 1 (100% NPK) produced better yield compared to Treatment 3 (100% SumaGrow).

Based on the calculated yield this trial showed that by applying SumaGrow in combination with commercial fertilizers, cane yield and subsequently sugar yield can be increased. However, the effects of SumaGrow needs to be studied on plant and ratoon stages of sugarcane on different soil types and different sugarcane varieties to be able to recommend SumaGrow for sugarcane.

**TRIAL 2: The effects of potassium fertilization on plant cane and successive ratoons.**

**Trial code:** LA1101R9
**Location:** Drasa, Lautoka
**Variety:** Kiuva
**Trial Design:** Randomized Complete Block Design
**Replications:** 4
**Plot size:** 9rows x 8m x 1.37m
**Date Planted:** 24 June 2011
**Date harvested:** 10 September 2012

**Table 5: Treatments for the trial**

| Treatments | Muriate of Potash ( kg/ha) | | |
|---|---|---|---|
| 1 | 80 | | |
| 2 | 125 | | |
| 3 | 200 | | |
| 4 | 40 | 40 | (Split Application) |
| 5 | 40 | 85 | (Split Application) |
| 6 | 40 | 160 | (Split Application) |

This trial was planted in 2011 with the aim of acquiring more information on response of different rates of potassium fertilization when adequate nitrogen and phosphorus are added. The treatment fertilizer used was Muriate of Potash (50%) at three different rates; 80, 125, and 200 K kg/ha. The trial has six treatments as shown in table 5 above.

Treatment 4, 5 and 6 are split application. The cane was supplied with top dressing of ammonium sulphate at 120 kg/ha 6 weeks after harvesting. Amine 2, 4 D and Velpar were applied as post emergence at 4 kg/ha after emergence of weeds. A pre-harvest sampling of cane was carried out from each treatment to determine %brix, %pol, %pocs %fiber. The cane from each plot was weighed to determine cane and sugar yields obtained from each treatment. The results obtained from the trial are tabulated below.

**Table 6: %brix in juice**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 19.9 | 20.5 | 20.2 | 21.5 | 18.8 | 21.0 | 121.8 | 20.3 |
| 2 | 21.1 | 21.8 | 20.4 | 21.4 | 20.7 | 21.7 | 127.0 | 21.2 |
| 3 | 21.6 | 21.2 | 21.5 | 20.7 | 21.6 | 20.2 | 126.7 | 21.1 |
| 4 | 20.7 | 20.7 | 21.5 | 21.4 | 21.6 | 21.5 | 127.4 | 21.2 |

**Table 7: %pol in juice**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 17.3 | 17.9 | 17.4 | 18.5 | 16.0 | 18.3 | 105.4 | 17.6 |
| 2 | 18.6 | 19.6 | 17.6 | 19.0 | 18.4 | 18.8 | 111.8 | 18.6 |
| 3 | 19.2 | 18.4 | 18.9 | 18.2 | 18.9 | 17.6 | 111.1 | 18.5 |
| 4 | 17.6 | 18.0 | 19.0 | 19.0 | 19.0 | 19.0 | 111.6 | 18.6 |

**Table 8: %fiber**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 13.0 | 12.9 | 12.2 | 13.2 | 12.1 | 12.9 | 76.2 | 12.7 |
| 2 | 11.8 | 13.3 | 12.9 | 12.7 | 12.8 | 12.9 | 76.4 | 12.7 |
| 3 | 13.5 | 12.6 | 13.4 | 13.0 | 12.9 | 12.4 | 77.8 | 13.0 |
| 4 | 12.5 | 12.5 | 12.1 | 12.9 | 12.7 | 12.2 | 74.9 | 12.5 |

**Table 9: % pocs**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 13.0 | 13.4 | 13.1 | 13.7 | 11.9 | 13.7 | 78.8 | 13.1 |
| 2 | 14.2 | 14.8 | 13.1 | 14.5 | 13.9 | 14.0 | 84.5 | 14.1 |
| 3 | 14.4 | 13.9 | 14.1 | 13.6 | 14.2 | 13.2 | 83.4 | 13.9 |
| 4 | 13.1 | 13.6 | 14.5 | 14.4 | 14.3 | 14.5 | 84.3 | 14.1 |

**Table 10: tc/ha**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 31.6 | 25.2 | 25.6 | 24.3 | 21.0 | 33.8 | 161.5 | 26.9 |
| 2 | 23.7 | 34.4 | 14.3 | 38.3 | 11.6 | 31.3 | 153.6 | 25.6 |
| 3 | 27.7 | 33.2 | 33.5 | 26.5 | 32.2 | 25.2 | 178.2 | 29.7 |
| 4 | 20.1 | 10.0 | 45.9 | 40.5 | 24.9 | 38.9 | 180.4 | 30.1 |

**Table 11: ts/ha**

| Trt. | Reps | | | | | | Total | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 1 | 4.1 | 3.4 | 3.4 | 3.3 | 2.5 | 4.6 | 21.3 | 3.6 |
| 2 | 3.4 | 5.1 | 1.9 | 5.5 | 1.6 | 4.4 | 21.9 | 3.6 |
| 3 | 4.0 | 4.6 | 4.7 | 3.6 | 4.6 | 3.3 | 24.8 | 4.1 |
| 4 | 2.6 | 1.4 | 6.7 | 5.8 | 3.6 | 5.7 | 25.7 | 4.3 |

**Table 12: Analysis of Variance for tc/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 3 | 84.4 | 28.1 | | |
| Treatment | 5 | 329.4 | 62.9 | 0.7 | 0.6341 |
| Error | 15 | 1418.1 | 94.5 | | |
| Total | 23 | | | | |

**Table 13: Analysis of variance for ts/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 3 | 2.34 | 0.8 | | |
| Treatment | 5 | 7.23 | 1.4 | 0.7 | 0.6521 |
| Error | 15 | 32.38 | 2.2 | | |
| Total | 23 | | | | |

From the data obtained for the trial, it is evident there is no significant effect of potassium on cane (p=0.6341) and sugar (p=0.6521) yield. The cane yield is much lower than expected and this could be attributed to non-conducive weather conditions in 2014.

**TRIAL 3: The effects of time of harvest on sugarcane yield in Fiji.**

**Trial No.**: LA1102R9
**Location:** Drasa, Lautoka
**Varieties:** Kiuva, Naidiri and Mana
**Trial Design:** Split-plot design
**Replications:** 4
**Plot size:** 4rows x 7m x 1.37m
**Date Planted:** 24 June 2011
**Date harvested:**

- Early harvested : 07.07.14
- Mid harvested: 12.08.14
- Late harvested: 26.09.14

**Table 14: Treatments for the trial**

| Replication 1 | Replication 2 | Replication 3 | Replication 4 |
|---|---|---|---|
| **P1**T2**A** | **P1**T2**B** | **P1**T1**C** | **P1**T1**B** |
| **P2**T1**A** | **P2**T3**B** | **P2**T2**C** | **P2**T3**B** |
| **P3**T3**A** | **P3**T1**B** | **P3**T3**C** | **P3**T2**B** |
| **P4**T2**B** | **P4**T2**A** | **P4**T1**B** | **P4**T1**A** |
| **P5**T1**B** | **P5**T3**A** | **P5**T2**B** | **P5**T3**A** |
| **P6**T3**B** | **P6**T1**A** | **P6**T3**B** | **P6**T2**A** |
| **P7**T2**C** | **P7**T2**C** | **P7**T1**A** | **P7**T1**C** |
| **P8**T1**C** | **P8**T3**C** | **P8**T2**A** | **P8**T3**C** |
| **P9**T3**C** | **P9**T1**C** | **P9**T3**A** | **P9**T2**C** |

**Table 15: Definition of acronyms**

| Treatment | Harvest Season/ Variety |
|---|---|
| 1 | Early season[July 2014] |
| 2 | Mid-season[Aug 2014] |
| 3 | Late season[Sept 2014] |
| A | Mana |
| B | Naidiri |
| C | Kiuva |
| P[#] | Plot [Number] |

Three commercial varieties of sugarcane Kiuva, Naidiri and Mana were planted to evaluate optimum harvesting time for different varieties. The trial was harvested thrice in the harvesting season, early harvesting (July), mid harvesting (August) and late harvesting (September) and weighed manually. Six stalks were randomly selected from each treatment to determine %brix, %pol and %fibre and %pocs.

The tables below shows analysis of variances for selected parameters.

**Table 16: Analysis of variance for %pocs**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Rep | 3 | 4.5 | 1.5 | | |
| Variety | 2 | 4.7 | 2.4 | 1.3 | 0.3466 |
| Error Rep*Variety | 6 | 11.1 | 1.9 | | |
| Treatment | 2 | 19.1 | 9.6 | 26.5 | 0.0000 |
| Variety*Treatment | 4 | 1.0 | 0.3 | 0.7 | 0.6015 |
| Error Rep*Variety*Treatment | 18 | 6.5 | 0.4 | | |
| Total | 35 | | | | |

**Table 17: Analysis of variance for %brix**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Rep | 3 | 8.5 | 2.8 | | |
| Variety | 2 | 20.3 | 10.1 | 8.5 | 0.0178 |
| Error Rep*Variety | 6 | 7.1 | 1.2 | | |
| Treatment | 2 | 0.8 | 0.4 | 1.9 | 0.1837 |
| Variety*Treatment | 4 | 0.3 | 0.1 | 0.3 | 0.8650 |
| Error Rep*Variety*Treatment | 18 | 3.9 | 0.2 | | |
| Total | 35 | | | | |

**Table 18: Analysis of variance for %fiber**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Rep | 3 | 2.9 | 1.0 | | |
| Variety | 2 | 57.1 | 28.5 | 59.4 | 0.0001 |
| Error Rep*Variety | 6 | 2.9 | 0.5 | | |
| Treatment | 2 | 0.1 | 0.04 | 1.1 | 0.3677 |
| Variety*Treatment | 4 | 1.1 | 0.3 | 6.4 | 0.0022 |
| Error Rep*Variety*Treatment | 18 | 0.8 | 0.04 | | |
| Total | 35 | | | | |

**Table 19: Analysis of variance for tc/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Rep | 3 | 420.6 | 140.2 | | |
| Variety | 2 | 245.8 | 122.9 | 1.1 | 0.3895 |
| Error Rep*Variety | 6 | 665.5 | 110.9 | | |
| Treatment | 2 | 377.4 | 188.7 | 4.5 | 0.0266 |
| Variety*Treatment | 4 | 57.6 | 14.4 | 0.3 | 0.8470 |
| Error Rep*Variety*Treatment | 18 | 760.9 | 42.3 | | |
| Total | 35 | | | | |

**Table 20: Analysis of variance for ts/ha**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Rep | 3 | 8.4 | 2.8 | | |
| Variety | 2 | 1.8 | 0.9 | 0.4 | 0.6973 |
| Error Rep*Variety | 6 | 14.0 | 2.3 | | |
| Treatment | 2 | 23.8 | 11.9 | 13.7 | 0.0002 |
| Variety*Treatment | 4 | 0.8 | 0.2 | 0.2 | 0.9199 |
| Error Rep*Variety*Treatment | 18 | 15.6 | 0.9 | | |
| Total | 35 | | | | |

The sugar and cane yield obtained was very low. The first ratoon was lost to accidental fire and the fertilizer application for ratoon was applied which attributed to low yields. However, the tonnes of sugar obtained per hectare were found to be significantly different (p= 0.0002)

within all three harvesting seasons. Yield of sugar was found to be higher in late harvesting season. The percent brix for Kiuva and Naidiri are higher than more commonly planted variety Mana in all harvesting season including early harvesting season.

**TRIAL 4: Effect of lime on soil properties and sugarcane yield in Fiji**

**Location:** Drasa, Lautoka
**Varieties:** 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 21: Details of Treatments**

| Treatments | Details |
|---|---|
| 1 | No lime was applied |
| 2 | 0.7 tonnes per hectare of lime was applied in furrows |
| 3 | 1.4 tonnes per hectare of lime was applied in furrows |
| 4 | 2.1 tonnes per hectare of lime was applied in furrows |

The trial was planted manually with the aim of identifying effects of lime on soil properties and yield of sugarcane. Trial was laid out in April afterwhich the dry weather conditions setted in. Thus poor germination was noticed as per following table;

**Table 22: Germination percentage**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 29.7 | 43.3 | 26.9 | 36.5 | 137 | 34 |
| 2 | 45.7 | 41.0 | 27.6 | 25.8 | 140 | 35 |
| 3 | 36.1 | 37.6 | 38.9 | 31.6 | 144 | 36 |
| 4 | 38.6 | 48.7 | 34.8 | 24.2 | 146 | 37 |

Growth measurements were taken at 3, 5 and 8 months after planting. The data for each measurement is tabulated below.

**Table 23: Growth Measurement (Height of cane at 3 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 30.5 | 37.0 | 24.8 | 38.5 | 131 | 33 |
| 2 | 28.3 | 37.3 | 26.3 | 29.3 | 121 | 31 |
| 3 | 33.5 | 28.8 | 33.8 | 33.3 | 130 | 33 |
| 4 | 30.8 | 37.3 | 31.8 | 34.0 | 134 | 34 |

**Table 24: Growth Measurement (No. of tillers at 3 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 4.0 | 4.5 | 1.3 | 4.5 | 15 | 4 |
| 2 | 3.3 | 6.0 | 2.8 | 3.0 | 15 | 4 |
| 3 | 3.3 | 2.8 | 3.3 | 4.0 | 14 | 4 |
| 4 | 3.5 | 4.0 | 4.5 | 6.3 | 19 | 5 |

**Table 25: Growth Measurement (Population count at 3 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 65.0 | 104.0 | 51.5 | 87.0 | 308 | 77 |
| 2 | 47.0 | 133.5 | 38.0 | 68.0 | 287 | 72 |
| 3 | 69.0 | 74.5 | 63.5 | 77.0 | 284 | 71 |
| 4 | 90.0 | 102.0 | 82.5 | 79.5 | 354 | 89 |

**Table 26: Growth Measurement (Height of cane at 5 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 45.0 | 69.5 | 37.0 | 62.0 | 214 | 54 |
| 2 | 35.5 | 75.0 | 41.8 | 51.3 | 204 | 51 |
| 3 | 46.8 | 47.5 | 45.5 | 68.8 | 209 | 52 |
| 4 | 52.5 | 65.0 | 48.3 | 69.8 | 236 | 59 |

**Table 27: Growth Measurement (No. of tillers at 5 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 4.0 | 7.8 | 2.5 | 5.8 | 20 | 5 |
| 2 | 3.8 | 8.0 | 3.5 | 8.5 | 24 | 6 |
| 3 | 4.8 | 4.0 | 3.8 | 8.0 | 21 | 5 |
| 4 | 5.3 | 7.5 | 6.0 | 8.8 | 28 | 7 |

**Table 28: Growth Measurement (Population count at 5 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 68.5 | 116.5 | 59.0 | 96.0 | 340 | 85 |
| 2 | 37.0 | 125.5 | 45.0 | 102.0 | 310 | 78 |
| 3 | 66.0 | 81.5 | 57.5 | 100.0 | 305 | 77 |
| 4 | 97.5 | 90.5 | 75.0 | 106.5 | 370 | 93 |

**Table 29: Growth Measurement (Height of cane at 8 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 117.8 | 150.0 | 81.3 | 128.8 | 478 | 120 |
| 2 | 75.0 | 156.3 | 95.0 | 120.0 | 447 | 112 |
| 3 | 83.8 | 122.5 | 109.8 | 127.0 | 443 | 111 |
| 4 | 112.3 | 130.0 | 117.3 | 127.5 | 487 | 122 |

**Table 30: Growth Measurement (No. of tillers at 8 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 8.3 | 10.0 | 4.5 | 7.5 | 31 | 8 |
| 2 | 5.0 | 6.5 | 5.0 | 7.0 | 24 | 6 |
| 3 | 3.8 | 7.0 | 4.5 | 11.0 | 27 | 7 |
| 4 | 5.3 | 8.5 | 5.8 | 9.8 | 30 | 8 |

**Table 31: Growth Measurement (Population count at 8 months)**

| Trt. | Reps | | | | Total | Avg. |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | |
| 1 | 92.0 | 117.5 | 66.0 | 107.5 | 383 | 96 |
| 2 | 73.5 | 122.0 | 80.0 | 99.0 | 375 | 94 |
| 3 | 83.0 | 95.0 | 77.0 | 103.0 | 358 | 90 |
| 4 | 106.5 | 113.5 | 107.5 | 115.5 | 443 | 111 |

Samples will be selected randomly to be analyzed for biochemical analysis (%brix, %fibre, %pol and %pocs). The trial will be harvested manually in 2016. Each plot will be weighed and the data will be utilized to determine tons of cane and sugar produced.

### TRIAL 5: Nitrogen trial - Labasa

Nitrogen is one of the main building blocks of protein. It is responsible for growth and expansion of green leaves and is essential for photosynthesis and sugar production.

**Table 32: Nitrogen trial summary - Effect of nitrogen fertilizer on sugarcane yield**

| | | | |
|---|---|---|---|
| **Trial code** | BA1301P9 | BA1302P9 | BA1303P9 |
| **Location** | Seaqaqa (Bulivou sector) | Waiqele | Waiqele |
| **Variety** | Kiuva | Naidiri | Kiuva |
| **Trial Design** | RCBD | RCBD | RCBD |
| **Reps/Trt.** | 4/4 | 4/4 | 4/4 |
| **Plot size** | 6rows x 10m x 1.37m | 6rows x 10m x 1.37m | 6rows x 10m x 1.37m |
| **Date planted** | 24 April 2013 | 29th April 2013 | 08th May 2013 |

Application rates of nitrogen in the field are determined by leaf and soil analysis done in the lab. Three nitrogen trials have been established in Seaqaqa to study the effect of different rates of nitrogen fertiliser on cane growth and yield in the field. The treatments and data collected on growth attributes are shown in the tables below:

**Table 33: Details of treatments**

| Trt. | Nitrogen rates | Time of Application |
|---|---|---|
| 1 | 60 Kg N per hectare | 8 weeks after planting |
| 2 | 90 Kg N per hectare | 8 weeks after planting |
| 3 | 120 Kg N per hectare | 8 weeks after planting |
| 4 | 150 Kg N per hectare | 8 weeks after planting |

*Note: Blend A was applied at the rate of 3 bags per hectare as per laboratory recommendation*

The 1st ratoon data from these trials shows that 150Kg N per hectare gave higher plant population with tallest plants, which was followed by 120Kg N per hectare. Even though $T_4$ recorded higher plant growth and population, $T_3$ gave economic growth which is desirable for profit in the field. The data in each table below shows the difference of each treatment:

**Table 34: Growth attributes – Kiuva variety (BA1301P9)**

| Trt. | Tillers per stool | | | | Stalk | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Population ($10^3$) | | | | Length (cm) | | | |
| | Months | | | | Months | | | | Months | | | |
| | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 |
| 1 | 7 | 5 | 4 | | 80 | 72 | 60 | | 27 | 48 | 86 | |
| 2 | 10 | 7 | 6 | | 100 | 90 | 81 | | 35 | 63 | 97 | |
| 3 | 12 | 10 | 7 | | 137 | 130 | 122 | | 44 | 82 | 157 | |
| 4 | 12 | 11 | 7 | | 140 | 134 | 127 | | 52 | 94 | 164 | |

**Table 35: Yield attributes – Kiuva variety (BA1301P9)**

| Trt. | tch | Fibre % | % Pocs | tsh |
|---|---|---|---|---|
| 1 | 98 | 10 | 16.4 | 16.0 |
| 2 | 102 | 11 | 16.1 | 16.4 |
| 3 | 126 | 12 | 16.3 | 20.5 |
| 4 | 130 | 12 | 16.1 | 20.9 |

**Table 36: Growth attributes – Kiuva variety (BA1303P9)**

| Trt. | Tillers per stool | | | | Stalk | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Population ($10^3$) | | | | Length (cm) | | | |
| | Months | | | | Months | | | | Months | | | |
| | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 |
| 1 | 6 | 5 | 5 | | 88 | 72 | 58 | | 20 | 60 | 77 | |
| 2 | 7 | 5 | 5 | | 100 | 91 | 70 | | 26 | 72 | 89 | |
| 3 | 9 | 8 | 7 | | 146 | 132 | 120 | | 33 | 98 | 143 | |
| 4 | 12 | 10 | 8 | | 155 | 142 | 128 | | 38 | 101 | 155 | |

**Table 37: Yield attributes – Kiuva variety (BA1303P9)**

| Trt. | tch | Fibre % | % Pocs | tsh |
|---|---|---|---|---|
| 1 | 90 | 12.6 | 16.1 | 14.5 |
| 2 | 95 | 12.0 | 16.8 | 15.9 |
| 3 | 126 | 12.5 | 16.7 | 21.0 |
| 4 | 129 | 12.7 | 16.7 | 21.5 |

**Table 38: Growth attributes – Naidiri variety (BA1302P9)**

| Trt. | Tillers per stool | | | | Stalk | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Population ($10^3$) | | | | Length (cm) | | | |
| | Months | | | | Months | | | | Months | | | |
| | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 |
| 1 | 5 | 4 | 4 | | 55 | 49 | 45 | | 18 | 32 | 67 | |
| 2 | 6 | 5 | 5 | | 66 | 58 | 51 | | 28 | 41 | 72 | |
| 3 | 8 | 7 | 5 | | 84 | 77 | 73 | | 36 | 54 | 109 | |
| 4 | 8 | 7 | 6 | | 88 | 80 | 78 | | 39 | 59 | 119 | |

**Table 39: Yield attributes – Naidiri variety (BA1302P9)**

| Trt. | tch | Fibre % | % Pocs | tsh |
|---|---|---|---|---|
| 1 | 121 | 12.5 | 15.9 | 19.2 |
| 2 | 133 | 12.4 | 16.4 | 21.8 |
| 3 | 161 | 11.8 | 17.0 | 27.4 |
| 4 | 173 | 11.8 | 16.9 | 29.2 |

The yield data from all three trial shows that adding **120kg N/ha** gave economical yield for the farmers. Adding 150kg N/ha also gave similar yield compared to 120kg N/ha, but was not economical. Also this rate is excess and will prove harmful for the soil and environment.

### TRIAL 6: Lime trial - Labasa

Fiji soils are acidic in nature which may be one of the reasons attributed to the declining productivity of sugarcane. There are various reasons of increased pH such as:

- Continuous cropping of sugarcane on Fiji soils
- Soil erosion
- Continuous use of ammonia based fertilisers on sugarcane cultivated soils

To verify this problem, two lime trials have been established in Seaqaqa to study the effect of lime on soil pH and cane sugar yield. Lime addition in the soil reduces soil pH which is desirable for cane growth.

