Effects of Three Growth Regulators Induced Flowering on Yield and Quality of Ripley Queen Pineapple (*Ananas comosus)* in Fiji.

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OUTLINE

1. INTRODUCTION
2. LITERATURE BACKGROUND