**Table 40: Lime trial summary – Effect of lime on sugarcane yield (Labasa Trials)**

| | | |
|---|---|---|
| **Trial code** | BA1304P9 | BA1305P9 |
| **Location** | Seaqaqa (Solove sector) | Seaqaqa (Bulivou sector) |
| **Variety** | Naidiri | LF91-1925 |
| **Trial Design** | RCBD | RCBD |
| **Replications/treatments** | 4/4 | 4/4 |
| **Plot size** | 6 rows x 10m x 1.37m | 6 rows x 10m x 1.37m |
| **Date planted** | 10th May 2013 | 14th May, 2013 |

The treatments and data collected on growth attributes are shown in the table below:

**Table 41: Details of treatments**

| Trt. | Lime rates | Time of Application |
|---|---|---|
| 1 | 0 tonnes of lime per hectare | At the time of planting in the furrows |
| 2 | 1.3 tonnes of lime per hectare | At the time of planting in the furrows |
| 3 | 2.6 tonnes of lime per hectare | At the time of planting in the furrows |
| 4 | 3.9 tonnes of lime per hectare | At the time of planting in the furrows |

*Note: Blend A and B fertilizers were added according to laboratory recommendation after soil analysis*

There was no significant difference in plant growth, stalk population and the tiller production between the treatments. Lime is a slow reacting component and the effect of it will take time, therefor the result of significance can be noticed in the ratoon. The yield of both trials showed similar trends as with growth attributes.

Lime is a soil amendment and only should be recommended to the soils with high pH. Those farms should be resampled to see the changes in soil pH. If the pH comes to its optimum level then lime is no longer required. The farmers should practice thrash blanketing and legume planting so that the nutrients are replenished back into the soil with less chance of increased soil pH. One of the main reasons of increased pH of the soil is the use of chemical fertilizer and continuous mono-culturing. The land should be fallowed for a while to avoid the buildup of H+ ions in the soil. The data are shown in the tables below:

**Table 42: Growth attributes – LF91-1925 variety**

| Trt. | Tillers per stool | | | | Stalk | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Population ($10^3$) | | | | Length (cm) | | | |
| | Months | | | | Months | | | | Months | | | |
| | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 |
| 1 | 6 | 5 | 4 | | 131 | 101 | 85 | | 19 | 72 | 142 | |
| 2 | 6 | 6 | 5 | | 138 | 105 | 88 | | 22 | 70 | 148 | |
| 3 | 7 | 6 | 5 | | 129 | 102 | 86 | | 23 | 86 | 145 | |
| 4 | 7 | 6 | 6 | | 140 | 109 | 91 | | 21 | 83 | 138 | |

**Table 43: Yield attributes – LF91-1925 variety**

| Trt. | tch | Fibre % | % Pocs | tsh |
|---|---|---|---|---|
| 1 | 119 | 11.2 | 16.9 | 20.1 |
| 2 | 120 | 11.8 | 16.3 | 19.5 |
| 3 | 118 | 11.5 | 16.7 | 19.7 |
| 4 | 124 | 12.1 | 16.4 | 20.3 |

**Table 44: Growth Attributes – Naidiri variety**

| Trt. | Tillers per stool | | | | Stalk | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Population ($10^3$) | | | | Length (cm) | | | |
| | Months | | | | Months | | | | Months | | | |
| | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 | 3 | 5 | 7 | 9 |
| 1 | 6 | 5 | 4 | | 96 | 78 | 73 | | 31 | 88 | 171 | |
| 2 | 5 | 4 | 4 | | 109 | 76 | 72 | | 34 | 92 | 168 | |
| 3 | 6 | 4 | 3 | | 102 | 80 | 76 | | 36 | 95 | 174 | |
| 4 | 6 | 5 | 4 | | 95 | 73 | 70 | | 30 | 94 | 176 | |

**Table 45: Yield attributes**

| Trt. | tch | Fibre % | % Pocs | tsh |
|---|---|---|---|---|
| 1 | 114 | 12.1 | 16.2 | 18.4 |
| 2 | 109 | 11.3 | 15.5 | 16.9 |
| 3 | 113 | 11.8 | 14.8 | 16.8 |
| 4 | 116 | 12.0 | 15.2 | 17.6 |

## TRIAL 7: Legume trial

Planting of legume crops with sugarcane tends to fix nitrogen in the soil and also becomes a source of cash income for the farmers. The 1st ratoon data showed that cowpea and peanut at after flowering stage gave better plant growth and yield.

**Table 46: Legume trial summary – Effect of Legumes on sugarcane yield**

| | | |
|---|---|---|
| **Trial code** | BA1306P9 | BA1307P9 |
| **Location** | Labasa | Wailevu |
| **Variety** | Ragnar, Mali, LF91-1925 & Naidiri | Ragnar, Mali, LF91-1925 & Naidiri |
| **Trial Design** | Split –plot | Split - plot |
| **Rep/Trt.** | 3/4/4 | 3/4/4 |
| **Plot size** | 6 rows x 10m x 1.37m | 6 rows x 10m x 1.37m |
| **Date planted** | 17th Sept 2013 | 25th Sept 2013 |

Growth assessment was carried out at 3, 5 and 7 months. The trials were sampled and harvested in September, 2015. The treatments, growth and yield attribute data are shown in the next set of tables.

**Table 47: Treatments**

| Trt. | Main treatment - Diuron |
|---|---|
| $M_1$ | Spraying of legumes before flowering |
| $M_2$ | Spraying of legumes after flowering |
| $M_3$ | Spraying of legumes after fruiting |
| | Sub Plot treatment - Varieties |
| $S_1$ | Cowpea |
| $S_2$ | Urd |
| $S_3$ | Peanut |

**Table 48: Growth attributes**

| Trt. | Population (000/ha) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | | | 5 | | | 7 | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ |
| $S_1$ | 146 | 128 | 109 | 121 | 106 | 96 | 87 | 70 | 64 |
| $S_2$ | 165 | 143 | 132 | 118 | 107 | 97 | 90 | 80 | 77 |
| $S_3$ | 168 | 145 | 138 | 128 | 118 | 104 | 82 | 76 | 74 |
| Total | 479 | 416 | 379 | 367 | 331 | 297 | 259 | 226 | 215 |
| Avg. | 160 | 139 | 126 | 122 | 110 | 99 | 86 | 75 | 72 |

**Table 49: Growth attributes**

| Trt. | Stalk Length (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | | | 5 | | | 7 | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ |
| $S_1$ | 33 | 24 | 20 | 95 | 88 | 85 | 175 | 165 | 168 |
| $S_2$ | 28 | 20 | 18 | 92 | 80 | 73 | 178 | 160 | 160 |
| $S_3$ | 24 | 20 | 19 | 90 | 78 | 77 | 178 | 158 | 160 |
| Total | 95 | 73 | 76 | 291 | 260 | 253 | 541 | 459 | 500 |
| Avg. | 32 | 24 | 25 | 97 | 87 | 84 | 180 | 165 | 167 |

**Table 50: Growth attributes**

| Trt. | Tillers Per Stool | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | | | 5 | | | 7 | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ |
| $S_1$ | 7 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |
| $S_2$ | 7 | 7 | 6 | 5 | 5 | 5 | 4 | 4 | 4 |
| $S_3$ | 5 | 5 | 5 | 6 | 5 | 6 | 4 | 4 | 4 |
| Total | 19 | 19 | 18 | 17 | 16 | 16 | 13 | 13 | 13 |
| Avg. | 6 | 6 | 6 | 6 | 5 | 5 | 4 | 4 | 4 |

**Table 51: Yield attributes**

| Trt. | tch | | | % Fibre | | | %pocs | | | tsh | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ | $M_1$ | $M_2$ | $M_3$ |
| $S_1$ | 133 | 128.2 | 129.0 | 11.1 | 12.3 | 12.8 | 17.0 | 15.1 | 15.1 | 22.6 | 19.4 | 19.4 |
| $S_2$ | 121 | 118.6 | 119.2 | 10.9 | 12.1 | 10.7 | 16.2 | 16.2 | 15.6 | 19.6 | 17.3 | 18.6 |
| $S_3$ | 128 | 125.3 | 122.0 | 9.7 | 9.7 | 13.0 | 17.0 | 15.9 | 16.2 | 21.3 | 20.0 | 19.7 |
| Total | 382 | 372.1 | 370.2 | 31.7 | 34.1 | 36.5 | 50.2 | 47.2 | 46.9 | 63.5 | 56.7 | 57.7 |
| Avg. | 127 | 124.0 | 123.4 | 10.6 | 11.4 | 12.2 | 16.8 | 15.8 | 15.6 | 21.2 | 19.0 | 19.2 |

## Recommendations

- More trials need to be established to evaluate the effects of potassium fertilizer application on cane and successive ratoons of Kiuva.
- Early maturing varieties such as Naidiri should be planted and harvested early to boost sugar production. Farmers should be encouraged to plant early maturing varieties.
- More lime trials should be conducted to collect data for recommendation of lime in farmers' field.
- Legume crop should be intercropped with sugar cane to reduce the usage of chemical fertilizer since it fixes nitrogen from the atmosphere into the soil. Also it gives additional income to the farmer as a cash crop.
- Diuron rate should not exceed 5kg per hectare as it gives phytotoxic effect to sugar cane plants. It may also become detrimental to the environment and increase cost of production. There is a rising concern surrounding the use of Diuron in Fiji. Farmers tend to continuously use it in the field and the weeds are beginning to show symptoms of resistance to this herbicide. A trial should be carried out with all necessary treatment to ascertain the resistance level of weeds to Diuron.
- 120kg per hectare of N is optimum for cane production in Vanua Levu soils as concluded from the Nitrogen trial. This rate supplies adequate nitrogen for optimum yield per hectare and farmers should apply this rate as a general recommendation and also follow lab recommendation from soil and leaf analysis where applicable.

- Lime application is beneficial to soil. Accurate amount of lime application should be determined in the lab and recommendation should be given to the farmers so that appropriate amount is applied by the farmers. Since the effect of Lime is not always immediately observed after one crop season since last applied, more intense field trials are needed on application rates, methods and type of lime to determine the best application rates, methods and which lime source is beneficial and profitable for the farmers.

# ANALYTICAL LABORATORY SERVICES

# ANALYTICAL LABORATORY SERVICES

## Summary

A total of 1503 soil samples were received in 2015 for analysis, comprising of advisory and research samples. A total of twenty leaf samples were received for analysis comprising only of advisory leaf samples. As a requirement to increase turnaround time for soil analysis, an alternative method for quantifying the amount of lime to be added as per soil pH has been trialed.

The sugar mill was able to crush 1404 samples in the year 2015 and the sugar laboratory successfully validated the 140 saved samples. As a continuous effort to fine tune the Spectra-Cane since its introduction in 2013, the successful analysis of 86% of the total samples received in 2015 has been hailed a success for the Spectra-Cane. This success was achieved with validations averaging 0.80 unit difference.

In light of the Quality Based Payment Scheme (QBPS) being proposed to be introduced in the Fijian Sugar Industry (FSI), there has been emphasis on sample validation and also adopting new instruments and procedures to increase efficiency and throughput. The introduction of QBPS created exposure for the laboratory staff to trainings hosted by SIT and FSC which was related to QBPS. The laboratory staff has also attended work attachment at the Fiji Sugar Mills to gain insight on the operations of the sugar process.

## Recommendations

- Improve turnaround time for soil and leaf samples through alternative methods of determining lime requirement.
- Improve data quality in small mill by conducting parallel analysis with different equipment.

## Introduction

The analytical laboratory acts as a link between the growers and the industry by providing analytical services for advisory and research programmes. This service is essential due to the rising cost of fertilizers and to maintain optimum production in the future. Analytical services provided by SRIF analytical laboratory include soil, leaf and cane analysis. Soil and leaf samples are received from all sugar cane districts including Penang, Rarawai, Lautoka and Labasa for analysis and fertilizer recommendation.

The sugar laboratory also carries out all sugarcane related analysis required in the Institute. The laboratory may either analyse sugarcane as a whole or as a part (juice). The analysis considered is dependent on the requirement of the researcher. The Lautoka sugar laboratory analyses sugarcane samples from the respective mill areas as per requirements for research and breeding programs.

With the introduction of the Spectra-Cane in 2013 several activities have been adopted to better monitor the performance of the instrument over time. Several incidents required the presence of the Spectra-Cane consultant that made various modifications which later resulted in a successful 2015 small mill operation. With regards to the introduction of the QBPS in the FSI, the sugar laboratory now embarks on enduring into adopting new methods and instruments to attain optimum efficiency and throughput.

## Soil Analysis

A total of 1503 soil samples were analyzed, of which 167 were research soil samples and 1336 were advisory soil samples. Reports are released by email as soon as it's available from the laboratory to the Fiji Sugar Corporation Ltd Extension staffs. The laboratory is equipped and staffed to process samples quickly and efficiently that the sample requests are completed within two weeks from the date samples are received at laboratory.

**Table 1: Summary of soil samples for 2015**

| Mill | Advisory | Research | Total |
|---|---|---|---|
| Lautoka | 549 | 137 | **686** |
| Rarawai | 562 | - | **562** |
| Penang | 10 | 30 | **40** |
| Labasa | 215 | - | **215** |
| Total | 1336 | 167 | 1503 |

## Leaf Analysis

The analytical laboratory received a total of 20 leaf samples for advisory services but due to equipment malfunction, the sample analysis is currently pending.

**Table 2: Summary of plant samples for 2015.**

| Mill | Advisory | Research | Total |
|---|---|---|---|
| Lautoka | 20 | - | **20** |
| Rarawai | - | - | |
| Penang | - | - | |
| Labasa | - | - | |
| **Total** | **20** | **-** | **20** |

## 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 will be made in 2016 which will be used for quality checks in analysis. The laboratory conducts the QC checks by having standards as well as random control samples and referring to the accepted range of values for QC samples. Any value out of this 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.

## Research Trials

### Lime Buffering Capacity Trial – A modified approach.

It has been observed that the amount of soil having low pH has been increasing over the years. With the interest of the Fijian sugar industry to increase the mill efficiency it is important to ensure that sugarcane are planted in the right conditions where applicable. Hence the analytical laboratory has been involved in trialing a method of determining the amount of lime to be added to growers' field in order to buffer the soil conditions where pH is extremely low.

This modified method has been considered to be used as a routine method of analysis. As a small scale trial the soil samples received in 2014 were used to validate the modified method.

All soil samples with low pH were treated using the modified method and compared to the current SRIF Lime Recommendation method. According to the study it was observed that the results obtained from the modified method is similar to that of the current SRIF method as illustrated in Table 3.

| Table 3: A summary of analysis result on LBC-modified method | |
|---|---|
| Total no of soils | 834 |
| Total no of soils with low pH | 405 |
| Total no. of soil types | 18 |
| Average (difference between LBC & pHBC) | 0.4 |
| Max Difference | 0.98 |
| Min Difference | 0.02 |
| Correlation | 0.98 |

## Trainings

Two sessions of training was provided by Fiji Sugar Industry Tribunal on the "Procedures for the operation of the Cane Quality Payment Scheme" on the 17th and 18th of August.
Staff who took part in this training were;

- Mr. Prema Naidu
- Ms. Doreen Pillay
- Ms. Nazeea Bano
- Ms. Mere Tauvoli
- Ms. Milika Vaniqi
- Mrs. Merlyn Goundar
- Mr. Suresh Mani

The training highlighted how the Fiji Sugar Industry has resolved SRIF to undertake professional reviews of the operation of the Cane Quality Department (CQD) thus SRIF has to undertake regular visits to the mills next year.

## Biochemical Analysis

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 1404 cane samples were crushed for the year. This consisted of samples for Stage 4 (LF2009, LF2008 and LF2010) trials, Stage 3 (LF2012) trials, Stage 2 (LF2013) trials and Agronomy trials (lime, potassium and time of harvest), Pest & Disease and Variety trials. Majority of the samples crushed were received from the variety selection program as displayed in figure 1.

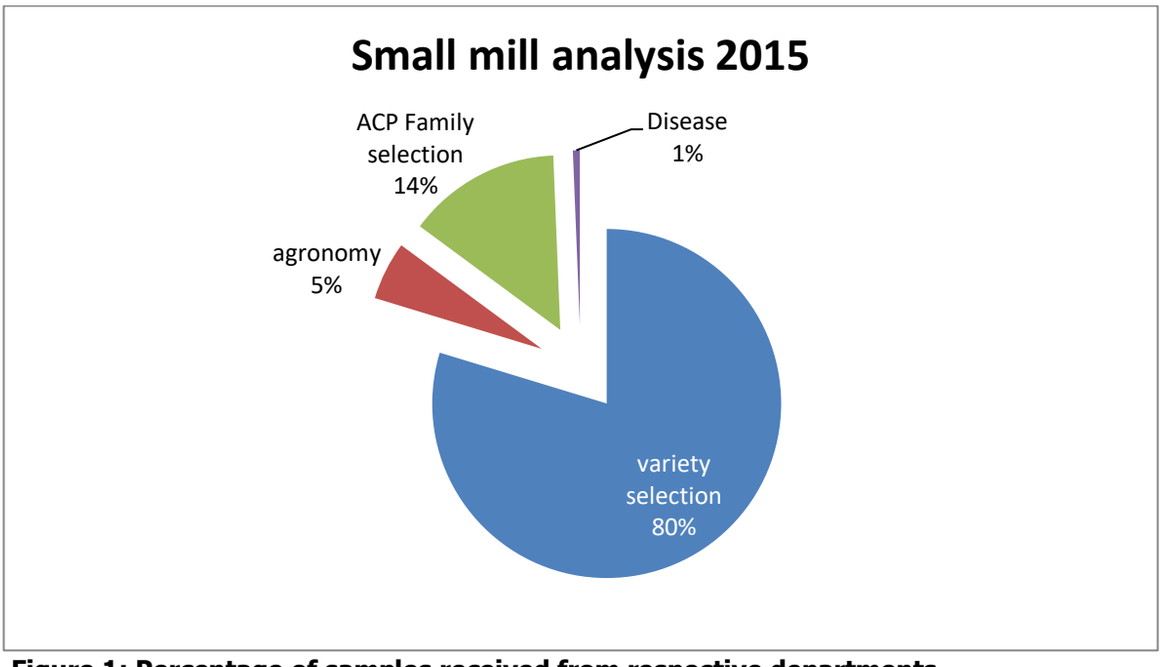



**Figure 1: Percentage of samples received from respective departments.**

During the season majority of the samples were analysed by NIR while the remaining were analysed by the classic method (Jeffco Grinder). The interchange of method of analysis was due to occurrence of power disruption. This year may be marked as an achievement as the percentage usage of the NIR peaked at 86% as compared to the previous years as displayed in the table below.

**Table 4: Three-Year Summary of Spectra-Cane success**

| Year | Frequency of instrument use (%) | No. of samples crushed (%) |
|---|---|---|
| **2013** | 75 | 85 |
| **2014** | 54 | 64 |
| **2015** | 85 | 86 |

**Table 5: Summary of cane samples for 2015**

| Trial name | | No of samples | Total |
|---|---|---|---|
| **Variety** | LF 2010 – Stg 4 | 147 | |
| | LF2009 – Stg 4 | 143 | |
| | LF 2008 – Stg 4 | 91 | 1319 |
| | LF 2012- Stg 3 | 98 | |
| | LF 2013 – Stg 2 | 520 | |
| | ACP Family selection | 200 | |
| **Agronomy** | Lime trial | 16 | |
| | Potassium trial | 24 | 76 |
| | Time of Harvest | 36 | |
| **Disease** | Pest & Disease | 9 | 9 |
| **Grand Total** | | | **1404** |

All the data has been processed and returned to respective personnel. Parallel analysis for validation of the spectra-cane has continued accordingly, whereby the validation data has been sent to the consultant (Mr. David Marston) for analysis. As the matrix had been serviced by the consultant earlier in the year, an improvement on the parallel analysis has been observed. The validation difference in fiber values was at 5 units in 2014; now down to approximately 2 units in 2015 as illustrated in table 6 below.

| Table 6: A summary of sugarcane juice analysis validation (2015) | | | | |
|---|---|---|---|---|
| | **Av. Diff** | **Max Diff** | **Min. Diff** | **Corr.** |
| **Brix in Juice** | 0.9 | 3.2 | 0.1 | 0.5 |
| **Pol in Juice** | 1.3 | 4.2 | 0.3 | 0.3 |
| **Fiber in Cane** | 0.8 | 2.1 | 0.1 | 0.8 |
| **Purity** | 4.2 | 12.3 | -1.6 | 0.3 |
| **POCS** | 1.4 | 3.8 | 0.2 | 0.3 |

## Frontier Transform Infra-Red (FTIR) trial.

The analytical laboratory has been selected to trial the use of the Alpha FT-IR spectrometer (figure 2) to analyse cane juice. The instrument was supplied by Bruker Optics of New Zealand for a 3 months trial. As this was an initial trial on sugarcane juice the development of a database was required. Thus the sugar laboratory was able to analyse 218 samples in conjunction with the use of the classical methods as validation of the developed spectra. All developed spectra along with wet laboratory readings were returned to the consultants for evaluation. As per evaluation reports the commercial variety samples have demonstrated that the sugarcane juice starter calibration with good $R^2$ and relatively low errors (RMSECV) can be achieved as illustrated in table 7 below. The analysis on FTIR is conducted in parallel with the conventional method (polatronic, refractometer, pH meter, UV-Vis spectrophotometer) for validation purpose. The trial intended to include sugarcane juice analysis for the major constituents (starch, gums, dextran, reducing sugars, pol, brix, phenolic acids) per sample and to determine the amounts of constituents in response to deterioration.

**Figure 2: The portable Alpha-FT-IR spectrometer.**

| Table 7: Sugarcane Juice starter calibration performance (Alpha-FTIR) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameters** | **n** | **R2** | **RMSECV** | **RPD** | **Rank** | **Range** | **Performance** |
| **Brix** | 93 | 95.7 | 0.3 | 4.9 | 3 | 17-25 | QC |
| **Pol** | 93 | 96.2 | 0.4 | 5.1 | 4 | 13-23 | QC |
| **Sugar** | 89 | 97.2 | 1.5 | 5.9 | 3 | 55-96 | QC |
| **Purity** | 90 | 90.1 | 1.0 | 3.2 | 8 | 77-95 | Screening |
| **pH** | 97 | 88.9 | 0.2 | 3.0 | 6 | 3.6-5.5 | Screening |

The small mill intends to improve its service in the coming crushing season by:

- Increasing the amount of samples analysed by NIR.
- Conducting parallel runs for validation.
- Adopt other sugar methods, hence a wider range of analysis per sample.

## Quality Based Payment Scheme (QBPS) – Audit

As the Fiji Sugar Industry embarks on adopting the QBPS, SRIF has been appointed to act as an external auditor. Hence the analytical laboratory staff has been assigned by SRIF to participate in this imperative task. A staff (Ms. Mere Tauvoli) has been actively involved in this activity while the other laboratory staff has been involved as support staff in ensuring the success of the program. All the laboratory staff had attended Phase I and Phase II training on the requirements of QBPS and carrying our auditing of the task carried out by the CQD (SIT). Both the training was conducted by Mr. Bernard Milford. After the second training a trial audit was conducted at Lautoka and Rarawai mill respectively to verify the applicability of the developed procedures for Operation of the Cane Quality Payment scheme and to practice the developed scope of work for audit. The program is proposed to officially commence in 2016.

## Trainings

### Phase I: Analysis of Audit of Cane for the Fijian Cane Quality Scheme.

The analytical laboratory staff and agronomy staff attended training on the 12th of February, 2015 which was conducted by Mr. Bernard Milford. The training was conducted at the Lautoka Mill. The training also included representatives from all Industry stakeholders that were directly involved with the QBPS (FSC (millers), SIT (CQD) and SCGC). The training emphasized on the responsibilities of each parties involved and the importance of compliance with the agreed QBPS operation procedures. A checklist was introduced whereby all the attendees evaluated and agreed on the activities that were vital and applicable for the scheme.

### FTIR operations training.

Two analytical staff (Mere and Milika) were trained on the use of the Fourier Transformer Infrared (FTIR) by Mr. David Marston.

### Phase II: Fiji Sugar Industry Tribunal Procedures for the Operation of the Cane Quality Payment Scheme (the Procedures)

The analytical laboratory and agronomy staff attended Phase II training of QBPS at the Lautoka Mill Training center on the 17th of August, 2015. The training was conducted to review the proposed QBPS auditing procedure and amend as discussed and agreed amongst the partners, to best suit all aspects of the sugar industry. The workshop was conducted as an interactive meeting whereby the representatives of the various stakeholders were to raise their views and issues as the program progressed. The Progress of discussion was as follows:

- ✓ View of the millers & growers on the subject of QBPS implementation in the Fiji Sugar Industry (FSI)
- ✓ Review of documented procedures
- ✓ Review of checklists
- ✓ Trial run with procedures & checklists
- ✓ View of IMG's & growers on provision of feedback to growers
- ✓ Role of SRIF in the QBPS
- ✓ Alternative methods to be adopted if necessary
- ✓ The Future of Cane Quality Department

### Fiji Sugar Mill Attachment

As a requirement of the institute one of the laboratory staff (Mere) has been assigned for mill attachment for familiarization of milling processes. As all the four Fiji sugar mills differ in processing arrangement it has be required that the staff attends work attachment at all the mills respectively. During the year 2015 the staff was able to attend work attachment at

Lautoka and Rarawai mill. During the attachment the staff has gained knowledge in the different setups of the two mills and how sugarcane is processed respectively to obtain similar required raw sugar at the end of the day.

**Recommendation**

- Purchase of UV-VIS spectrophotometer to develop the range of Biochemical analysis for sugarcane samples.
- Adopting latest analytical methods and instruments for increased efficiency and throughput and to develop new paths in sugarcane biochemical research.
- Improve Occupational Health and Safety Conditions in the Laboratory and Small Mill.
- Installation of a power stabilizer to safeguard instruments against power failure or fluctuations
- Improve the functionality of the Spectra-Cane (NIR), by reducing the amount of outliers obtained per batch. Updating the current manuals in the laboratory (MSDS, Quality Assurance System, and Equipment and Work procedures).
- Training in QBPS auditing at a sugar mill with existing practice.

The laboratory aims to provide resourceful and reliable data to growers, research staffs and other non-stakeholders. The decline in soil samples received by the laboratory is an issue of concern. The farmers are advised and leader farmers' trained to take samples by themselves to make maximum benefit from the free service available for them. The sugar laboratory will continue to carry out its routine activity and provide reliable data to research staff for the betterment of the sugar industry. The sugar laboratory will continue to endeavor into new inclusions of methods or instruments that is applicable to increase the efficiency and throughput of the Institute and in turn the Fiji Sugar Industry

# METEOROLOGY

# METEOROLOGY

## Summary


- Daily meteorological readings were recorded at 9am and maximum temperature readings were recorded at 3pm.
- Drier than normal conditions were experienced across the sugarcane belt over the past several months.
- Majority of the sugarcane growing areas were currently in meteorological drought.


## Highlights

- Pacific island climate outlook forum (PICOF-1) was held from October 12-16, 2015 in Suva with the special focus on the water resources management sectors of the Pacific Island region.
- El Nino emerged in March and matured to moderate strength by June and reached strong El Niño category in August. In November, it reached its peak intensity but weakened some of its indicators in December.
- Current conditions are still indicative of a strong El Niño and are expected to continue for at least the next three months.
- In December, warm sea surface temperatures anomalies extended across nearly the entire equatorial Pacific.
- Trade winds have been consistently weaker than average
- Cloudiness has been above the long term average
- The Southern Oscillation Index (SOI) has dropped to -16.3 and the atmospheric and oceanic anomalies reflect the presence of a strong El Niño in the Pacific.

## Introduction

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

## El Niño Southern Oscillation (Enso)

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

## Rainfall

Fiji enjoys a tropical maritime climate without extremes of heat or cold. Considering the current ENSO conditions, Fiji experienced severe rainfall deficiency during the season. In other words, the total annual rainfall was below average across the country. The annual rainfall for all the 4 mills was ***below average*** when compared to the 46 years long term mean. The most-to-least driest mill, in order was Lautoka, Rarawai, Labasa and Penang respectively. Lautoka had an average of 150mm of rainfall compared to 46 year mean of 306mm, Rarawai had an average of 169mm of rainfall compared to 46 year mean of 342mm, Labasa had an average of 180mm of rainfall compared to 46 year mean of 353mm and Penang had an average of 202mm of rainfall compared to 46 year mean of 306mm.

### Lautoka Mill

The least rain was recorded at Olosara sector of 68.2mm and the most rain was recorded for Malolo, which had 139mm of rainfall.

### Rarawai Mill

The least rain was recorded at Yaladro sector of 64.3mm and the most rain was recorded for Koronubu, which had 142mm of rainfall.

### Penang Mill

The least rain was recorded at Ellington 1 sector of 37mm and the most rain was recorded for Malau, which had 109mm of rainfall.

### Labasa Mill

The least rain was recorded at Labasa estate of 80mm and the most rain was recorded for Seaqaqa estate, which had 135mm of rainfall.

**Table 1: Rainfall (mm) for all mills - 2015**

| Mills | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lautoka Mill - 2015** | | | | | | | | | | | | | | |
| Monthly rainfall | 212 | 342 | 130 | 64 | 10 | 9 | 27 | 35 | 43 | 19 | 2 | 82 | 974 | 81 |
| No. of rain days | 12 | 16 | 14 | 5 | 2 | 2 | 1 | 8 | 8 | 5 | 1 | 14 | 88 | 7 |
| 46 yrs avg. (1970-2015) | 377 | 313 | 323 | 189 | 87 | 69 | 52 | 70 | 80 | 98 | 138 | 197 | 1991 | 166 |
| **Rarawai Mill - 2015** | | | | | | | | | | | | | | |
| Monthly rainfall | 196 | 246 | 143 | 82 | 13 | 8 | 5 | 22 | 53 | 43 | 7 | 283 | 1101 | 92 |
| No. of rain days | 7 | 23 | 13 | 5 | 1 | 2 | 1 | 5 | 7 | 3 | 1 | 14 | 82 | 7 |
| 46 yrs avg. (1970-2015) | 418 | 353 | 382 | 205 | 97 | 82 | 43 | 65 | 77 | 107 | 161 | 233 | 2222 | 185 |
| **Penang Mill - 2015** | | | | | | | | | | | | | | |
| Monthly rainfall | 150 | 364 | 143 | 102 | 72 | 15 | 5 | 53 | 59 | 124 | 28 | 196 | 1310 | 109 |
| No. of rain days | 24 | 21 | 20 | 14 | 10 | 10 | 4 | 12 | 12 | 5 | 11 | 14 | 157 | 13 |
| 46 yrs avg. (1970-2015) | 410 | 353 | 376 | 267 | 158 | 96 | 51 | 69 | 88 | 111 | 181 | 267 | 2427 | 202 |
| **Labasa Mill - 2015** | | | | | | | | | | | | | | |
| Monthly rainfall | 185 | 404 | 175 | 105 | 59 | 2 | Nil | 82 | 36 | 7 | 27 | 86 | 1167 | 97 |
| No. of rain days | 11 | 21 | 13 | 9 | 4 | 1 | Nil | 6 | 10 | 3 | 11 | 7 | 96 | 8 |
| 46 yrs avg. (1970-2015) | 401 | 354 | 368 | 239 | 110 | 76 | 53 | 50 | 75 | 122 | 187 | 259 | 2294 | 191 |

**Table 2: Rainfall data (mm) for Lautoka, Nadi and Sigatoka Districts - 2015**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Drasa** | 242 | 357 | 212 | 109 | 1 | 2 | 21 | 60 | 77 | 2 | 2 | 149 | 1233 | 103 |
| No. of rain days | 7 | 14 | 10 | 4 | 1 | 2 | 1 | 6 | 8 | 1 | 1 | 13 | 68 | 6 |
| **Lautoka** | 212 | 342 | 130 | 64 | 10 | 9 | 27 | 35 | 43 | 19 | 2 | 82 | 974 | 81 |
| No. of rain days | 12 | 16 | 14 | 5 | 2 | 2 | 1 | 8 | 8 | 5 | 1 | 14 | 88 | 7 |
| **Saweni** | 220 | 475 | 433 | 100 | Nil | 10 | 18 | 81 | 62 | 25 | Nil | 117 | 1539 | 128 |
| No. of rain days | 12 | 17 | 14 | 5 | 0 | 2 | 1 | 8 | 6 | 4 | 0 | 12 | 81 | 7 |
| **Natova** | 183 | 328 | 184 | 125 | Nil | 14 | 25 | 69 | 57 | 27 | 2 | 138 | 1152 | 96 |
| No. of rain days | 13 | 23 | 14 | 5 | 0 | 3 | 1 | 8 | 8 | 4 | 1 | 15 | 95 | 8 |
| **Legalega** | 187 | 420 | 214 | 99 | Nil | 16 | 26 | 54 | 75 | 34 | 44 | 215 | 1384 | 115 |
| No. of rain days | 14 | 19 | 15 | 4 | 0 | 2 | 1 | 7 | 6 | 3 | 1 | 13 | 85 | 7 |

**Table 2: Cont'd**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Meigunyah** | 223 | 366 | 133 | 74 | Nil | 12 | 24 | 49 | 76 | 17 | 33 | 161 | 1166 | 97 |
| No. of rain days | 13 | 20 | 17 | 4 | 0 | 2 | 1 | 7 | 6 | 4 | 1 | 13 | 88 | 7 |
| **Yako** | 259 | 277 | 165 | 118 | Nil | 10 | 115 | 92 | 64 | 3 | 15 | 145 | 1264 | 105 |
| No. of rain days | 10 | 14 | 14 | 2 | 0 | 2 | 1 | 4 | 5 | 2 | 1 | 11 | 66 | 6 |
| **Malolo** | 305 | 410 | 299 | 119 | Nil | 8 | 35 | 64 | 103 | 18 | 21 | 288 | 1668 | 139 |
| No. of rain days | 11 | 20 | 19 | 4 | 0 | 3 | 1 | 7 | 6 | 3 | 1 | 12 | 87 | 7 |
| **Nawaicoba** | 195 | 215 | 123 | 84 | Nil | 4 | 46 | 83 | 75 | 24 | 3 | 308 | 1160 | 97 |
| No. of rain days | 11 | 16 | 12 | 2 | 0 | 1 | 1 | 7 | 5 | 4 | 1 | 13 | 73 | 6 |
| **Lomawai** | 122 | 234 | 238 | 52 | 5 | 28 | 24 | 37 | 106 | 4 | Nil | 226 | 1076 | 90 |
| No. of rain days | 11 | 13 | 9 | 3 | 2 | 4 | 1 | 8 | 7 | 1 | 0 | 9 | 68 | 6 |
| **Cuvu** | 121 | 342 | 121 | 44 | 32 | 65 | 30 | 66 | 114 | 10 | Nil | 146 | 1092 | 91 |
| No. of rain days | 8 | 17 | 11 | 4 | 4 | 10 | 1 | 11 | 8 | 7 | 0 | 11 | 92 | 8 |
| **Olosara** | 89 | 343 | 136 | Nil | Nil | Nil | Nil | 51 | 94 | 3 | Nil | 101 | 818 | 68 |
| No. of rain days | 5 | 14 | 6 | 0 | 0 | 0 | 0 | 10 | 5 | 2 | 0 | 10 | 52 | 4 |

**Table 3: Rainfall data (mm) for Rarawai and Tavua Districts - 2015**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Varoko** | 107 | 224 | 154 | 90 | 9 | 2 | 14 | 24 | 60 | 40 | 10 | 234 | 968 | 81 |
| No. of rain days | 5 | 9 | 12 | 1 | 1 | 1 | 1 | 3 | 5 | 1 | 1 | 11 | 51 | 4 |
| **Mota** | 359 | 334 | 201 | 101 | 10 | Nil | 3 | 27 | 48 | Nil | Nil | 156 | 1239 | 103 |
| No. of rain days | 17 | 11 | 10 | 4 | 1 | 0 | 1 | 5 | 4 | 0 | 0 | 13 | 66 | 6 |
| **Koronubu** | 312 | 519 | 261 | 86 | 7 | 1 | 22 | 31 | 76 | 16 | Nil | 369 | 1700 | 142 |
| No. of rain days | 11 | 14 | 10 | 4 | 1 | 1 | 1 | 6 | 8 | 1 | 0 | 12 | 69 | 6 |
| **Rarawai** | 196 | 246 | 143 | 82 | 13 | 8 | 5 | 22 | 53 | 43 | 7 | 283 | 1101 | 92 |
| No. of rain days | 7 | 23 | 13 | 5 | 1 | 2 | 1 | 5 | 7 | 3 | 1 | 14 | 82 | 7 |
| **Veisaru** | 169 | 208 | 141 | 45 | 23 | 15 | 5 | 38 | 65 | 20 | 8 | 146 | 883 | 74 |
| No. of rain days | 7 | 14 | 9 | 2 | 1 | 2 | 1 | 3 | 7 | 2 | 1 | 9 | 58 | 5 |
| **Varavu** | 209 | 231 | 156 | 31 | 15 | 11 | 15 | 12 | 73 | 18 | 4 | 121 | 896 | 75 |
| No. of rain days | 6 | 13 | 9 | 2 | 1 | 2 | 1 | 2 | 7 | 2 | 1 | 9 | 55 | 5 |
| **Naloto** | 377 | 303 | 208 | 120 | 22 | Nil | 5 | 38 | 53 | Nil | Nil | 171 | 1297 | 108 |
| No. of rain days | 18 | 11 | 11 | 4 | 1 | 0 | 1 | 5 | 4 | 0 | 0 | 13 | 68 | 6 |

**Table 3: Cont'd**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tagitagi** | 190 | 379 | 151 | 33 | 9 | Nil | 16 | 29 | 82 | 27 | Nil | 101 | 1017 | 85 |
| No. of rain days | 8 | 11 | 7 | 2 | 2 | 0 | 1 | 4 | 7 | 2 | 0 | 7 | 51 | 4 |
| **Drumasi** | 312 | 311 | 231 | 57 | 2 | Nil | 11 | 34 | 77 | 25 | 16 | 53 | 1129 | 94 |
| No. of rain days | 10 | 10 | 7 | 2 | 1 | 0 | 1 | 4 | 7 | 2 | 1 | 5 | 50 | 4 |
| **Yaladro** | 179 | 242 | 145 | 17 | 17 | Nil | 13 | 24 | 59 | 19 | 6 | 50 | 771 | 64 |
| No. of rain days | 9 | 11 | 8 | 2 | 2 | 0 | 1 | 4 | 7 | 2 | 1 | 6 | 53 | 4 |

**Table 4: Rainfall data (mm) for Penang District - 2015**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ellington 1** | *NR | 9 | 107 | 99 | 30 | 27 | 19 | 48 | 70 | 30 | 6 | NR | 443 | 37 |
| No. of rain days | NR | 3 | 28 | 22 | 9 | 13 | 10 | 14 | 14 | 8 | 2 | NR | 123 | 10 |
| **Malau** | 150 | 364 | 143 | 102 | 72 | 15 | 5 | 53 | 59 | 124 | 28 | 196 | 1310 | 109 |
| No. of rain days | 24 | 21 | 20 | 14 | 10 | 10 | 4 | 12 | 12 | 5 | 11 | 14 | 157 | 13 |
| **Nanuku** | 110 | 365 | 129 | 49 | 8 | 12 | 5 | 23 | 71 | 27 | Nil | 24 | 823 | 69 |
| No. of rain days | 6 | 13 | 7 | 4 | 2 | 2 | 1 | 5 | 5 | 1 | 0 | 3 | 49 | 4 |
| **Ellington 2** | 211.4 | 212.3 | 241 | 150.1 | 68.5 | 49 | 21 | 21 | 60 | 47 | 35 | 132 | 1247 | 104 |
| No. of rain days | 16 | 16 | 16 | 12 | 9 | 8 | 7 | 7 | 12 | 7 | 9 | 18 | 137 | 11 |

***NR – Not Recorded***

**Table 5: Rainfall data (mm) for Labasa and Seaqaqa District - 2015**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Waiqele** | 259 | 712 | 216 | 116 | 67 | 0.1 | Nil | 83 | 17 | 41 | 54 | 19 | 1584 | 132 |
| No. of rain days | 13 | 24 | 14 | 10 | 4 | 1 | 0 | 7 | 10 | 4 | 7 | 9 | 103 | 9 |
| **Wailevu** | 277 | 421 | 172 | 70 | 52 | 23 | 2 | 98 | 28 | 5 | 29 | 50 | 1227 | 102 |
| No. of rain days | 21 | 27 | 20 | 12 | 5 | 3 | 2 | 10 | 11 | 3 | 9 | 7 | 130 | 11 |
| **Vunimoli** | 369 | 515 | 209 | 158 | 93 | 4 | Nil | 98 | 50 | 4 | 21 | 102 | 1624 | 135 |
| No. of rain days | 13 | 19 | 11 | 7 | 4 | 1 | 0 | 5 | 10 | 3 | 11 | 6 | 90 | 8 |
| **Labasa** | 185 | 404 | 175 | 105 | 59 | 2 | Nil | 82 | 36 | 7 | 27 | 86 | 1167 | 97 |
| No. of rain days | 11 | 21 | 13 | 9 | 4 | 1 | 0 | 6 | 10 | 3 | 11 | 7 | 96 | 8 |
| **Bucaisau** | 187 | 487 | 194 | 101 | 76 | 59 | 2 | 164 | 41 | 37 | 19 | 79 | 1446 | 120 |
| No. of rain days | 11 | 17 | 11 | 10 | 2 | 5 | 1 | 9 | 4 | 3 | 5 | 4 | 81 | 7 |

**Table 5: Cont'd**

| Sector | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wainikoro** | 210 | 438 | 248 | 140 | 108 | 27 | Nil | 100 | 78 | 30 | 44 | 21 | 1444 | 120 |
| No. of rain days | 11 | 21 | 11 | 9 | 3 | 2 | 0 | 8 | 6 | 4 | 6 | 5 | 86 | 7 |
| **Daku** | 44 | 39 | 117 | 18 | 26 | 8 | 26 | 7 | 11 | Rain gauge and | | | 295 | 33 |
| No. of rain days | 7 | 8 | 15 | 6 | 6 | 3 | 10 | 3 | 5 | stand damaged | | | 63 | 7 |
| **Labasa Estate** | 144 | 410 | 214 | 65 | 68 | 1 | Nil | 6 | 32 | 2 | 15 | 3 | 960 | 80 |
| No. of rain days | 9 | 21 | 13 | 9 | 6 | 1 | 0 | 1 | 10 | 2 | 9 | 2 | 83 | 7 |
| **Natua** | 107 | 289 | 98 | 88 | 22 | 3 | 10 | 77 | 80 | 54 | 152 | NA | 980 | 89 |
| No. of rain days | 16 | 23 | 14 | 10 | 3 | 1 | 2 | 7 | 9 | 2 | 6 | NA | 93 | 8 |
| **Solove** | 105 | 506 | 277 | 112 | *NA | | Nil | NA | NA | 175 | 117 | NA | 1291 | 184 |
| No. of rain days | 3 | 12 | 12 | 2 | | | 0 | NA | NA | 1 | 2 | NA | 32 | 5 |
| **Bulivou** | 24 | 346 | 150 | 168 | 58 | 50 | Nil | NA | 4 | 52 | 73 | NA | 924 | 92 |
| No. of rain days | 2 | 19 | 6 | 10 | 2 | 3 | 0 | NA | 1 | 3 | 2 | NA | 48 | 5 |
| **Seaqaqa Estate** | 338 | 525 | 245 | 126 | 22 | 4 | 10 | 77 | 81 | 54 | 138 | 413 | 2033 | 169 |
| No. of rain days | 18 | 23 | 17 | 8 | 3 | 2 | 2 | 7 | 9 | 2 | 6 | 17 | 114 | 10 |

*NA - *Information Not Available*

**Table 6: Meteorological data for Sugar Research Institute of Fiji, Lautoka 2015**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Relative Humidity (%)** | 77 | 78 | 73 | 67 | 70 | 68 | 68 | 69 | 68 | 58 | 59 | 64 | **68** |
| 46 yrs avg. | 75 | 79 | 77 | 75 | 74 | 72 | 69 | 68 | 69 | 66 | 70 | 72 | **72** |
| **Air Temperature** | | | | | | | | | | | | | |
| *Mean Maximum* | 29 | 31 | 31 | 31 | 30 | 29 | 29 | 28 | 28 | 30 | 31 | 32 | **30** |
| 46 yrs avg. | 32 | 31 | 31 | 31 | 30 | 28 | 28 | 28 | 29 | 31 | 31 | 31 | **30** |
| *Mean minimum* | 24 | 24 | 23 | 22 | 21 | 20 | 19 | 19 | 20 | 20 | 23 | 23 | **21** |
| 46 yrs avg. | 24 | 24 | 24 | 24 | 22 | 20 | 20 | 20 | 21 | 26 | 23 | 23 | **23** |
| *Mean* | 26 | 28 | 27 | 26 | 26 | 25 | 24 | 23 | 24 | 25 | 27 | 27 | **26** |
| *Highest maximum* | 32 | 34 | 34 | 33 | 33 | 33 | 32 | 32 | 32 | 32 | 34 | 34 | **33** |
| *Lowest minimum* | 22 | 24 | 20 | 19 | 17 | 15 | 15 | 14 | 14 | 13 | 18 | 20 | **17** |
| **Evaporation** | | | | | | | | | | | | | |
| *Raised pan* | 190 | 143 | 170 | 143 | 141 | 119 | 153 | 138 | 133 | 205 | 216 | 177 | **161** |
| **Earth thermometers** | | | | | | | | | | | | | |
| *5cm* | - | - | - | - | - | - | - | - | - | - | - | - | **-** |
| 46 yrs avg. | - | - | - | - | - | - | - | - | - | - | - | - | **-** |
| *10cm* | 28 | 29 | 28 | 27 | 26 | 25 | 24 | 24 | 25 | 27 | 30 | 29 | **27** |
| 46 yrs avg. | - | - | - | - | - | - | 24 | 24 | 26 | - | 29 | 29 | **26** |
| *50cm* | - | - | - | - | - | - | - | - | - | - | - | - | **-** |
| 46 yrs avg. | - | - | - | - | - | - | - | - | - | - | - | - | **-** |

**Temperature**

The highest monthly average maximum temperature was recorded for the month of February and November, with temperatures more than 32°C. The lowest monthly average minimum temperature was recorded for the month of July, with temperature less than 20°C.

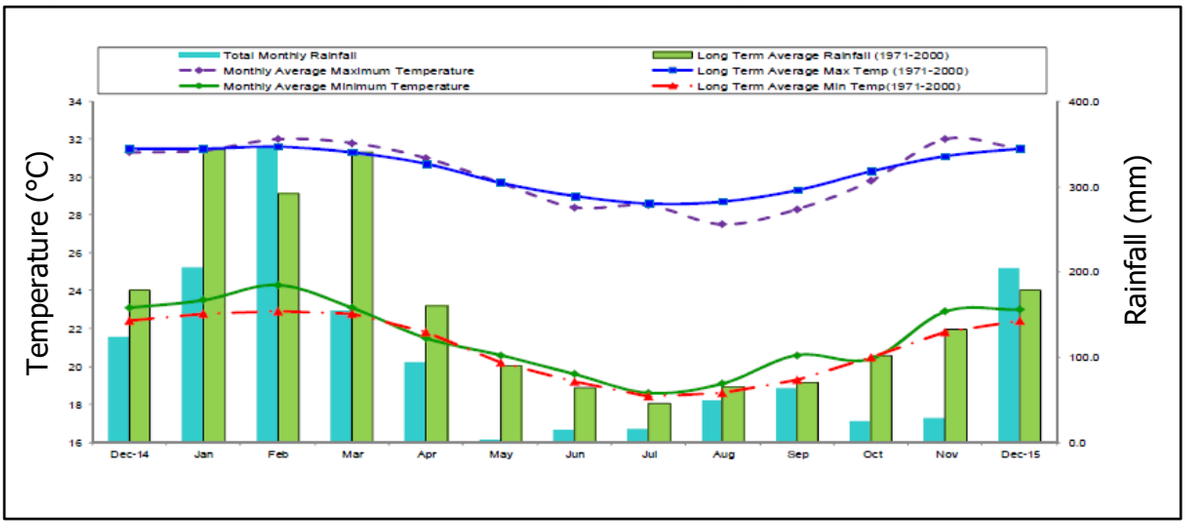



*Figure 1: Temperature and Rainfall Records for the last 13 months (Dec 2014 – Dec 2015) for Western Division - Ref: FIJI METEOROLOGICAL SERVICE - Fiji Climate Summary, December, 2015.*

**Earth Thermometers**

The earth thermometers at SRIF are at depths of 5cm, 10cm and 50cm. The annual average for 10cm earth thermometer was above normal (27°C) than the long term average of (26°C). 8 out of the 12 months recorded temperatures more than the long term average.

**Evaporation**

The annual evaporation average of the raised pan was 6mm less compared to last year. This year, evaporation value was 161mm while for year 2014, the value was 167mm.

**Relative Humidity**

The average humidity recorded for 2015 was 68% whereas the long term average was 72%. The first quarter of the year recorded values higher than the long term average, i.e. more than 72% whereas the rest of the months recorded relative humidity less than the 46 years mean.

**Sunshine**

There is no sunshine recorder installed at the Drasa meteorological station (Station No: V77555)

# CROP PROTECTION

# CROP PROTECTION

## Summary


### Plant Parasitic Nematodes Survey

Forty soil samples were collected from 30th September to 12th October. The soil samples were taken from the Penang mill regions of Malau, Nanuku, Ellington 1 and Ellington 2 Sectors. Plant parasitic nematodes were detected from soil extraction, the % incidence of *Helicotylenchus* and *Rotylenchulus* was high.

### Fiji Leaf Gall Screening of Stage 3 Clones

A trial was conducted during the year 2015 from February to November, on screening of clones of the 2012 series. The results were highly significant ($P<0.000$). There were negative linear relationships between standards and days ($R^2=0.874$). The study has showed that 79% clones were resistant, 13% clones were moderately susceptible and 8% clones were susceptible.

### Cane Grubs

Active survey of cane grubs was carried out by digging out the roots and soil in Malau, Lovu, Drasa and Lautoka sector. Samples were sent abroad (Mauritius) for identification. A preliminary survey for the grubs started on the 4th of August, 2015 and to date it has been found that Lovu sector is the most affected. Roots of plants showing symptoms were dug out and grubs were collected and put in containers.


## Recommendation

### Plant Parasitic Nematodes

- Further training in nematodes
- Establishment of nematodes lab with work bench.
- There is a need for a refrigerator for samples collected.
- Certain equipment are required such as blender, multichannel counter, tray rack, and tray, basket for nematodes extraction for soil and roots samples

### Fiji Leaf Gall Disease

- Adopt an improved method for testing resistance to Fiji leaf gall disease through molecular technology.

### Cane Grubs

- Compare the number of larvae and beetles caught during the months and confirm its life cycle.
- Deep ploughing of the soil to expose the larvae to their predators such as birds.
- Avoid having too many ratoons where fields are highly infested.
- More research to be done on biological control of Cane grubs.
- Flooding of the fields. This would lead to killing of the eggs as well as the larvae.
- While carrying out agronomy practices such as tillage as a control, if population of grubs are less, hand picking and elimination can be done immediately.
- Light trapping to become a part of the cane grub program.
- Develop sex pheromone to disrupt and prevent mating and breeding of cane grubs.

## Project details

### Nematology - Plant parasitic nematodes

A survey was conducted in Penang mill districts on 4 sectors (Nanuku, Malau, Ellington1 and Ellington2) to determine the occurrence and population density of plant-parasitic nematodes on sugarcane in October 2015.

A total of 40 soil samples were collected and analyzed, ten samples from each sectors (from ten different active cane growing farms). Ten samples from each sector were taken out. Ten nematode 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, Root knot, Lance and Pin. The table 1 shows the level of nematode occurrence in 40 farms in Penang mill regions.

**Table 1: Nematodes found in 40 sugarcane fields in Penang district (Survey Area 1)**

| Nematodes | | Nematodes/200ml of soil | | |
|---|---|---|---|---|
| Common name | Species | Incidence (%) | Mean | Maximum |
| **Lesion** | *Pratylenchus spp* | 11.7 | 50.9 | 2035 |
| **Spiral** | *Helicotylenchuc spp* | 55.6 | 248.8 | 9705 |
| **Ring** | *Criconemella spp* | 4.4 | 19.1 | 764 |
| **Dagger** | *Xiphinema spp* | 0.3 | 0.6 | 15 |
| **Stubby root** | *Trichodorus spp* | 2.0 | 1.4 | 35 |
| **Root knot** | *Meloidogyne spp* | 12.5 | 54.6 | 2185 |
| **Stunt** | *Tylenchorhynchus spp* | 2.0 | 1.6 | 40 |
| **Reniform** | *Rotylenchulus spp* | 42.1 | 19.1 | 764 |
| **Lance** | *Hoplolaimus spp* | 2.0 | 10.4 | 355 |
| **Pin** | *Paratylenchus spp* | 0.1 | 0.2 | 5 |

### Pathology - Screening of stage 3 clones

Fiji leaf gall is widespread in Fiji in the dominant commercial variety, Mana and in the garden cane, Duruka. Significant resources are devoted to managing the disease through rouging team and screening new varieties for resistance. FLG is caused by the virus and it is spread by infected planting material and by plant hoppers of the genus, Perkinsiella. In Fiji, the vector is Perkinsiella vitiensis. Leaf hopper (*Perkinsiella vitiensis*) survey is carried out every year in Fiji, in Lautoka mill area in Viti Levu.

This survey is done to observe that the population of hoppers can be found in each sector, so that hoppers can be collected and breed for Fiji Leaf Gall Screen. The resistance screening of the new clones were commenced in March with hopper survey and hopper collection from the commercial cane field. The insect that were collected from the field was bred on infected Fiji 10 (*Erianthus maximus*) for the nymphs. The 89 tested clones and 10 standards were inoculated with the Fiji disease virus and assessed.

Before taking out the plant from the insectary, the insecticide (Permethrin/ Improthrin) was used to kill all the infected nymphs. The assessment was done in a hundred days. The results in Table 2 and 3 shows the susceptibility of the 89 clones screened for Fiji Leaf gall disease of which 79% were resistant, 13% intermediate and 18%.

**Table 2: Showing the disease rating of LF2012 series**

| Clones | Clones Rating | Clones | Clones Rating | Clones | Clones Rating | Clones | Clones Rating |
|---|---|---|---|---|---|---|---|
| LF12-1 | 1 | LF12-65 | 3 | LF12-140 | 1 | LF12-257 | 4 |
| LF12-2 | 1 | LF12-67 | 1 | LF12-141 | 4 | LF12-266 | 3 |
| LF12-3 | 1 | LF12-73 | 3 | LF12-143 | 1 | LF12-267 | 1 |
| LF12-4 | 1 | LF12-74 | 5 | LF12-148 | 1 | LF12-274 | 7 |
| LF12-6 | 1 | LF12-76 | 1 | LF12-153 | 2 | LF12-276 | 1 |
| LF12-7 | 1 | LF12-79 | 1 | LF12-154 | 3 | LF12-278 | 3 |
| LF12-11 | 1 | LF12-85 | 3 | LF12-156 | 1 | LF12-280 | 1 |
| LF12-14 | 1 | LF12-87 | 3 | LF12-168 | 4 | LF12-282 | 1 |
| LF12-15 | 1 | LF12-88 | 1 | LF12-169 | 1 | LF12-286 | 6 |
| LF12-22 | 1 | LF12-90 | 1 | LF12-171 | 1 | LF12-289 | 1 |
| LF12-28 | 1 | LF12-94 | 1 | LF12-173 | 1 | LF12-521 | 1 |
| LF12-31 | 1 | LF12-97 | 3 | LF12-185 | 1 | LF12-596 | 1 |
| LF12-33 | 1 | LF12-103 | 1 | LF12-189 | 4 | LF12-618 | 4 |
| LF12-34 | 5 | LF12-109 | 2 | LF12-195 | 1 | LF12-629 | 1 |
| LF12-35 | 6 | LF12-112 | 6 | LF12-205 | 7 | LF12-682 | 1 |
| LF12-36 | 1 | LF12-114 | 1 | LF12-207 | 3 | LF12-692 | 1 |
| LF12-39 | 8 | LF12-117 | 1 | LF12-211 | 1 | LF12-700 | 7 |
| LF12-40 | 1 | LF12-119 | 1 | LF12-212 | 2 | LF12-729 | 5 |
| LF12-49 | 3 | LF12-120 | 1 | LF12-219 | 1 | LF12-732 | 7 |
| LF12-58 | 1 | LF12-124 | 1 | LF12-233 | 9 | LF12-733 | 1 |
| LF12-60 | 1 | LF12-134 | 1 | LF12-253 | 1 | LF12-766 | 9 |
| LF12-63 | 1 | LF12-138 | 1 | LF12-255 | 1 | LF12-768 | 1 |
| LF12-793 | 4 | | | | | | |

**Table 3: Number of varieties of the LF2012 series at**

| Series | Resistant | Moderate | Susceptible |
|---|---|---|---|
| LF 2012 | 79 | 13 | 8 |

## Disease control

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 was continued this year. However the disease remains endemic in wild canes and *Saccharum edule* (Duruka) in the neighboring commercial farms and transmitted to the cultivated crop by the Fijian sugarcane leaf hopper, *Perkensiella vitiensis*.

A total area of 4,581.50 ha was inspected in 2015 0f which 906.39 ha plant crop and 3675.11ha were ratoon cane.

**Table 4: Monthly roguing figures from January-December 2015**

| Months | Lautoka | | Nadi | | Labasa | | Sigatoka | | Ba/Tavua | | Penang | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon |
| **Jan** | 14.7 | 56.6 | 13.7 | 74.5 | 82.3 | 171.3 | 10.2 | 40.4 | | | | |
| **Feb** | 12.1 | 66.0 | 1.5 | 85.9 | 102.5 | 225.3 | 13.0 | 55.4 | | | | |
| **Mar** | | 82.7 | 5.2 | 160.6 | 155.0 | 156.0 | 10.8 | 61.2 | 2.9 | 67.3 | | |

**Table 4: Cont'd**

| Months | Lautoka | | Nadi | | Labasa | | Sigatoka | | Ba/Tavua | | Penang | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon | Plant | Ratoon |
| **Apr** | | 93.5 | | 99.8 | 117.5 | 197.5 | 6.1 | 77.0 | | | | |
| **May** | | | 3.6 | 88.2 | | | 10.0 | 51.5 | | | | |
| **Jun** | | 58.9 | 0.3 | 54.4 | | | 18.0 | 49.1 | 12.1 | 59.1 | | |
| **Jul** | | 136.1 | | | 132.5 | 118.6 | | | | | | |
| **Aug** | | 130.2 | | | 34.0 | 255.5 | 35.5 | 37.9 | 17.3 | 58.2 | | |
| **Sept** | 2.8 | 120.4 | | | 7.3 | 117.5 | 18.4 | 62.8 | | | | |
| **Oct** | | | | | 11.0 | 10.8 | 7.1 | 35.5 | | | | |
| **Nov** | | 5.5 | | | 47.2 | 316.3 | | | | | | |
| **Dec** | 1.7 | 53.1 | | | | | | | | 85.0 | | |
| **Total** | 31.4 | 803.1 | 24.3 | 563.3 | 689.31 | 1568.71 | 129.1 | 470.5 | 32.3 | 269.6 | | |

The trend on which Fiji Leaf Gall Disease is increasing in the sugarcane farms is an indication that the disease can flare up at any time given the availability of the pathogen, the transmission agent, *Perkensiella vitiensis*, weather conditions and planting of only one major variety, Mana. Mana was the only variety that was infected with FLG in all the cane districts except for Labasa and Penang. 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 5: Summarized Rouging Report from January-December 2015**

| Mill District | No. of Farms Inspected | Area Rouged (Ha) | | No. of FLGD stools Rouged |
|---|---|---|---|---|
| | | Plant | Ratoon | |
| Lautoka | 354 | 31.4 | 803.1 | 29 |
| Nadi | 185 | 24.3 | 563.3 | 32 |
| Labasa | 612 | 689.3 | 1568.7 | 0 |
| Sigatoka | 224 | 129.1 | 470.5 | 376 |
| Ba/Tavua | 139 | 32.3 | 269.6 | 45 |
| Penang | 0 | 1.23 | 4.0 | 0 |
| **Total** | **1490** | **892.94** | **3622.58** | **482** |

## Cane Grub

Cane grub in Fiji is an emerging pest in sugarcane crop. It has been generally identified as *Rhophea sp.* It has a life cycle of one to two years. It is "C" shaped, white with a greyish black abdomen. It has a sclerotized head and three pairs of legs. Cane grubs have three instars out of which the third one causes the most problems. The cane grub feeds and clings on the roots of the sugarcane crop. The infested fields display dry cane patches as well as yellowing of leaves. The affected plant roots turn black, the spindle wilts. The affected clumps are easily pulled out. A survey is still currently being carried out to find out the number of infested fields. Drasa sector seemed to be the most infected. The cane grubs were collected from the fields by using active method. According to the symptoms, the fields were diagnosed for the presence of cane grubs. Fields were searched for all developmental stages of cane grubs in soils, around cane roots and soils removed from the pit. Numbers of larvae, pupae and adults collected per pit were recorded. Larvae and pupae were transferred, singly, into labeled rearing vials containing moistened peat. Cane grub samples were sent to MSIRI for identification whereas the rest of it was being reared in the lab for multiplication. Rearing of the grub larvae was done by placing them with few stools with roots in a container with soil from the field where the grub was found with moistened peat moss. Rearing of the grubs was

done for further studies such as that of entomopathogen.Light trapping during the swarming period of *Rhophea sp*. would enable to precise the life cycle and to capture the adult grub beetles as these beetles are attracted to light. Light trapping will act as a control method for the adults and the collected grub beetles would be sent abroad for identification to confirm its species and this once more will be reared for additional studies.

**Figure 2: Third instar of cane grub in the field**

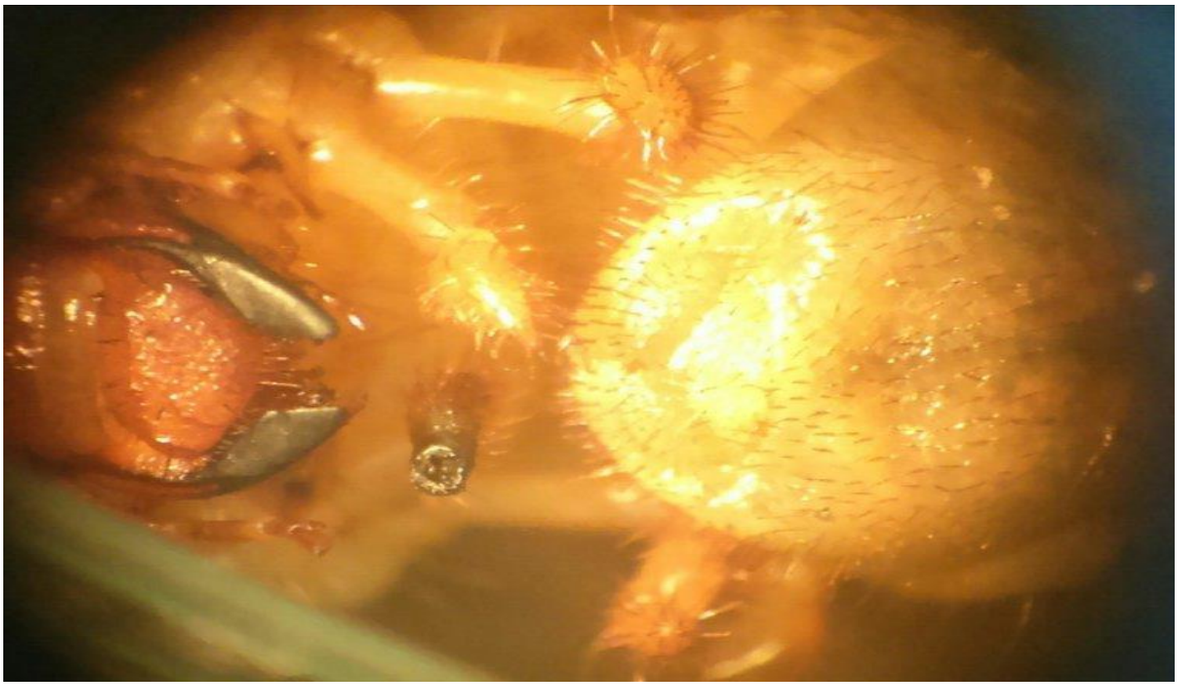


**Figure 3: Close view of third instar larvae of cane grub.**

**Figure 4: Damage caused by cane grub infestation**

**Figure 5: "Patchy" effects of cane grub infestation**

## List of sectors visited

**Table 7: Saweni Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Vuda | 613 | Harun Ali Shah | No | Mana | Ratoon | 0 |
| Lomolomo | 711 | Estate of Abram | No | Mana | Plant | 0 |
| Lomolomo | 708 | Minakshi | No | mana | Ratoon | 0 |
| Lomolomo | 707 | Ganga Reddy | No | Mana | Ratoon | 0 |
| Saweni | 9410 | Mukesh Chand | No | Mana | Ratoon | 0 |
| Saweni | 566 | Mohammad Yasuf | No | Mana | Ratoon | 0 |
| Saweni | 18340 | Est of Vijay Nand/ Krishnan Niraj Sharma | No | Mana | Ratoon | 0 |
| Saweni | 579 | Est of Kapil Prasad | No | Mana | Ratoon | 0 |
| Saweni | 1320 | Est of Jamilan Bi | No | Mana | Ratoon | 0 |
| Saweni | 18358 | Est of Daventi | No | Mana | Ratoon | 0 |

**Table 8: Lovu Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Buabua | 199 | Raj Pal | Yes | Mana | Ratoon | 8 |
| Qalitu Rd | 169 | Karna Karan | No | Mana | Ratoon | 0 |
| Qalitu Rd | 19062 | Jiten Singh | No | Mana | Ratoon | 0 |
| Qalitu Rd | 22020 | Ratesh | No | Mana | Ratoon | 0 |
| Qalitu Rd | 1199 | Est of Vidya Wati | No | Mana | Ratoon | 0 |
| Qalitu Rd | 22086 | Bhiren Wati | Yes | Mana | Ratoon | 4 |
| Naikabula | 1188 | Est of Ram Narayan | No | Mana | Ratoon | 0 |
| Buabua | 22039 | Ravin Kumar | No | Mana | Ratoon | 0 |
| Qalitu Rd | 22086 | Beran Wati | Yes | Mana | Ratoon | 3 |

**Table 9: Lautoka Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Vaivai | 24029 | Anil Chand | No | Mana | Ratoon/Plant | 0 |
| Vaivai | 49 | Est of Atish Chand | No | Mana | Ratoon | 0 |
| Vaivai | 24075 | Zakar Ali | No | Mana | Ratoon | 0 |
| Vaivai | 13036 | Ami Chand | No | Mana | Ratoon | 0 |
| Vaivai | 24056 | Aren Kumar | No | Mana | Ratoon | 0 |
| Bandrama | 24043 | Rajendra Prasad | No | Mana | Ratoon | 0 |

**Table 10: Drasa Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Cuvu | 8524 | Suriya deep Singh | No | Mana | Ratoon | 0 |
| Tavarau | 18069 | Vishwa Nand | No | Mana | Ratoon | 0 |
| Tavarau | 8280 | Est of Deo Narayan | No | Mana | Ratoon | 0 |
| Lomolomo | 106 | Manjula Devi | No | Mana | Ratoon | 0 |
| Lomolomo | 14094 | Mognam Bal | No | Mana | Ratoon | 0 |
| Lomolomo | 14070 | Bal Bir Singh | No | Mana | Ratoon | 0 |
| Lomolomo | 14064 | Est of Subarmani | No | Mana | Ratoon | 0 |
| Lomolomo | 14063 | Rayesh Chand | No | Mana | Ratoon | 0 |
| Lomolomo | 14124 | Bal Ram | No | Mana | Ratoon | 0 |
| Lomolomo | 110 | Sumintra Devi | No | Mana | Ratoon | 0 |
| Lomolomo | 18888 | Venu Gopal Naidu | No | Mana | Ratoon | 0 |
| Lomolomo | 14126 | Est of Suruj Narayan | No | Mana | Ratoon | 0 |
| Drasa Sector | 11902 | SRIF | No | Mana, Qamea, Kuiva | Ratoon/Plant | 0 |
| Lomolomo | 14103 | Uday Singh | No | Mana | Ratoon | 0 |
| Lomolomo | 14098 | Subhash Chand | No | Mana | Ratoon | 0 |
| Lomolomo | 14000 | Est of Ram Nand | No | Mana | Ratoon | 0 |
| Lomolomo | 14093 | Ronald Rohit Singh | No | Mana | Ratoon | 0 |
| Lomolomo | 14092 | Wardha Reddy | No | Mana | Ratoon | 0 |
| Lomolomo | 14061 | Anil | Yes | Mana | Ratoon | 17 |
| Lomolomo | 14057 | Est of Hari Ram Daven | Yes | Mana | Ratoon | 4 |

**Table 11: Malau Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Malau | 1 | Ram Kumar | No | Mana | Ratoon | 0 |
| Malau | 1353 | Est of Dhanbhagyam | No | Mana | Ratoon/ Plant | 0 |
| Malau | 1349 | Ragwal Naidu | No | Mana | Ratoon/ Plant | 0 |
| Malau | 233 | Est of Ram Dass | No | Mana | Ratoon | 0 |
| Malau | 11196 | Bisun Lal | No | Mana | Ratoon | 0 |
| Malau | 275 | Poona Balam | No | Kiuva | Ratoon | 0 |

**Table 12: Natova Sector**

| Location | Farm No. | Name | Infestation | Variety | Crop Type | Larvae Count |
|---|---|---|---|---|---|---|
| Masimasi | 14617 | Est Ram Daiyal | No | Mana | Ratoon | 0 |
| Nadele | 9608 | Vishnu Deo | No | Mana | Ratoon | 0 |
| Nadele | 14613 | Yad Ram Singh | No | Mana | Ratoon | 0 |

# CROP PRODUCTION

## CROP PRODUCTION

The Sugar Industry Strategic Action Plan highlighted the need to get more support out to growers through the designation of five different groups and one of the groups is the Crop production and Grower Advisory that was mandated to set-up demonstration plots in each mill area. The demonstration plots focus on the technology transfer program that incorporates Weed Control, Use of Clean Seed, Adoption of Sugar Cane Varieties, Recommended rates of Fertiliser usage and Intercropping and provides the opportunity to the farmers to adopt practices that will help in improving their production, acquire additional revenue and provide food security.

### Technology Transfer

Field days were held in the demonstration plots that highlighted the objective of the technology transfer program which is to disseminate information to the farmers that will be 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.

### Grower Demonstration Trials

Demonstration on the following topics were covered during the field days

1. Land preparation
2. Quality seed cane
3. Promote varietal spread
4. Mechanical planting with single row cutter planter that could also apply blend A (basal phosphorous) and lime simultaneously.
5. 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.
6. Mechanical spraying using a boom sprayer
7. Timeliness of operations

**Figure 1: Broadcast application of lime**

**Figure 2: Lautoka Mill General Manager addressing growers**

**Figure 3: Growers listen to deliberations**

**Figure 4: Cleaning seedcane for mechanical planting**


**Figure 5: Mechanical planting with Blend A and Lime application**

**Figure 6: Pre-emergence application.**

## Grower Demonstration Trials

The table below summaries the grower demonstration trials that were carried out in 2015. In summary:

- 18 Trials Conducted
- 670 growers attended the demonstration trial field days

**Table 1: Summary of GD trials in 2015 and relevant activities**

| No | Location/Sector | District | topics | Theme/attendance |
|---|---|---|---|---|
| 1 | Estate of Mahmood Khan's farm at Waiqaliqali, Cuvu Sector | Sigatoka/ Cuvu sector<br>24/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br>15 growers attended |
| 2 | Estate of Sundressan's farm at Raviravi | Lautoka/ Drasa sector<br>22/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br>25 growers attended |
| 3 | Anand's Farm - | Rarawai/Veisaru<br>02/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br>26 growers attended |
| 4 | Suresh Chandras farm (16156) at Vunicuicui | Labasa/ Vunimoli<br>30/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br>56 growers attended |

**Table 1: Cont'd**

| No | Location/Sector | District | topics | Theme/attendance |
|---|---|---|---|---|
| 5 | Anand's Farm<br>Tuva Point<br>• Demonstration plot of QAMEA<br>Biren Gosai's Farm<br>• Launching of planting | Sigatoka/ Lomawai<br><br>01/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br><br>25 growers attended |
| 6 | Gopal Krishna's | Nadi/ Qeleloa<br><br>27/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br><br>34 growers attended |
| 7 | Nurul Hak<br>Farm No. 6722 | Rarawai/ Naloto<br><br>17/04/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | Result demonstration<br><br>38 growers attended |
| 8 | Mukesh Chands farm | Rarawai/Mota<br><br>05/05/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br><br>23 growers attended |
| 9 | Anil Kumar & Rohit Kumar<br>Farm No. 6120 & 6123 | Rarawai/ Koronubu<br><br>04/05/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | launching of planting & varietal spread<br><br>result demonstration<br>21 growers attended |
| 10 | Legalega Research Station<br>Farm no. 2097 | Legalega<br><br>14/05/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | Mechanical planting and spraying<br><br>37 growers attended |
| 11 | Amir Ali's farm<br>Farm no. 8730 | Varoko<br><br>25/05/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | Result demonstration<br><br>24 growers attended |
| 12 | Yenktaiyas farm<br>Farm no 914 | Nanuku<br>11/06/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread Inter-cropping | Result demonstration<br><br>19 growers attended |
| 13 | Nemani Soli<br>Farm no. 1606 | Malau<br>10/06/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread | Varietal established<br><br>31 growers attended |
| 14 | Gaj Raj<br>Farm no. 14107 | Ellington 2<br>9/06/2015 | Land preparation, seedcane quality, Blend A application, Pre-emergence application, Varietal spread Inter-cropping | Good establishment<br><br>33 growers attended |

| | | | | |
|---|---|---|---|---|
| 15 | Rohit Kumar<br>Farm no. 4202 | Yaladro<br>3/06/2015 | Land preparation,<br>seedcane quality,<br>Blend A application,<br>Pre-emergence application,<br>Varietal spread<br>Inter-cropping | Result demonstration<br><br>27 growers attended |
| 16 | Legalega Research Station<br>Farm no. 2097 | Legalega<br><br>06/07/2015 | Mechanical planting of pulses as an inter-crop | Mechanical planting of pulses<br>40 growers attended |
| 17 | Legalega Research Station<br>Farm no. 2097 | Legalega<br><br>29/09/2015 | Intercropping results<br>Mechanical planting of pulses as an inter–crop<br>Good land preparation<br>Planting<br>Pre emergence application | Result demonstration of intercrops<br>110 growers attended |
| 18 | Nawaicoba<br>Farm no. 10659 | Nawaicoba<br>29/10/2015 | Intercropping in the ratoon cane an opportunity to improve total farm productivity | Result demonstration of intercrops<br>86 growers attended |

## Seed Cane Production

### Introduction

Profitable crop production partly depends on the quality of the seed planted. This principle applies to sugarcane as much as to any other crop. The potential cane yield that should be obtained will not be achieved if seed cane of poor quality is planted.

Ratoon stunting disease (*Leifsonia xyli* subsp. *xyli*) is prevalent in Fiji (Johnson et al, 2006) and can cause loss up to 27% in cane yield annually (Johnson and Tyagi, 2010). This major disease can be cured by hot water treatment. Other minor diseases are also cured by heat treatment. Good germination that is quick and even gives rise to increased production. With a well maintained seed cane nursery, the grower is certain that the seed cane quality received from such a program is free from disease, varietal purity and has a good germination capacity.

Adoption of heat treated seed cane nurseries by growers will promote the efficient and sustainable agricultural practices that protect, sustain, and enhance water and soil resources and ultimately achieve greater harmony between agriculture and environment. The seed cane produced from these nurseries should increase sugar yield by 5 to 10 %. Coupled with new varieties developed at SRIF, this would assist in achieving the required sugar yield.

Since 2010, the uptake of seed cane by farmers from SRIF administered seed beds has been increasing slowly but surely and this is an opportunity to probe further with more marketing to be done to farmers through the use of Technology Transfer.

In Labasa the prolonged drought experienced affected the adoption the planting of sugarcane in both the Labasa and Seqaqa districts. The seed cane which was propagated for 2015 planting seasons exceeded the maturity age and had to be sent to the mill for crushing. Similar case was experienced in the October planting season. For early window planting of 2016, about 200 tonnes of seed cane will be available. This is due to the drought and lack of irrigation which hindered the seed cane planting in 2015. Adoption rate for new variety Qamea was promising in 2015 compared to Viwa. An estimate of 30 to 40 hectares was planted with this new variety.

As the weather was not favorable for the (March – April) planting season in 2015, the available seed cane at SRIF Labasa estate was harvested and sent to the mill. Total of 751 tonnes of cane was sent to the mill for crushing which passed the age of 7 – 9 months and was not of good quality seed cane for planting. Around 35 tonnes of Qamea/ Viwa was sold to farmers during Oct – Nov planting window. Farmers took around 10 tonnes of Ragnar seed cane. Thirty five tonnes of seed cane (Viwa/ Qamea) was used for planting. About 6 tonnes of seed cane (Qamea) was used to plant demonstration plots at 4 different locations. Also 30 tonnes of seed cane (Qamea and Viwa) was given to the farmers for free from Oct – Nov (2014) to Mar – April (2015) planting window for variety promotion. For, (March – April) planting window in 2016, about 4 ha of seed cane will be ready for distribution to the farmers.

Five ha of hot water treated seed nursery was established as Mother Plot in Drasa. The plot was irrigated due to the meteorological drought experienced. The germination was more than 90% because these seedlings were raised in the greenhouse then transferred to the field in the Drasa Estate. The varieties planted in the Mother plot were selected on the demand of these variety types from farmers. Seed cane from this nursery would be ready for planting in the 2016 planting season.

**Figure 7: Irrigation in the greenhouse on seedlings**


**Figure 8: New variety, Viwa in the greenhouse**

Challenges identified in Seed cane production are:

- Availability of land on the Estates. A minimum of 15ha is required for Labasa and Rarawai Estate each to cater for seed cane production
- Lack of farmer uptake of clean seed cane. Uptake of seed cane this year has been low due to the drought conditions faced and also the lack of awareness on the advantage of using quality seed cane by farmers.

**Recommendation**

It is recommended that demonstration plots are planted on farmer's field using heat treated or clean seed material.

# EU SUPPORT

## EUROPEAN UNION SUPPORT TO THE SUGAR RESEARCH INSTITUTE OF FIJI

The support for the research activities is available through the **Accompanying Measures for the Sugar Protocol Programme** (AMSP Programme). The Sugar Protocol was the agreement that sets the guaranteed import prices and import levels for sugar between ACP countries that signed up to it and the European Union. Following a ruling of the WTO, which put an end to guaranteed prices for the EU's own producers, the EU could not justify paying guaranteed prices for ACP producers when we no longer guarantee prices for its own producers. The decision was taken in 2009 to terminate the Sugar Protocol after a transition period that will come to an end in October 2017. The AMSP programme was designed to help ACP countries adapting to the foreseen EU market access conditions over the Protocol phasing out period (2009-2017). In this framework, Fiji has received nearly 50 million euros to help the sugar producers improve competitiveness and diversify their sources of income, through the implementation of 14 projects. The duration of these projects varies; the longest ones will end in 2018. The Sugar Research Institute of Fiji has benefitted significantly from the support of European Union through the Annual Action Programs (AAP) 2011-2013. The total of € 3.5M has been made available to SRIF from 2012 to 2018 in the form of AAP2011, AAP2012 and AAP2013.

**Annual Action Program 2011**
**Title:** 'Cane variety research is improved and good quality seed cane is available to growers'
**Budget:** € 1 Million
**Implementation Period**: August 2012- December 2015
AAP2011 focused on two key result areas: (a) Strengthening Research and (b) Capacity Building. **Strengthening research** concentrated on targeted inputs in various areas of sugarcane research, production of seed cane and improved estate and infrastructure to assist in the production of new varieties and multiplication of seed cane. **Capacity building** focused on staff training and education to increase their research capabilities. Most activities planned in the original Grant contract were completed except purchase and installation of an eco-friendly hot water treatment unit and set-up of irrigation and reticulation system for Drasa estate. An addendum was sought to change the eco-friendly hot water treatment unit into two biogas operated HWT units and two greenhouses to be located at Rakiraki and Labasa. The unspent budget lines were diverted to include the purchase of lowboy truck and equipment's for bio-compost. The initial implementation period of AAP2011 was 24 months from 13th August 2012 but due the delays in completing project activities, this was extended twice with the final implementation period being 40 months to end of December 2015. Despite the extensions, the activities which were identified in the second addendum were not completed at the end of the project. This was due to lack of justification and utilisation plan for the proposed investments. As a result of this failure, SRIF lost a total of €345,000. Notwithstanding the above, most of the activities were completed as planned and the desired outcome was achieved for most of them. The specific objective of the action was 'Cane variety research is strengthened and good quality seed cane is available to growers'. Improving and introducing new varieties with increased yield and sucrose content is the ultimate aim of any sugarcane research programme and requires long term vision, resource input and dedicated personnel. The sugarcane breeding programme at SRIF has been in existence for decades and had its basis in making large number of random combinations to increase the chances of producing a superior cultivar. Although effective, this method has long been set aside in favour of modern methods of using available molecular tools and statistical programs to identify superior parents more likely to pass on their favourable attributes to their offspring to make limited but highly productive crosses. The transition from a conventional to more modern approach to breeding requires appropriate adjustments in terms of infrastructure, germplasm material and staff training. The investments under the AAP2011 Grant helped to

fast-track these changes, with the introduction of new varieties, staff training and purchase of necessary equipment. This has resulted in an improved sugarcane breeding programme capable of producing cultivars which are superior to the existing ones in all aspects. The AAP2011 funding enabled SRIF staff to access formal education at local and overseas universities, with training and attachments undertaken at sugarcane research institutes in Australia, Mauritius and Thailand. SRIF staff have benefitted though upgrading their qualifications and further developing their research capacities and improved skills. Attendance at conferences and workshops has helped staff to build professional networks with other scientists in their fields, get research ideas and increase confidence.

**Table 1 : List of staff who enrolled for formal studies under AAP2011**

| Staff | Qualification before project | Qualification after project | Status | Anticipated Finish Date |
|---|---|---|---|---|
| Mumta Gounder | Diploma in Laboratory Technology | Bachelor in Chemistry | 10/24 units | 2017 |
| Nalini Prasad | Diploma in Agriculture | Bachelor in Agriculture | Completed | |
| Natasha Nair | Diploma in Business Management | Bachelors in Management | 8/10 units | 2016 |
| Saimone Johnson | Masters in Biology | Master's in Business Administration | Completed | |
| Sanjay Prakash | Diploma in Accounting | Master's in Business Administration | Completed | |
| Jyotika Prasad | Bachelor of science in Biotech, Chemistry and Genetics | Postgrad Diploma in Biology | Completed | |
| Nazeea Bano | Bachelor of Science in Chemistry and Biology | Unclassified | 3/6 units | |
| Pedro Rounds | Bachelor of Science in Biology and Computer Science | Unclassified | 1/4 units | |
| Ilisoni Vorelevu | Bachelors in Agriculture | Masters in Botany | Completed | |
| Mere Tauvoli | Bachelor of Science in Chemistry and Biology | Masters in Chemistry | Completed | |
| Doreen Pillay | Bachelor of Science in Environmental Science (Chemistry) | Masters in Chemistry | Completed | |

**Table 2: Staff attendance to workshop and seminars**

| Conference/Workshop | Staff |
|---|---|
| ASPAC Workshop, New Zealand | Milika Vaniqi |
| | Mumta Gounder |
| ASSCT Workshop, Townsville | Jyotika Prasad |
| | Doreen Pillay |
| ISSCT, Brazil | Amit Singh |
| Step Up conference. Gold Coast | Sanjay Prakash |
| | Saimone Johnson |
| | Nazeea Bano |
| | Sanmogam Gounder |

SRIF benefitted through an upgrade in its equipment and infrastructure. Training activities and interactions with other research institutes resulted in the development new project ideas and collaboration at an institutional level in fields such as breeding, molecular biology and

agronomy. This has also resulted in access to resources such as primer sequences and laboratory protocols which otherwise would not be available to SRIF.

The ultimate beneficiaries of this project are the sugar cane farmers. The short-term benefit to these farmers has been ensuring that their crops remain free from pest and diseases. The use of pheromone traps in the cane belt have kept the spread of cane weevil borer in check and the use of molecular diagnostics has helped in rapid identification and elimination of any bacterial and viral diseases. One of the long-term benefits anticipated was the availability of sufficient amounts of clean seed cane for farmers. This could not be realised on a large scale due to the absence of distribution plots and only a small number of farmers benefitted from SRIFs primary nursery. The longer-term impact of the AAP2011 Grant will be the availability of new sugarcane varieties which have high yield and sucrose content.


**Figure 1: Greenhouse constructed at Drasa for production of disease free sugarcane seedlings**

**Figure 2: Seedling production at the Drasa greenhouse**

**Annual Action Program 2012**
**Title:** Sugar research capacity building and improvement of cane production
**Budget:** €1 Million
**Implementation Period:** December 2013-December 2016
The AAP2012 centers on increasing the overall cane production and improving the self-financing and research capacities of the Institute. Building on the achievements of AAP2011, the infrastructure and disease testing facilities will be used to produce quality seed cane for distribution to the growers. There has been a rapid decline in production in the past decade and some of the contributing factors are the reluctance of growers to plant new cane after a ratooning period of 5-8 years and their dependence on a single cultivar. The approach to increasing the cane production is ensuring that there is sufficient quality of seed material available for the new and early maturing cultivars. The project also looks at setting up demonstration trials in every sector to show the benefits of quality seed material, planting legumes, and adopting new varieties of sugarcane. A total of 30 demonstrations trials have been conducted since 2015. The success of the above approach has been visible in terms of increase in number of growers interested in planting new varieties.

**Figure 3: Participants at the stakeholder workshop conducted at the Tanoa Waterfront Hotel in October**

**Annual Action Program 2013**
**Title:** Improvement of management and operation capacities of SRIF
**Budget:** €1.5 Million
**Implementation Period:** December 2014-December 2018
AAP2013 will continue to focus on increasing the production through adoption of new varieties. The interim seed cane production programme under the AAP2012 will link seamlessly with the long-term seed cane production plan for the industry. The objective will be to reduce the total area covered by the current dominant variety 'Mana' and increase the area planted using new and early maturing varieties. In addition to this, research projects are being conducted to recommend alternative sources of fertilizer which will decrease the input cost for the growers; pest and disease management studies that will provide

recommendations on the cost-effective methods of producing a healthy crop and mechanization techniques which will help growers plant and maintain their farms.

The project also focuses on inclusion of services and activities which will generate income for the Institute. Changing political scenarios constantly affect the flow of funds available for research and this becomes an inhibitory factor in achieving the desired results. Starting income generating activities such as providing farm contracting services to the growers, providing soil and water testing services at a cost will ensure that SRIF does not have to be dependent on the funding by the industry stakeholders and there are funds available for research once the Grant Contract ends.
The project is on hold pending approval of the inception report.

**ASIAN CARIBBEAN PACIFIC- SUGAR RESEARCH PROGRAMME (ACP-SRP)**
**Title:** A comparative study of family and individual mass selection methods as early selection criteria and Nobilisation of Erianthus species.
**Budget:** €799,765.00
**Implementation Period:** December 2010-December 2015
The goal of this project was to increase sugar productivity per unit area by testing the efficiency of the family selection comparison with mass individual selection system and to undertake a nobilisation programme involving *E. arundinaceous* and *E. procerus* type clones with selected *S. officinarum*.

The project focused on four main objectives:

[1] Evaluate the efficiency of the methodology of the two early selection system that is family selection and individual mass selection where mechanical harvesting and weighing technique are not available.

The two trials planted to this effect were planted in April 2013 and February 2014 respectively. The 2013 trial is in Stage 2 now and was planted in July 2015 and the effect of the selection system would be seen after evaluation of the plant crop in 2016 season. For 2014 trial, the individual selection as been done and the selections are being propagated. The family selection will be carried out in ratoon in 2016 and a stage 2 trial will be planted. Both the trials involve families from West Indies whereas 2013 trial also have some SRIF crosses. SRIF will continue this trial and the results will be made available after the evaluation.

[2] To focus on the possibility of determining the breeding values of parental clones that produced the families using Best Linear Unbiased Predictors (BLUPs) of parental performance estimated from family selection trials. BLUPs are estimates of breeding value, which is the additive genetic component of the genotype.

It will take 5-8 years of repeated use of proven parents and families to ascertain the breeding values. The proven families would be those producing good progenies in terms of high sugar and cane yielding varieties. In 2015, the refresher course on ASReml software which will use BLUP's to estimate the breeding values was undertaken in November. The SRIF staff are prepared to conduct necessary analysis as and when data becomes available.

[3] To undertake a germplasm collection programme where very little or no collections have been made so far such as Burma, Laos, Cambodia and Vietnam.

This had been initiated earlier in 2013 but it has not been possible to bring the collected materials to Fiji due to tough biosecurity conditions in case of Myanmar. However with respect to Vietnam it has been possible to sign a MoU and import 15 Erianthus and 5 S. officinarum varieties. Two of the Vietnam Erianthus have been used for crosses in 2015 season together with local Erianthus arundinaceous and preserved Indonesian collection.

[4] To select five to ten *S. officinarum* clones and make crosses with six *E. arundinaceous* and four *E. procerus* to develop an array of genotype with bloodline from genu *Erianthus*. These genotypes are to have minimum characteristics for the other traits of agronomic importance for further breeding and commercial acceptability. The normal time span for release of varieties is beyond the scope of this operation however it would lay the foundation for the parental line development.

In 2015, 29 crosses had been conducted of which 2 were with the officinarum. The fuzz (seeds) have not been sown yet.

The project also had provision for improvement of the infrastructure required for sugarcane breeding and some of the infrastructure development include:

- Construction of the crossing shed at Dobuilevu, Rakiraki
- Purchase of germination chamber for sugarcane breeding
- Purchase of SpectraCane for analysis of sugarcane samples
- Purchase of PCR and other equipment to set up the molecular diagnostics lab
- Purchase of farm implements and irrigation equipment

In addition to the infrastructure development; staff received training in various aspects of sugarcane breeding. Some of the training and attachments carried out in collaboration with other research institutes include:

- Training in sugarcane breeding at Sugar Research Australia (SRA -previously BSES)
- Training in Sugarcane breeding at West Indies Sugarcane Breeding Station (WISCBS)
- Training in statistics at SRA
- Training in DNA extraction and PCR at Mauritius Sugarcane Breeding Station (MSIRI)

**Figure 4: Biparental crosses set-up at the Breeding Facility in Dobuilevu**

# FACP APPENDICES

# FACP APPENDICES

**Appendix 1: Main features of 2015 season compared with 2014**

| | Lautoka | | Rarawai | | Labasa | | Penang | | All mills | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| Total registrations (Numbers) | 5327 | 5388 | 5206 | 5268 | 4011 | 4017 | 1693 | 1714 | 16237 | 16387 |
| Total farm basic allotments (tonnes) | 923991 | 936592 | 929885 | 935815 | 891325 | 895990 | 255612 | 261552 | 3000813 | 2116040 |
| Total registered area (hectares) | 22569 | 22810 | 21767 | 21907 | 19459 | 18771 | 7711 | 7785 | 71505 | 985181 |
| Total area cultivated (hectares) | 11702 | 11516 | 14022 | 13062 | 13337 | 13245 | 5353 | 3883 | 44414 | 41705 |
| Total area harvested (hectares) | 11018 | 10882 | 11973 | 11849 | 12079 | 12972 | 3358 | 3588 | 38427 | 39291 |
| Total farm harvest quotas (tonnes) | open | open | open | open | open | open | open | open | open | open |
| Sugar make actual (tonnes) | 71869 | 61463 | 66742 | 62570 | 67338 | 79797 | 20910 | 18103 | 226858 | 221933 |
| Tonnes 94 N.T sugar | 76456 | 63784 | 68277 | 61083 | 69647 | 82744 | 21684 | 18731 | 236065 | 226342 |
| Yield tonnes 94 N.T.sugar per hectare | 6.9 | 5.9 | 5.6 | 5.5 | 5.6 | 8.3 | 6.5 | 5.2 | 6.1 | 6.2 |
| Tonnes cane per tonnes sugar 94 N.T. | 7.7 | 8.2 | 8.3 | 8.1 | 8.1 | 8.5 | 8.3 | 9 | 8.1 | 8.4 |
| %POCS | 13 | 12.4 | 12 | 12.6 | 12 | 12.1 | 12 | 11.9 | 12 | 12.3 |
| Cane purity average for season | 83 | 83.4 | 82 | 82.9 | 84 | 83.3 | 81 | 81.7 | 83 | 82.8 |
| Tonnes cane harvested | 520264 | 521065 | 596350 | 490765 | 544353 | 662600 | 171214 | 170129 | 1832181 | 1844559 |
| Tonnes cane crushed | 554224 | 502327 | 553014 | 510322 | 544353 | 662600 | 180571 | 169317 | 1832162 | 1844566 |

**Appendix 2: Monthly rainfall(mm) for 2015 compared with long term average**

| Mills | No. of years | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lautoka | 2015 actual | 212 | 342 | 130 | 64 | 10 | 9 | 27 | 35 | 43 | 19 | 2 | 82 | 974 |
| | 107 yrs avg. to 2015 | 308 | 323 | 321 | 183 | 98 | 65 | 51 | 68 | 74 | 90 | 126 | 189 | 1895 |
| Rarawai | 2015 actual | 196 | 246 | 143 | 82 | 13 | 8 | 5 | 22 | 53 | 43 | 7 | 283 | 1101 |
| | 130 yrs avg. to 2015 | 357 | 358 | 360 | 284 | 80 | 38 | 29 | 95 | 103 | 144 | 220 | 238 | 2299 |
| Labasa | 2015 actual | 185 | 404 | 175 | 105 | 59 | 2 | 0 | 82 | 36 | 7 | 27 | 86 | 1167 |
| | 127 yrs avg. to 2015 | 365 | 362 | 379 | 232 | 110 | 65 | 47 | 51 | 102 | 102 | 204 | 252 | 2271 |
| Penang | 2015 actual | 150 | 364 | 143 | 102 | 72 | 15 | 5 | 53 | 59 | 124 | 28 | 196 | 1310 |
| | 118 yrs avg. to 2015 | 437 | 355 | 403 | 378 | 124 | 70 | 52 | 90 | 86 | 145 | 153 | 245 | 2535 |

| Appendix 3: Crop production details | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lautoka | | Rarawai | | Labasa | | Penang | | All mills | |
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| **Areas harvested (hectares)** | | | | | | | | | | |
| Plant | 681 | 1006 | 803 | 1095 | 1035 | 1756 | 260 | 580 | 2780 | 4437 |
| First ratoon | 577 | 653 | 863 | 799 | 1700 | 1219 | 262 | 238 | 3401 | 2908 |
| 2nd ratoon | 237 | 513 | 639 | 761 | 582 | 1573 | 127 | 232 | 1584 | 3079 |
| Other ratoons | 9523 | 8710 | 9667 | 9194 | 8762 | 8424 | 2709 | 2538 | 30662 | 28867 |
| Total | 11018 | 10882 | 11973 | 11849 | 12079 | 12972 | 3358 | 3588 | 38427 | 39291 |
| **Cane harvested** | | | | | | | | | | |
| Plant | 40769 | 55820 | 49438 | 54325 | 60413 | 103332 | 15713 | 30250 | 166333 | 243727 |
| First ratoon | 33012 | 36231 | 51957 | 39760 | 97645 | 79412 | 14320 | 11995 | 196934 | 167398 |
| 2nd ratoon | 12340 | 27064 | 34407 | 34170 | 28940 | 82683 | 6313 | 10812 | 82000 | 154729 |
| Other ratoons | 434143 | 401950 | 460548 | 362510 | 357355 | 397173 | 134868 | 117072 | 1386914 | 1278705 |
| Total | 520264 | 521065 | 596350 | 490765 | 544353 | 662600 | 171214 | 170129 | 1832181 | 1844559 |
| **Yield tonnes cane per hectare (tch)** | | | | | | | | | | |
| Plant | 60.0 | 55.5 | 62.0 | 49.6 | 58.0 | 58.9 | 60.0 | 52.2 | 60.0 | 54.9 |
| First ratoon | 53.0 | 55.5 | 60.0 | 49.8 | 57.0 | 65.2 | 55.0 | 50.3 | 58.0 | 57.6 |
| 2nd ratoon | 52.0 | 52.7 | 54.0 | 44.9 | 50.0 | 52.6 | 50.0 | 46.7 | 52.0 | 50.3 |
| Other ratoons | 46.0 | 46.1 | 48.0 | 39.4 | 41.0 | 47.1 | 50.0 | 46.1 | 45.0 | 44.3 |
| Avg. yield/ha | 47.0 | 47.9 | 50.0 | 41.4 | 45.0 | 51.1 | 51.0 | 47.4 | 48.0 | 46.9 |
| **Varieties crushed (% of total cane harvested)** | | | | | | | | | | |
| Ragnar | 0.6 | 0.9 | 0.5 | 0.9 | 23.9 | 24.8 | 0.1 | 0.7 | 7.5 | 9.5 |
| Aiwa | 0.4 | 0.5 | 0.3 | 0.3 | 0.2 | 0.2 | nil | 0.1 | 0.3 | 0.3 |
| Beqa | 0.3 | 0.1 | nil | nil | nil | 0.1 | 0.1 | nil | 0.1 | 0.1 |
| Galoa | 0.1 | 0.2 | nil | nil | 6.2 | 5.5 | nil | 0.4 | 1.9 | 2.0 |
| Kaba | 2.3 | 2.7 | 5.0 | 6.2 | 0.4 | 0.4 | 0.3 | 0.9 | 2.6 | 2.6 |
| Mali | 0.1 | nil | nil | 1.1 | 10.3 | 12.2 | 0.1 | 0.1 | 3.1 | 4.7 |
| Mana | 91.8 | 90.5 | 90.9 | 88.9 | nil | nil | 95.4 | 90.1 | 64.3 | 57.5 |
| Naidiri | 1.7 | 2.1 | 0.9 | 1.2 | 33.8 | 31.7 | 3.4 | 6.5 | 11.2 | 12.9 |
| Vatu | nil | 0.1 | 0.0 | nil | 16.6 | 16.3 | nil | 0.2 | 4.9 | 5.9 |
| Waya | nil | nil | 0.4 | 0.3 | 6.7 | 6.8 | 0.1 | 0.4 | 2.1 | 2.6 |
| LF91-1925 | 1.0 | 1.5 | 0.3 | 0.9 | 0.9 | 1.3 | 0.1 | 0.2 | 0.6 | 1.1 |
| Kiuva | 1.3 | 1.1 | 1.1 | nil | 0.8 | 0.5 | 0.3 | 0.3 | 1.0 | 0.5 |
| Expt./Others | 0.3 | nil | nil | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.3 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

| Appendix 4: Rainfall (mm) at mill centres | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mill | For 12 months ended 31st December | | | | | For 12 months ended 30th September | | | | |
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | 3115 | 3563 | 2438 | 1541 | 974 | 2422 | 3384 | 1570 | 1250 | 991 |
| Rarawai | 2779 | 2640 | 2268 | 1250 | 1101 | 3029 | 2351 | 1469 | 1009 | 998 |
| Labasa | 2814 | 2679 | 2752 | 1679 | 1167 | 3087 | 2322 | 2066 | 1134 | 1519 |
| Penang | 3246 | 3000 | 2342 | 2179 | 1310 | 3335 | 2793 | 1850 | 1490 | 5452 |

| Appendix 5: Rainfall distribution affecting 2015 crop(mm) | | | | | |
|---|---|---|---|---|---|
| Month | Period | Lautoka | Rarawai | Labasa | Penang |
| Jul-14 | Early | nil | nil | 3.5 | 3.6 |
| | Mid | 0.8 | nil | 4.6 | 0.2 |
| | Late | 0.5 | nil | 9.6 | 19.9 |
| Aug-14 | Early | nil | nil | 2.4 | 2.5 |
| | Mid | nil | nil | Nil | 4.7 |
| | Late | nil | nil | Nil | 9.0 |
| Sep-14 | Early | nil | nil | Nil | Nil |
| | Mid | nil | nil | Nil | Nil |

| | | | | | |
|---|---|---|---|---|---|
| | Late | 17.1 | 5.8 | 5.8 | 0.4 |
| Oct-14 | Early | 20.1 | 14.0 | 45.4 | 16.7 |
| | Mid | 6.4 | 5.2 | 76.1 | 31.0 |
| | Late | 6.2 | 22.0 | 78.9 | 50.8 |
| Nov-14 | Early | 31.3 | 42.4 | 46.7 | 21.4 |
| | Mid | Nil | Nil | 29.6 | 0.2 |
| | Late | 55.1 | 8.7 | 40.0 | 43.2 |
| Dec-14 | Early | 42.8 | 57.0 | 60.2 | 281.8 |
| | Mid | 22.0 | 44.8 | 58.0 | 211.8 |
| | Late | 71.4 | 35.5 | 35.8 | 25.9 |
| Jan-15 | Early | 62.1 | 81.5 | 70.0 | 315.5 |
| | Mid | 13.8.3 | 62.5 | 45.7 | 312.4 |
| | Late | 12.9 | 52.1 | 68.8 | 350.6 |
| Feb-15 | Early | 61.9 | 80.2 | 157.3 | 325.6 |
| | Mid | 209.4 | 115.9 | 133.1 | 319.6 |
| | Late | 67.0 | 50.0 | 113.5 | 252.8 |
| Mar-15 | Early | 54.8 | 35.0 | 5.5 | 33.7 |
| | Mid | 73.1 | 107.8 | 162.5 | 100.1 |
| | Late | 5.9 | Nil | 7.4 | 9.6 |
| Apr-15 | Early | 0.7 | Nil | 7.9 | 43.9 |
| | Mid | 60.9 | 81.9 | 84.8 | 57.5 |
| | Late | 2.1 | Nil | 12.7 | 0.4 |
| May-15 | Early | Nil | Nil | 58.9 | 70.5 |
| | Mid | 4.4 | 13.0 | Nil | 1.3 |
| | Late | Nil | Nil | Nil | 0.4 |
| Jun-15 | Early | 11.8 | 7.8 | Nil | 2.4 |
| | Mid | Nil | Nil | 2.0 | 3.1 |
| | Late | 3.5 | Nil | Nil | 9.1 |
| Early - 1st to 10th of the month Mid - 11th to 20th of the month Late - 21st to end of the month | | | | | |

**Appendix 6 : hectares harvested**

| Mills | | Average for period of five seasons | | | | | Last four seasons individually | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Crop | 1991/ 1995 | 1996/ 2000 | 2001/ 2005 | 2006/ 2010 | 2011/ 2015 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | P | 3634 | 2944 | 1042 | 788 | 775 | 279 | 566 | 681 | 1006 |
| | R | 20580 | 19701 | 19730 | 14614 | 10630 | 11925 | 10403 | 10337 | 9876 |
| | Total | 24214 | 22645 | 20772 | 15402 | 11405 | 12204 | 10969 | 11018 | 10882 |
| Rarawai | P | 2899 | 3164 | 1055 | 1127 | 953 | 665 | 833 | 803 | 1095 |
| | R | 17360 | 14613 | 17585 | 14553 | 11367 | 12206 | 11415 | 11170 | 10754 |
| | Total | 20259 | 17777 | 18640 | 15680 | 12320 | 12871 | 12248 | 11973 | 11849 |
| Labasa | P | 3120 | 2597 | 1269 | 1116 | 1403 | 559 | 1598 | 1035 | 1756 |
| | R | 19604 | 18348 | 15911 | 14039 | 11500 | 12799 | 10054 | 11044 | 11216 |
| | Total | 22724 | 20945 | 17180 | 15155 | 12903 | 13358 | 11652 | 12079 | 12972 |
| Penang | P | 1386 | 1120 | 542 | 339 | 368 | 158 | 318 | 260 | 580 |
| | R | 4958 | 4674 | 4568 | 3991 | 3142 | 3367 | 2973 | 3098 | 3008 |
| | Total | 6344 | 5794 | 5110 | 4330 | 3510 | 3525 | 3291 | 3358 | 3588 |
| All mills | P | 11039 | 9825 | 3908 | 3369 | 3499 | 1661 | 3315 | 2780 | 4437 |
| | R | 62502 | 57336 | 57794 | 47197 | 36640 | 40298 | 34845 | 35647 | 34854 |
| | Total | 73541 | 67161 | 61702 | 50567 | 40139 | 41959 | 38160 | 38427 | 39291 |

**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 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | 1283569 | 1216597 | 971454 | 763321 | 516159 | 481483 | 405652 | 520264 | 521065 |
| Rarawai | 1017374 | 957507 | 878509 | 738316 | 551682 | 508638 | 498881 | 596350 | 490765 |
| Labasa | 1166055 | 1017061 | 840388 | 695728 | 547372 | 413285 | 546156 | 544353 | 662600 |
| Penang | 291206 | 309205 | 239044 | 213253 | 170698 | 143568 | 159720 | 171214 | 170129 |
| All mills | 3758204 | 3500370 | 2929395 | 2410619 | 1785912 | 1546974 | 1610409 | 1832181 | 1844559 |

**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 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | P | 64.7 | 64.2 | 63.9 | 67.2 | 57.7 | 53.9 | 51.2 | 59.8 | 55.5 |
| | R | 51.2 | 51.4 | 45.9 | 47.6 | 44.3 | 39.1 | 36.2 | 46.4 | 47.1 |
| | Total | 52.4 | 53.7 | 46.8 | 49.1 | 45.2 | 39.5 | 37.0 | 47.2 | 47.9 |
| Rarawai | P | 61.2 | 62.1 | 59.6 | 58.8 | 56.7 | 53.1 | 56.6 | 61.6 | 49.6 |
| | R | 48.1 | 52.9 | 46.4 | 44.8 | 43.8 | 38.8 | 39.6 | 49.0 | 40.6 |
| | Total | 50.1 | 53.9 | 47.1 | 46.5 | 44.8 | 39.5 | 40.7 | 49.8 | 41.4 |
| Labasa | P | 59.3 | 56.5 | 59.7 | 56.7 | 53.4 | 43.9 | 59.4 | 58.3 | 58.9 |
| | R | 50.4 | 47.4 | 47.6 | 43.5 | 41.4 | 30.4 | 44.8 | 43.8 | 49.9 |
| | Total | 51.3 | 48.6 | 48.9 | 45.8 | 42.7 | 30.9 | 46.9 | 45.1 | 51.1 |
| Penang | P | 57.2 | 62.6 | 54.2 | 56.3 | 50.6 | 46.4 | 40.8 | 60.4 | 52.2 |
| | R | 43.1 | 51.2 | 46.4 | 48.3 | 48.4 | 40.5 | 49.3 | 50.2 | 46.5 |
| | Total | 46.0 | 53.3 | 46.8 | 49.1 | 48.6 | 40.7 | 48.5 | 51.0 | 47.4 |
| All | P | 61.2 | 61.8 | 58.3 | 59.5 | 55.3 | 49.5 | 55.5 | 59.8 | 54.9 |
| Mills | R | 48.1 | 50.0 | 46.0 | 45.8 | 43.5 | 36.3 | 40.9 | 46.7 | 45.9 |
| | Total | 50.2 | 52.1 | 47.5 | 47.3 | 44.5 | 36.9 | 42.2 | 47.7 | 46.9 |

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

| Mills | 2015 hectares (A) | | | Hectares harvested as % of various categories "A" | |
|---|---|---|---|---|---|
| | Registered (1) | Cultivated (2) | Harvested | (1) | (2) |
| Lautoka | 22810 | 11516 | 10882 | 47.7 | 94.5 |
| Rarawai | 21910 | 13062 | 11849 | 54.1 | 90.7 |
| Labasa | 18771 | 13245 | 12972 | 69.1 | 97.9 |
| Penang | 7785 | 3883 | 3588 | 46.1 | 92.4 |
| Total | 71276 | 41705 | 39291 | 55.1 | 94.2 |

**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 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | 15.0 | 13.0 | 5.0 | 5.5 | 8.5 | 3.1 | 7.1 | 7.8 | 10.7 |
| Rarawai | 14.0 | 18.0 | 6.0 | 8.2 | 9.7 | 6.9 | 9.4 | 8.3 | 11.1 |
| Labasa | 14.0 | 12.0 | 7.0 | 8.2 | 13.4 | 5.9 | 17.4 | 11.1 | 15.6 |
| Penang | 23.0 | 19.0 | 11.0 | 8.2 | 10.7 | 5.1 | 8.1 | 9.2 | 17.8 |
| All mills | 16.0 | 15.0 | 7.0 | 7.4 | 10.5 | 5.3 | 10.5 | 9.1 | 13.2 |

| Appendix 11: Plant, ratoon yields and percentage of total area harvested - 2015 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 | 55.5 | 1006 | 9.2 | 55.5 | 653 | 6.0 | 46.5 | 9223 | 84.7 | 47.9 | 10882 |
| Rarawai | 49.6 | 1095 | 9.2 | 49.8 | 799 | 6.7 | 39.8 | 9955 | 8.4 | 41.4 | 11849 |
| Labasa | 58.9 | 1756 | 14.0 | 65.2 | 1219 | 9.0 | 48.0 | 9997 | 7.7 | 51.1 | 12972 |
| Penang | 52.2 | 580 | 16.2 | 50.3 | 238 | 6.6 | 46.2 | 2770 | 7.7 | 47.4 | 3588 |
| All Mills | 54.9 | 4437 | 11.3 | 57.6 | 2908 | 7.4 | 44.9 | 31946 | 81.3 | 46.9 | 39291 |

| 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 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | 12.5 | 11.4 | 11.5 | 10.8 | 11.4 | 10.7 | 11.6 | 12.9 | 12.4 |
| Rarawai | 12.9 | 11.4 | 11.9 | 10.9 | 11.3 | 10.7 | 11.5 | 12.0 | 12.6 |
| Labasa | 12.1 | 11.1 | 11.5 | 10.7 | 11.5 | 11.6 | 11.2 | 12.3 | 12.1 |
| Penang | 12.6 | 11.1 | 11.9 | 11.1 | 11.1 | 11.5 | 10.6 | 11.9 | 11.9 |
| All Mill Avg. | 12.5 | 11.2 | 11.7 | 11.0 | 11.4 | 11.1 | 11.3 | 12.3 | 12.3 |

| Appendix 13: Weekly POCS in cane 2015 season | | | | | |
|---|---|---|---|---|---|
| Week no. | Lautoka | Rarawai | Labasa | Penang | Average |
| 1 | 12.03 | 10.25 | 11.89 | 10.67 | 11.21 |
| 2 | 11.91 | 10.39 | 12.01 | 11.92 | 11.56 |
| 3 | 11.83 | 11.09 | 11.87 | 12.27 | 11.77 |
| 4 | 12.30 | 11.87 | 11.94 | 11.85 | 11.99 |
| 5 | 12.67 | 12.49 | 12.00 | 12.20 | 12.34 |
| 6 | 12.89 | 12.60 | 12.26 | 11.68 | 12.36 |
| 7 | 12.77 | 12.78 | 12.56 | 12.00 | 12.53 |
| 8 | 12.59 | 12.74 | 11.88 | 11.61 | 12.21 |
| 9 | 12.71 | 12.69 | 12.58 | 11.69 | 12.42 |
| 10 | 12.53 | 12.71 | 12.56 | 11.70 | 12.38 |
| 11 | 12.85 | 12.70 | 12.32 | 11.95 | 12.46 |
| 12 | 12.84 | 12.72 | 12.47 | 11.90 | 12.48 |
| 13 | 11.91 | 12.73 | 12.48 | 11.89 | 12.25 |
| 14 | 10.91 | 12.62 | 12.47 | 12.00 | 12.00 |
| 15 | 12.53 | 12.47 | 12.11 | 12.43 | 12.39 |
| 16 | 12.43 | 12.49 | 11.90 | 11.40 | 12.06 |
| 17 | 11.84 | 12.45 | 12.33 | 10.84 | 11.87 |
| 18 | 12.62 | 11.87 | 11.60 | | 12.03 |
| 19 | 12.60 | 11.77 | 10.92 | | 11.76 |
| 20 | 12.65 | 11.70 | 8.09 | | 10.81 |
| 21 | 12.73 | | | | 12.73 |
| 22 | 12.75 | | | | 12.75 |
| Average | 12.40 | 12.16 | 11.91 | 11.76 | 12.11 |

| Appendix 14 : Sugar produced (tonnes 94 N.T. equivalent) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Mills | Tonnes sugar 94 N.T equivalent | | | | | | | | |
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Lautoka | 75656 | 77311 | 53313 | 43384 | 50306 | 48129 | 41874 | 76456 | 63784 |
| Rarawai | 78786 | 63954 | 42222 | 31580 | 61028 | 45732 | 60039 | 68277 | 61083 |
| Labasa | 68255 | 53160 | 57548 | 40943 | 45146 | 45398 | 63423 | 69647 | 82744 |
| Penang | 21858 | 23231 | 22818 | 18530 | 16838 | 19908 | 19258 | 21684 | 18731 |
| All mills | 244555 | 217656 | 175901 | 134436 | 173318 | 159166 | 184594 | 236065 | 226342 |

| 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** | **2011** | **2012** | **2013** | **2014** | **2015** |
| Lautoka | 6.2 | 5.6 | 4.9 | 4.4 | 4.9 | 4.2 | 3.8 | 3.8 | 6.9 | 5.9 |
| Rarawai | 6.3 | 5.6 | 5.4 | 4.0 | 4.9 | 4.8 | 3.8 | 4.7 | 5.6 | 5.2 |
| Labasa | 6.0 | 5.0 | 5.0 | 4.0 | 5.1 | 3.1 | 3.4 | 5.3 | 5.6 | 6.4 |
| Penang | 5.5 | 5.4 | 4.7 | 5.4 | 5.5 | 4.5 | 5.6 | 5.9 | 6.5 | 5.2 |
| Average | 6.1 | 5.4 | 5.1 | 4.3 | 5.1 | 4.0 | 4.2 | 4.9 | 6.1 | 5.7 |

| 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** | **2012** | **2013** | **2014** | **2015** |
| Lautoka | 28.0 | 29.7 | 27.6 | 27.0 | 27.9 | 24.2<br>26/06/12 to 04/12/12 | 19.0<br>02/06/13 To 03/11/13 | 19<br>01/07/14 To 08/11/14 | 21<br>02/07/15 To 24/11/15 |
| Rarawai | 25.3 | 26.5 | 24.2 | 28.0 | 22.1 | 22.8<br>10/07/12 to 17/12/12 | 20<br>26/06/13 To 13/11/13 | 21.5<br>19/06/14 To 17/11/14 | 19.4<br>23/06/15 To 28/10/15 |
| Labasa | 29.4 | 30.7 | 24.1 | 25.9 | 18.7 | 16.1<br>26/06/12 to 16/10/12 | 19<br>27/06/13 To 09/11/13 | 16.5<br>17/06/14 To 11/10/14 | 19.2<br>17/06/15 To 28/10/15 |
| Penang | 21.5 | 26.2 | 20.4 | 22.5 | 18.1 | 16.3<br>26/06/12 to 18/10/12 | 17<br>25/06/13 To 20/10/13 | 16.9<br>27/06/14 To 11/10/14 | 15.9<br>29/06/15 To 19/10/15 |
| All mills | 26.1 | 28.2 | 24.1 | 25.9 | 21.7 | 19.9 | 18.7 | 18.5 | 18.9 |

| Appendix 17 : Varieties Percent of hectares harvested | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Lautoka** | | **Rarawai** | | **Labasa** | | **Penang** | | **All Mills** | |
| **Varieties** | **2014** | **2015** | **2014** | **2015** | **2014** | **2015** | **2014** | **2015** | **2014** | **2015** |
| Ragnar | 0.6 | 0.7 | 0.5 | 0.7 | 23.9 | 24.4 | 0.1 | 0.7 | 7.5 | 8.5 |
| Waya | nil | nil | 0.4 | 0.3 | 6.7 | 7.3 | 0.1 | 0.4 | 2.1 | 2.5 |
| Mali | 0.1 | nil | nil | 1.2 | 10.3 | 11.8 | 0.1 | 0.1 | 3.1 | 4.3 |
| Galoa | 0.1 | 0.2 | nil | 0.0 | 6.2 | 5.3 | 0.1 | 0.3 | 1.9 | 1.8 |
| Aiwa | 0.4 | 0.4 | 0.3 | 0.3 | 0.2 | 0.3 | nil | 0.1 | 0.3 | 0.3 |
| Kiuva | 1.3 | 0.9 | 1.1 | nil | 0.8 | 0.5 | 0.3 | 0.3 | 1.0 | 0.5 |
| Mana | 91.8 | 92.1 | 90.9 | 89.9 | nil | nil | 95.4 | 90.9 | 64.3 | 60.9 |
| LF91-1925 | 1.0 | 1.2 | 0.3 | 0.6 | 0.9 | 1.3 | 0.1 | 0.2 | 0.6 | 1.0 |
| Kaba | 2.3 | 2.3 | 5.0 | 5.6 | 0.4 | 0.4 | 0.3 | 0.9 | 2.6 | 2.6 |
| Vatu | nil | 0.1 | nil | nil | 16.6 | 16.9 | nil | 0.2 | 4.9 | 5.6 |
| Beqa | 0.3 | 0.1 | nil | nil | nil | 0.1 | nil | nil | 0.1 | 0.0 |
| Naidiri | 1.7 | 1.6 | 0.9 | 1.0 | 33.8 | 31.7 | 3.4 | 5.9 | 11.2 | 11.8 |
| Exp. | nil | 0.1 | nil | nil | nil | nil | nil | nil | nil | 0.0 |
| Other var. | 0.3 | 0.1 | 0.6 | 0.3 | nil | 0.2 | 0.03 | nil | nil | 0.2 |

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

| Mills | Hectares planted | | | Hectares planted as % of registered area | | | Hectares planted as % of cultivated area | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2013 | 2014 | 2015 | 2013 | 2014 | 2015 |
| Lautoka | 741 | 1117 | 574 | 3.3 | 4.9 | 2.5 | 5.5 | 9.5 | 5.0 |
| Rarawai | 944 | 1277 | 546 | 44.6 | 5.9 | 3.0 | 61.9 | 9.1 | 4.4 |
| Labasa | 1157 | 1979 | 1256 | 6.3 | 10.2 | 6.7 | 8.5 | 14.8 | 9.4 |
| Penang | 285 | 509 | 355 | 3.7 | 6.6 | 4.4 | 5.5 | 9.5 | 8.9 |
| Total | 3128 | 4882 | 2731 | 14.5 | 6.8 | 3.8 | 20.4 | 11.0 | 6.5 |

**Appendix 19: Percentage of total area planted by different varieties over three years**

| | | Lautoka | | Rarawai | | Labasa | | Penang | | All mills | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Varieties | % | Area ha | % | Area ha | % | Area ha | % | Area ha | % | Area ha |
| 2013 | Ragnar | 3.8 | 28.2 | 2.3 | 21.7 | 27.2 | 314.8 | nil | nil | nil | nil |
| 2014 | | 0.6 | 6.7 | 0.5 | 6.4 | 23.9 | 473.0 | 0.1 | 0.5 | 7.5 | 366.1 |
| 2015 | | 0.7 | 3.8 | 2.8 | 15.3 | 25.0 | 313.9 | 0.1 | 0.4 | 12.2 | 333.1 |
| 2013 | Waya | nil | nil | 0.6 | 5.7 | 5.0 | 57.9 | nil | nil | nil | nil |
| 2014 | | 0.1 | 1.1 | 0.4 | 5.1 | 6.7 | 132.6 | 0.1 | 0.5 | 2.1 | 102.5 |
| 2015 | | nil | nil | 0.9 | 4.9 | 5.6 | 70.3 | nil | nil | 2.8 | 76.5 |
| 2013 | Mana | 69.0 | 511.4 | 63.0 | 594.8 | nil | nil | 64.6 | 184.3 | 41.3 | 3128.0 |
| 2014 | | 91.8 | 1025.1 | 90.9 | 1160.4 | nil | nil | 95.4 | 485.6 | 64.3 | 3138.8 |
| 2015 | | 80.8 | 463.8 | 60.0 | 327.8 | nil | nil | 62.3 | 221.0 | 37.1 | 1013.1 |
| 2013 | Galoa | 1.0 | 7.4 | nil | nil | 6.3 | 72.9 | nil | nil | nil | nil |
| 2014 | | 0.1 | 1.1 | nil | nil | 6.2 | 122.7 | 0.1 | 0.5 | 1.9 | 92.7 |
| 2015 | | 0.3 | 1.7 | nil | nil | 8.2 | 103.0 | 2.9 | 10.3 | 4.2 | 114.7 |
| 2013 | Vatu | nil | nil | nil | nil | 13.0 | 150.4 | 0.4 | 1.1 | nil | nil |
| 2014 | | nil | nil | nil | nil | 16.6 | 328.5 | nil | nil | 4.9 | 239.2 |
| 2015 | | nil | nil | nil | nil | 7.9 | 99.2 | nil | nil | 3.6 | 98.3 |
| 2013 | Mali | 0.1 | 0.7 | nil | nil | 8.5 | 98.4 | nil | nil | nil | nil |
| 2014 | | 0.1 | 1.1 | nil | nil | 10.3 | 203.9 | 0.1 | 0.5 | 3.1 | 151.3 |
| 2015 | | nil | nil | nil | nil | 6.2 | 77.8 | 0.1 | 0.4 | 2.9 | 79.2 |
| 2013 | Aiwa | 1.4 | 10.4 | 1.2 | 11.3 | 0.1 | 1.2 | nil | nil | nil | nil |
| 2014 | | 0.4 | 4.5 | 0.3 | 3.8 | 0.2 | 4.0 | nil | nil | 0.3 | 14.6 |
| 2015 | | 1.4 | 8.0 | 0.5 | 2.7 | 0.1 | 1.3 | 0.7 | 2.5 | 0.5 | 13.7 |
| 2013 | Beqa | 0.4 | 3.0 | nil | nil | nil | nil | nil | nil | nil | nil |
| 2014 | | 0.3 | 3.4 | nil | nil | nil | nil | nil | nil | nil | nil |
| 2015 | | nil | nil | nil | nil | nil | nil | nil | nil | nil | nil |
| 2013 | Kaba | 5.3 | 39.3 | 11.4 | 107.6 | 0.5 | 5.8 | 0.3 | 0.9 | nil | nil |
| 2014 | | 2.3 | 25.7 | 5.0 | 63.8 | 0.4 | 7.9 | 0.3 | 1.5 | 2.6 | 126.9 |
| 2015 | | 7.1 | 40.8 | 16.1 | 88.0 | 0.4 | 5.0 | 2.5 | 8.9 | 5.2 | 142.0 |
| 2013 | Naidiri | 8.8 | 65.2 | 2.8 | 26.4 | 34.7 | 401.6 | 0.3 | 0.9 | nil | nil |
| 2014 | | 1.7 | 19.0 | 0.9 | 11.5 | 33.8 | 669.0 | 3.4 | 17.3 | 11.2 | 546.7 |
| 2015 | | 4.0 | 23.0 | 5.0 | 27.3 | 37.4 | 469.6 | 29.1 | 103.2 | 22.8 | 622.6 |
| 2013 | Kiuva | 5.1 | 37.8 | nil | nil | 2.0 | 23.1 | nil | nil | nil | nil |
| 2014 | | 1.3 | 14.5 | 1.1 | 14.0 | 0.8 | 15.8 | 0.3 | 1.5 | 1.0 | 48.8 |
| 2015 | | nil | nil | 1.4 | 7.6 | 0.5 | 6.3 | 0.1 | 0.4 | 0.5 | 13.7 |
| 2013 | LF91-1925 | 4.6 | 34.1 | nil | nil | 2.4 | 27.8 | nil | nil | nil | nil |
| 2014 | | 1.0 | 11.2 | 0.3 | 3.8 | 0.9 | 17.8 | 0.1 | 0.5 | 0.6 | 29.3 |
| 2015 | | 3.8 | 21.8 | 11.0 | 60.1 | 6.9 | 86.6 | 2.1 | 7.5 | 6.5 | 177.5 |
| 2013 | Experiment | 0.2 | 1.5 | 0.2 | 1.9 | nil | nil | nil | nil | nil | nil |
| 2014 | Other | 0.1 | 1.1 | 0.6 | 3.3 | 0.1 | 2.0 | nil | nil | 0.3 | 14.6 |
| 2015 | Varieties | nil | nil | 2.3 | 29.4 | 1.8 | 22.6 | nil | nil | 1.3 | 35.5 |

| 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 | 2007 | 13652 | 2.0 | 158002 | 21.0 | 569577 | 77.0 | 741231 | 100 |
| | 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 |
| Rarawai | 2007 | 32927 | 5.0 | 184605 | 25.0 | 520946 | 70.0 | 738478 | 100 |
| | 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 |
| Labasa | 2007 | 2910 | 0.3 | 233371 | 31.0 | 532847 | 69.0 | 769138 | 100 |
| | 2008 | 1275 | 0.2 | 179815 | 30.0 | 423224 | 70.0 | 604314 | 100 |
| | 2009 | nil | nil | 230735 | 34.0 | 448849 | 66.0 | 679584 | 100 |
| | 2010 | nil | nil | 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 |
| Penang | 2007 | 3010 | 1.0 | 55450 | 24.0 | 171378 | 75.0 | 229838 | 100 |
| | 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 | nil | nil | 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 |
| All mills | 2007 | 52509 | 2.0 | 128061 | 16.0 | 2298115 | 82.0 | 2478685 | 100 |
| | 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 |

| Appendix 21: Percentage burnt cane of total tonnes crushed | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Lautoka | | Rarawai | | Labasa | | Penang | | Average | |
| | % | Total | % | Total | % | Total | % | Total | % | Total |
| 1976 | 12.9 | 917428 | 28.0 | 731865 | 4.9 | 445798 | 15.1 | 154116 | 15.2 | 2249027 |
| 1977 | 17.7 | 1044468 | 28.9 | 825628 | 6.9 | 606154 | 11.8 | 198116 | 16.3 | 2674366 |
| 1978 | 19.1 | 1043064 | 25.3 | 799497 | 9.6 | 756793 | 8.2 | 250168 | 15.6 | 2849522 |
| 1979 | 14.9 | 1699234 | 25.9 | 1123509 | 9.6 | 940636 | 15.0 | 294605 | 16.4 | 4057984 |
| 1980 | 21.5 | 1348039 | 27.4 | 958414 | 16.0 | 782742 | 18.0 | 271096 | 20.7 | 3360291 |
| 1981 | 17.6 | 1444504 | 21.2 | 1248910 | 19.4 | 930265 | 17.0 | 307753 | 18.8 | 3931432 |
| 1982 | 23.2 | 1507831 | 24.8 | 1100133 | 13.6 | 1140552 | 13.2 | 326348 | 18.7 | 4074864 |
| 1983 | 18.3 | 639823 | 18.4 | 561774 | 18.0 | 761454 | 12.0 | 239482 | 16.7 | 2202533 |
| 1984 | 25.1 | 1731580 | 8.2 | 1146140 | 12.9 | 1136737 | 10.0 | 382030 | 14.1 | 4396487 |
| 1985 | 28.6 | 947593 | 25.2 | 864264 | 22.4 | 934166 | 16.2 | 296418 | 23.1 | 3042441 |
| 1986 | 29.5 | 1526648 | 15.1 | 1204661 | 15.1 | 1017372 | 11.3 | 360284 | 17.8 | 4108965 |
| 1987 | 23.8 | 1090111 | 34.2 | 685994 | 20.9 | 877652 | 19.0 | 306706 | 24.5 | 2960463 |
| 1988 | 37.7 | 1116916 | 15.2 | 742128 | 16.0 | 1034788 | 19.2 | 291440 | 22.0 | 3185272 |
| 1989 | 20.6 | 1537337 | 13.6 | 1250977 | 12.7 | 974201 | 10.0 | 336418 | 14.2 | 4098933 |
| 1990 | 24.3 | 1347531 | 30.4 | 1148070 | 13.7 | 1171817 | 14.6 | 348110 | 20.8 | 4015528 |
| 1991 | 42.5 | 1112957 | 46.4 | 961961 | 32.0 | 1029223 | 27.6 | 276261 | 37.1 | 3380402 |
| 1992 | 52.5 | 1109778 | 52.1 | 962936 | 44.4 | 1162108 | 41.1 | 297818 | 47.5 | 3532640 |
| 1993 | 35.6 | 1341537 | 33.4 | 1013627 | 29.2 | 1124357 | 19.4 | 224383 | 29.4 | 3703904 |
| 1994 | 39.0 | 1337977 | 36.0 | 1104246 | 27.0 | 1298285 | 19.8 | 323743 | 30.5 | 4064251 |
| 1995 | 43.4 | 1515880 | 42.5 | 1044098 | 37.6 | 1216290 | 28.7 | 333790 | 38.1 | 4110058 |
| 1996 | 54.8 | 1561446 | 48.1 | 1229978 | 39.9 | 1238443 | 33.2 | 349348 | 44.0 | 4379215 |
| 1997 | 50.7 | 1160879 | 49.1 | 906495 | 33.5 | 910137 | 34.8 | 302095 | 42.0 | 3279606 |
| 1998 | 67.0 | 625763 | 67.7 | 406811 | 54.5 | 832622 | 44.6 | 232825 | 58.5 | 2098021 |
| 1999 | 41.6 | 1433143 | 39.8 | 992968 | 17.0 | 1192735 | 26.3 | 339292 | 32.4 | 3958138 |
| 2000 | 56.1 | 1301752 | 54.6 | 1251282 | 37.8 | 911370 | 49.0 | 322475 | 50.6 | 3786879 |
| 2001 | 56.7 | 906743 | 50.3 | 844411 | 18.9 | 845444 | 49.5 | 208183 | 42.9 | 2804781 |
| 2002 | 46.8 | 1137123 | 41.8 | 1071579 | 21.4 | 938450 | 33.9 | 275431 | 37.1 | 3422583 |
| 2003 | 40.1 | 890499 | 32.8 | 836728 | 29.3 | 638851 | 22.0 | 243602 | 33.4 | 2609680 |
| 2004 | 42.7 | 1032127 | 39.5 | 878121 | 18.3 | 848533 | 35.5 | 242408 | 34.3 | 3001189 |
| 2005 | 44.4 | 890779 | 38.4 | 761704 | 25.0 | 910663 | 34.9 | 225594 | 35.7 | 2788740 |
| 2006 | 60.5 | 1051097 | 58.5 | 1039474 | 34.4 | 871031 | 46.5 | 264498 | 51.7 | 3226100 |
| 2007 | 39.0 | 741231 | 40.5 | 738478 | 39.1 | 769138 | 53.5 | 229844 | 40.8 | 2478691 |
| 2008 | 50.9 | 770569 | 53.6 | 732165 | 49.1 | 604314 | 48.5 | 214572 | 51.1 | 2321620 |
| 2009 | 43.5 | 726046 | 33.3 | 659351 | 18.6 | 679584 | 28.8 | 181650 | 31.8 | 2246631 |
| 2010 | 30.4 | 527663 | 33.6 | 522114 | 18.6 | 554575 | 16.3 | 175701 | 25.0 | 1780053 |
| 2011 | 28.5 | 652333 | 28.2 | 663774 | 17.9 | 570468 | 26.6 | 208860 | 25.3 | 2095435 |
| 2012 | 43.8 | 481483 | 44.7 | 508638 | 18.7 | 413285 | 28.3 | 143568 | 35.9 | 1546974 |
| 2013 | 77.8 | 726046 | 31.9 | 347417 | 14.2 | 546156 | 27.0 | 159720 | 37.7 | 1779339 |
| 2014 | 50.7 | 520264 | 49.9 | 596350 | 22.0 | 544353 | 28.0 | 171214 | 39.9 | 1832181 |
| 2015 | 47.0 | 244680 | 48.5 | 238167 | 27.7 | 183840 | 31.0 | 52688 | 39.0 | 719375 |

# APPROVED VARIETIES

## APPROVED VARIETIES

The list of sugarcane varieties approved for planting during 2015 has been revised to include maturity trend. Varieties that are no longer planted have been removed from the approved varieties list. The varieties are recommended to growers on their soil type. The growers have a choice of at least three varieties to plant on their farms as laid down in the Master Award.

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

| Mill/Sectors | Soil types | Varieties recommended on maturity trends | |
|---|---|---|---|
| | | Early – mid maturing | Mid – late maturing |
| Lautoka/Saweni | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| | Sandy soils | LF91-1925 | Kaba, Mana, Galoa |
| Lautoka/Lovu | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Lautoka/Drasa | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| | Sandy soils | LF91-1925 | Kaba, Mana, Galoa |
| Rarawai/Varoko | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Mota | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Naloto | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Koronubu | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Veisaru | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Rarawai | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Varavu | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Vatu, Kiuva, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| Rarawai/Tagitagi | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | Medium soils | Aiwa, Beqa, Naidiri, LF91-1925 | Mana, Kaba, Vatu, Viwa |
| | Poor soils | LF91-1925, Qamea | Kaba, Mana, Viwa |
| | Saline areas | Naidiri, LF91-1925 | Kaba, Mana, Galoa |
| Rarawai/Yaladro | Flat Fertile soils | Aiwa, Beqa, Naidiri, LF91-1925 | Ragnar, Kaba, Kiuva, Viwa |
| | 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 |

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

## ABBREVIATIONS

| | | |
|---|---|---|
| SRIF | - | Sugar Research Institute of Fiji |
| FSC | - | Fiji Sugar Corporation Ltd |
| SIT | - | Sugar Industry Tribunal |
| SCGC | - | Sugar Cane Growers Council |
| SCGF | - | Sugar Cane Growers Fund |
| MoS | - | Ministry Of Sugar |
| SPF | - | South Pacific 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 |

## GLOSSARY

| | |
|---|---|
| **Clones / Varieties** | The distinct individual sugarcane type that can be identified by numerous attributes or a combination of it, such as stalk color, stalk shape, leaf type, etc. |
| **Series** | When used in the context of plant breeding, it refers to a set of clones or varieties distinguished by the year in which those clones or varieties were initially planted from fuzz (seed) stage. |
| **Germplasm** | A collection of clones that has recorded desirable traits such as high fiber, disease tolerant, etc. |
| **Fuzz** | Sugarcane seeds, not to be confused with seeds commonly referred to in the sugar industry as the stalks of sugarcane used for planting. Seeds in this case are all different varieties, much like seeds of beans, cucumbers or chilies. |
| **Ratoon** | Commonly referred to the sugarcane crop that established or grew after the initial plant crop was harvested. |
| **Breeding Plots / Flowering Beds** | Small areas planted with sugarcane for the purpose of harvesting flowers from. |
| **Gene Pool** | Basically referring to the Germplasm from a genetics point of view. |
| **Standards** | Sugarcane varieties that have already been released to growers to plant for commercial use. |
| **Brix** | Measure of dissolved solids in sugar juice, liquor or syrup using a refractometer. |
| **G X E trials** | Genetic by Environment trials to test the interaction of the genetic attributes of varieties against environmental conditions. |
| **Supply** | The term is normally used when "supplying" seedcane referring to sugarcane field that have |
| **Phytotoxic** | Poisonous to plants. |
| **Farmorganix/Stand Up SummaGrow** | Brand names of new organic 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.<br><br>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 |

# FINANCIAL REPORT

# Sugar Research Institute of Fiji

## Financial Statements

## For the year ended 31 December 2015

**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 2015 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 Intitute did not have a Board present for the period 30 September 2012 to 4 May 2014. An interim board was appointed by the Ministry of Sugar on 4 May 2014 and the Board details were as follows:

Mr Abdul Khan (appointed on 4 May 2014)
Mr Manasa Tagicakibau (appointed on 4 May 2014)
Mr Sundresh Chetty (appointed on 4 May 2014)

The new Board was appointed on 1 March 2015. The Directors in office and up to the date of this report are:

Professor Rajesh Chandra - Chairman (appointed 1 March 2015)
Mr Abdul Khan (appointed on 1 March 2015)
Mr Daniel Elisha (appointed 1 March 2015)
Mr Manasa Tagicakibau (appointed on 1 March 2015 and resigned on 18 July 2017)
Professor Paras Nath (appointed 1 March 2015)
Mr Sundresh Chetty (appointed on 1 March 2015)
Dr K. Shanmudha Sundaram (appointed 1 March 2015)
Mr Graham Clark (appointed 18 July 2017)
Ms Reshmi Kumari (appointed 18 July 2017)

The Board has taken all necessary steps to have the accounts prepared properly with external input and has insured that the external auditors have unfetted access to all documents and information sought by them with the shared aim to ensure that the final accounts represent the true state of affairs of the Institute in 2015, including any liabilities.

### 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 2015 and the accompanying statement of profit or loss and other comprehensive income and statement of cash flows give a true and fair view of the results and cash flows of the Institute for the year then ended.

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

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

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

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

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

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

**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 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 Sugar Cane Growers Council.

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 parliment that is proposing major changes in the functioning of Sugar Research Industry 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 Directors, 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 01 day of NOVEMBER 2017.

Signed in accordance with a resolution of the Board.

Rajesh Chandra

**Chairman**

**Board member**

KPMG

Honorable Commodore Josaia Voreqe Bainimarama
Minister responsible for the Sugar Industry
PO Box 2212
Government Buildings
Suva

Dear Minister

## INDEPENDENT AUDITOR'S REPORT TO THE BOARD MEMBERS OF SUGAR RESEARCH INSTITUTE OF FIJI

### Report on the Financial Statements

We have audited the accompanying financial statements of Sugar Research Institute of Fiji, which comprise the statement of financial position as at 31 December 2015, and the statement of profit or loss and other comprehensive income, and statement of cash flows for the year then ended, and a summary of significant accounting policies and other explanatory notes as set out in notes 1 to 19.

### Directors' and Management's Responsibility for the Financial Statements

Directors and management are responsible for the preparation of financial statements that give a true and fair view in accordance with International Financial Reporting Standards and for such internal control as the directors and management determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

### Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with International Standards on Auditing. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation of financial statements that give a true and fair view 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 entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by the management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

KPMG

## INDEPENDENT AUDITOR'S REPORT TO THE BOARD MEMBERS OF SUGAR RESEARCH INSTITUTE OF FIJI (continued)

### Basis for qualification

*VAT Payable*

The financial statements show an amount of VAT payable to the Fiji Government of $541,323. The VAT status of the Institute is currently being determined with FRCA and it is not presently known what the outcome of this will be. The impact on the amount recorded in the financial statements is currently 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.

*Expenses*

The Institute recorded $4,009,814 in total expenses in the statement of profit or loss and other comprehensive income for the year ended 31 December 2015. The Institute did not provide appropriate supporting documents totalling $36,314 for the year ended 31 December 2015 for audit verification. As a result we were unable to determine whether any adjustments might have been necessary in respect of the Institute's total expenses for the year ended 31 December 2015, and the elements making up the statement of financial position and cash flows.

### Opinion

In our opinion, except for the possible effects of the matters noted in the Basis for Qualification opinion paragraphs, the financial statements give a true and fair view of the financial position of Sugar Research Institute of Fiji as at 31 December 2015 and of its financial performance and its cash flows for the year then ended in accordance with International Financial Reporting Standards.

### 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, so far as it appears from our examination of those books;

ii) the financial statements are in agreement with the books of account; and

iii) to the best of our information and according to the 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

**1 November, 2017**
**Nadi, Fiji**

**KPMG**
**Chartered Accountants**

**Sugar Research Institute of Fiji**
**Statement of profit or loss and other comprehensive income**
**For the year ended 31 December 2015**

| | Note | 2015<br>$ | 2014<br>$ |
|---|---|---|---|
| Contributions and grants | 6 | 3,743,559 | 2,380,353 |
| Estate income | | 224,413 | 226,279 |
| Other income | 7 | 2,537 | 108,546 |
| **Total income** | | 3,970,509 | 2,715,178 |
| Cost of operations | 8 | (1,678,857) | (1,249,324) |
| Administrative expenses | 9 (a) | (2,330,957) | (1,485,426) |
| **Deficit from operations** | | (39,305) | (19,572) |
| Finance income | | 39,305 | 19,572 |
| **Deficit before tax** | | - | - |
| Income tax benefit | 10 | - | - |
| Balance at the beginning of the year | | - | - |
| **Deficit for the year** | | - | - |

The notes on pages 8 to 18 are an integral part of these financial statements.

**Sugar Research Institute of Fiji**
**Statement of financial position**
**For the year ended 31 December 2015**

| | Note | 2015 $ | 2014 $ |
|---|---|---|---|
| **Assets** | | | |
| **Current assets** | | | |
| Cash and cash equivalents | 12 | 4,000,895 | 2,674,107 |
| Receivables and prepayments | 13 | 157,104 | 2,750 |
| Receivable from related parties | 17 (b) | 5,224,999 | 5,924,999 |
| **Total current assets** | | 9,382,998 | 8,601,856 |
| **Non-current assets** | | | |
| Property, plant and equipment | 11 | 4,019,316 | 4,225,307 |
| **Total non-current assets** | | 4,019,316 | 4,225,307 |
| **Total assets** | | 13,402,314 | 12,827,163 |
| **Current liabilities** | | | |
| Bank overdraft | 12 | - | 16,836 |
| Deferred income | 14 | 10,448,540 | 10,083,526 |
| Payable to related parties | 17 (c) | 2,260,537 | 2,254,407 |
| Employee benefits | 15 | 45,933 | 45,933 |
| Trade and other payables | 16 | 647,304 | 426,461 |
| **Total current liabilities** | | 13,402,314 | 12,827,163 |
| **Total liabilities** | | 13,402,314 | 12,827,163 |

Signed on behalf of the board

Rajesh Chandra
**Chairman**

**Board Member**

The notes on pages 8 to 18 are an integral part of these financial statements.

**Sugar Research Institute of Fiji**
**Statement of cash flows**
**For the year ended 31 December 2015**

| | Note | 2015<br>$ | 2014<br>$ |
|---|---|---|---|
| **Operating Activities** | | | |
| Receipts from stakeholders and donors | | 4,335,523 | 3,093,462 |
| Payment to suppliers and employees | | (3,631,442) | (2,365,975) |
| Interest received | | 39,305 | 19,572 |
| **Cash flows provided by Operating Activities** | | 743,386 | 747,059 |
| **Investing Activities** | | | |
| Acquisition of property, plant and equipment | 11 | (116,598) | (583,791) |
| Received from related parties | | 700,000 | - |
| **Cash flows used in Investing Activities** | | 583,402 | (583,791) |
| Net increase in cash and cash equivalents | | 1,326,788 | 163,268 |
| Cash and cash equivalents at the beginning of the year | | 2,674,107 | 2,510,839 |
| Cash and cash equivalents at 31 December | 12 | 4,000,895 | 2,674,107 |

The notes on pages 8 to 18 are an integral part of these financial statements.

**Sugar Research Institute of Fiji**
**Notes to the financial statements**
**For the year ended 31 December 2015**

## 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 and 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 _____.

### (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 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 Sugar Cane Growers Council.

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 except where stated.

### (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.

### (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:

| | |
|---|---|
| Building and land | 80 years |
| Computers | 5 years |
| Fixtures and fittings | 10 years |
| Motor vehicles | 6.67 years |
| Plant and equipment | 6.67 - 10 years |

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

**3. Significant accounting policies (continued)**

**(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 receivables, prepayments, deposits and other receivables.

Cash and cash equivalents

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

(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 recognisition 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.

Trade and other payables and payable to related party are stated at amortised cost.

**3. Significant accounting policies (continued)**

**(d) Inventories**

Inventories are measured at the lower of cost and net realisable value. The cost of inventories is based on the first-in first-out principle, and includes expenditure incurred in acquiring the inventories, production or conversion costs and other costs incurred in bringing them to their existing location and condition.

Net realisable value is the estimated selling price in the ordinary course of business, less the estimated selling expenses.

**(e) 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 enter 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.

**(f) Revenue**

**Grant income**

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.

**(g) Employee benefits**

Superannuation

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

**3. Significant accounting policies (continued)**

**(g) Employee benefits (continued)**

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.

**(h) Income tax**

The Institute is not subject to income tax.

**(i) Receivable from related parties**

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

**4. Financial risk management**

The financial statements do not disclose information relating to the nature and extent of risks arising from financial instuments to which the Institute is exposed at year end, since credit risk, liquidity risk and market fluctuatuions are not material to the Institute.

**5. Standards Issued but not yet adopted**

A number of new standards, amendments to standards and interpretations are effective for annual periods beginning after 1 January 2014, and have not been applied in prepaing these financial statements. None of these are expected to have a significant effect on the financial statements of the Company.

## 6. Contributions and grants

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

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| African Caribbean and Pacific Group of States (ACP) | - | - |
| Contribution from the Fiji Government | 782,609 | 815,135 |
| European Union | 450,622 | - |
| Fiji Sugar Corporation (FSC) | 782,609 | 782,609 |
| Sugar Cane Growers | 782,609 | 782,609 |
| | 2,798,449 | 2,380,353 |

## 7. Other income

| | | |
|---|---|---|
| Sundry income | 2,537 | 108,546 |
| | 2,537 | 108,546 |

## 8. Cost of operations

| | | |
|---|---|---|
| Advertising | 3,176 | 4,105 |
| Bank charges | 2,764 | 5,928 |
| Consultancy fees | 41,209 | - |
| Depreciation | 307,033 | 339,681 |
| Electricity | 39,236 | 40,649 |
| EU Cost | 183,630 | 130,774 |
| Communication expenses | 20,910 | 15,861 |
| Material costs | 43,728 | 90,776 |
| Motor vehicle running expenses | 203,253 | 271,605 |
| RAF costs | - | 2,196 |
| Repair and maintenance | 13,953 | 14,376 |
| Subcontract expenses | 198,995 | 298,224 |
| Travel | 183,728 | 35,149 |
| Wages and salaries (refer note 9 (b)) | 437,242 | 391,189 |
| | 1,678,857 | 1,640,513 |

**Sugar Research Institute of Fiji**
**Notes to the financial statements**
**For the year ended 31 December 2015**

| | 2015<br>$ | 2014<br>$ |
|---|---|---|
| **9 (a) Administrative expenses** | | |
| Auditors remuneration - audit | 1,241 | 4,423 |
| - other services | 8,202 | 7,000 |
| Accomodation and meals | 56,694 | 24,783 |
| ACP cost | 173,260 | 49,709 |
| Bad debts | - | 12,992 |
| CEO security | 444 | - |
| Doubtful debts expense | 782,609 | - |
| Electricity | 12,556 | 9,208 |
| Fiji National Provident Fund contributions | 171,222 | 77,204 |
| General expenses | 115,443 | 95,941 |
| Hire of services | 88,897 | 88,972 |
| ICT consumables | 13,064 | 15,477 |
| ICT license | - | 2,283 |
| Insurance | 47,180 | 14,251 |
| Inventory write off | - | 1,311 |
| Legal fees | 3,250 | 1,250 |
| Medical expense | 548 | 2,149 |
| Media and publications | 2,392 | 2,255 |
| Freight | 50,005 | 31,873 |
| Postage | 2,339 | 978 |
| Rent | 5,987 | 40,991 |
| Repair and maintenance | 24,252 | 1,838 |
| Stationery | 25,039 | 5,233 |
| Staff expenses | 6,099 | - |
| Training | 5,818 | 3,915 |
| Training and Productivity Authority of Fiji | 9,650 | 9,074 |
| Travel | 34,951 | 427 |
| Tuition fees | 13,441 | - |
| OHS | 7,965 | - |
| Uniforms | 11,738 | - |
| Visa permit | - | 2,608 |
| Water | 808 | 1,309 |
| Wages and salaries (refer note 9 (b)) | 655,863 | 586,783 |
| | 2,330,957 | 1,094,237 |
| **(b) Personnel expenses** | | |
| Fiji National Provident Fund contributions | 95,123 | 77,204 |
| Training and Productivity Authority of Fiji | 9,650 | 9,074 |
| Key management compensation - short term benefits | 87,432 | 124,427 |
| Wages and salaries | 1,081,772 | 853,545 |
| Other staff related costs | 17,837 | - |
| | 1,291,814 | 1,064,250 |

**10. Income tax**

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

**Sugar Research Institute of Fiji**
**Notes to the financial statements**
**For the year ended 31 December 2015**

## 11. Property, plant and equipment

| | Land & Building | Fixtures & fittings | Plant & equipment | Motor vehicles | Computers | Work in progress | Total |
|---|---|---|---|---|---|---|---|
| | $ | $ | $ | $ | $ | $ | $ |
| **Cost** | | | | | | | |
| Balance at 1 January 2014 | 2,490,147 | 43,932 | 1,504,667 | 1,138,474 | 254,522 | 178,226 | 5,609,968 |
| Acquisitions | 140,759 | - | 320,674 | 65,435 | 56,923 | - | 583,791 |
| Transferred during the year | 178,226 | - | - | - | - | (178,226) | - |
| Balance as at 31 December 2014 | 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 during the year | - | - | (15,556) | - | - | - | (15,556) |
| Balance as at 31 December 2014 | 2,809,132 | 43,932 | 1,884,431 | 1,203,909 | 330,675 | 22,722 | 6,294,801 |
| | | | | | | | - |
| **Depreciation** | | | | | | | - |
| Balance at 1 January 2014 | 73,083 | 19,375 | 436,396 | 870,755 | 229,162 | - | 1,628,771 |
| Depreciation charge | 28,707 | 4,393 | 160,830 | 124,138 | 21,613 | - | 339,681 |
| Balance at 31 December 2014 | 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 2014 | 133,155 | 28,161 | 778,814 | 1,069,382 | 265,973 | - | 2,275,484 |
| **Carrying amount** | | | | | | | |
| At 1 January 2014 | 2,417,064 | 24,557 | 1,068,271 | 267,719 | 25,360 | 178,226 | 3,981,197 |
| At 31 December 2014 | 2,707,342 | 20,164 | 1,228,115 | 209,016 | 60,670 | - | 4,225,307 |
| At 31 December 2015 | 2,675,977 | 15,771 | 1,105,617 | 134,527 | 64,702 | 22,722 | 4,019,316 |

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| **12. Cash and cash equivalents** | | |
| Cash at bank | 4,000,885 | 2,674,097 |
| Cash on hand | 10 | 10 |
| Cash and cash equivalents in the statement of financial position | 4,000,895 | 2,674,107 |
| Bank overdraft | - | (16,836) |
| Cash and cash equivalents in the statement of cash flows | 4,000,895 | 2,657,271 |
| **13. Receivables and prepayments** | | |
| Staff loan | 20,658 | - |
| Prepayments | 133,696 | - |
| Deposits | 2,750 | 2,750 |
| | 157,104 | 2,750 |

**14. Deferred income**

The Institute's Deferred income comprises of the receipt of grant income from stakeholders, European Union, African Carribbean and Pacific Group of States, Mauritius Sugar Research Institute and Fiji Sugar Tribunal. Each grant received has its specific conditions that the Institute needs to comply with. The movement in Deferred income is as follows:

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| Balance at the beginning of the year | 10,083,526 | 7,840,186 |
| Funds received or receivable during the period | 4,366,973 | 4,978,090 |
| Utilised during the period | (4,001,959) | (2,734,750) |
| Balance at 31 December | 10,448,540 | 10,083,526 |
| This is comprised as follows: | | |
| Contribution from stakeholders | 4,598,172 | 4,174,540 |
| European Union grant | 4,425,346 | 4,943,375 |
| African Caribbean and Pacific Group of States (ACP) | 1,162,670 | 873,006 |
| Mauritius Sugar Research Instititue (MISRI) | 81,095 | 125,130 |
| Fiji Sugar Tribunal | 181,257 | - |
| | 10,448,540 | 10,116,051 |
| **15. Employee benefits** | | |
| Balance at 1 January | 45,933 | 45,933 |
| Provision during the year | - | - |
| Provision utilised during the year | - | - |
| Balance at 31 December | 45,933 | 45,933 |

## 16. Trade and other payables

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| Trade payables | 51,806 | 78,480 |
| Other payables | 54,175 | 66,908 |
| VAT payable | 541,323 | 281,073 |
| | 647,304 | 426,461 |

## 17. 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.

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

### (a) Board members

The Intitute did not have a Board present for the period 30 September 2012 to 4 May 2014. An interim board was appointed by the Ministry of Sugar on 4 May 2014 and the Board details were as follows:

Mr Abdul Khan (appointed on 4 May 2014)
Mr Manasa Tagicakibau (appointed on 4 May 2014)
Mr Sundresh Chetty (appointed on 4 May 2014)

The new Board was appointed on 1 March 2015. The Directors in office and up to the date of this report are:

Professor Rajesh Chandra - Chairman (appointed 1 March 2015)
Mr Abdul Khan (appointed on 1 March 2015)
Mr Daniel Elisha (appointed 1 March 2015)
Mr Manasa Tagicakibau (appointed on 1 March 2015 and resigned on 18 July 2017)
Professor Paras Nath (appointed 1 March 2015)
Mr Sundresh Chetty (appointed on 1 March 2015)
Dr K. Shanmudha Sundaram (appointed 1 March 2015)
Mr Graham Clark (appointed 18 July 2017)
Ms Reshmi Kumari (appointed 18 July 2017)

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| **(b) Amounts receivable from related parties** | | |
| Fiji Sugar Corporation | 3,424,999 | 4,124,999 |
| Sugar Cane Growers | 2,700,000 | 1,800,000 |
| Allowance for uncollectability - Sugar Cane Growers | (900,000) | - |
| | 5,224,999 | 5,924,999 |
| Reconciliation of allowance for uncollectability | | |
| Balance at the beginning of the month | - | - |
| Provision created during the year (VIP) | 900,000 | - |
| Balance at the end of the year | 900,000 | - |

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

**17. Related parties (continued)**

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| **(c) Amounts payable to related parties** | | |
| Fiji Sugar Corporation | 2,260,537 | 2,254,407 |
| | 2,260,537 | 2,254,407 |

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

**(d) Transactions with related parties**

| | | |
|---|---|---|
| Revenue | | |
| Grant income - Fiji Sugar Corporation | 782,609 | 782,609 |
| Grant income - Fiji Government | 782,609 | 815,135 |
| Grant income - Sugar Cane Growers | 782,609 | 782,609 |
| Estate income - Fiji Sugar Corporation | 224,412 | 226,279 |
| | 2,572,239 | 2,606,632 |
| Impairment loss | | |
| Sugar Cane Growers | 782,609 | - |

**(e) Key management personnel**

Key management personnel include the chief executive officer and finance and administration manager of the Institute.

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

Key management personnel compensation is comprised as below:

| | 2015 | 2014 |
|---|---|---|
| | $ | $ |
| Short-term employee benefits | 87,432 | 124,427 |

**18. Capital commitments and contingencies**

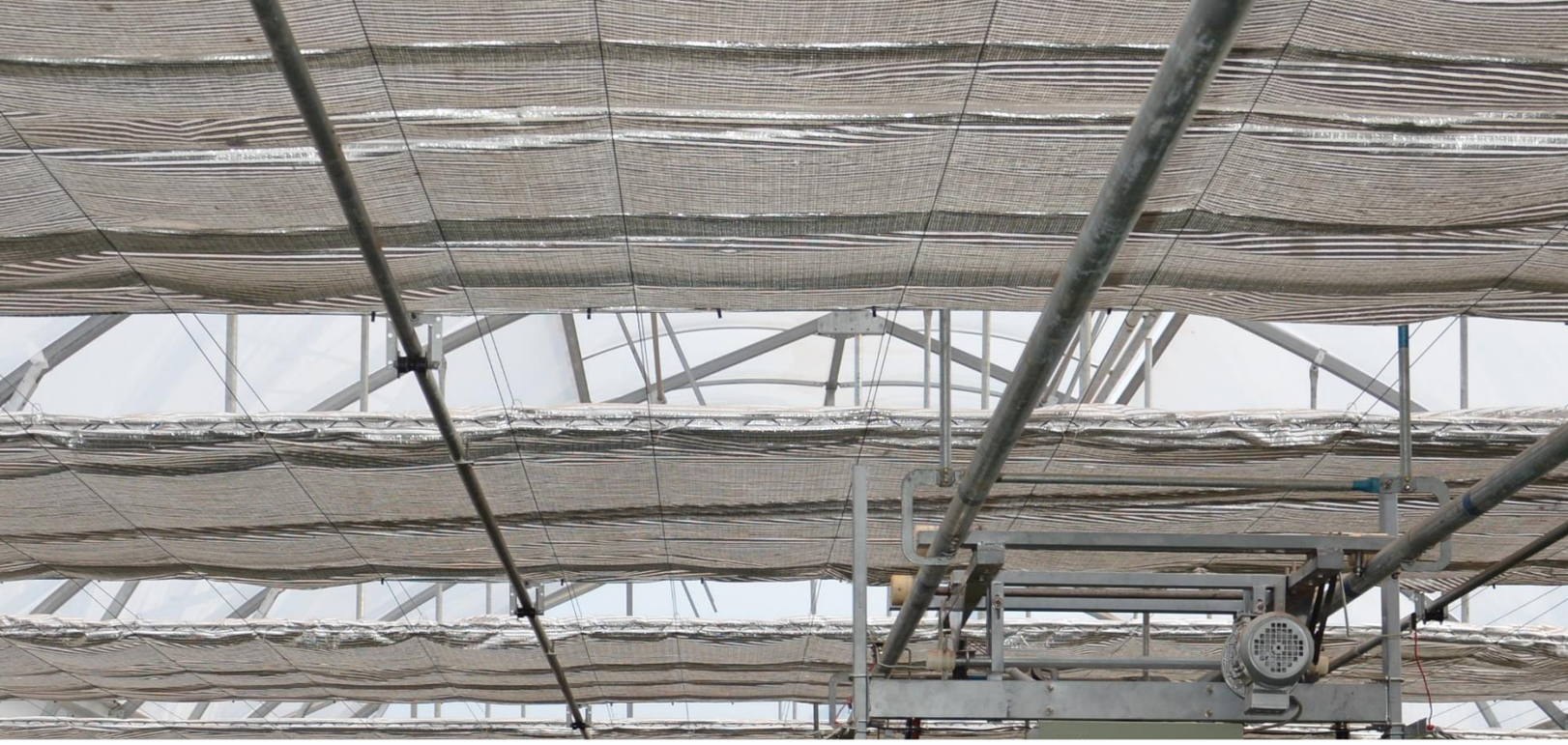
Capital commitments and contingent liabilities as at 31 December 2015 amounted to $Nil (2014: $Nil).

**19. Events subsequent to balance date**

There is a draft Sugar Industry Bill before the parliment that is proposing major changes in the functioning of Sugar Research Industry 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 Directors, 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.

DRONE VIEW OF SRIF HQ & DRASA SECTOR FARMS



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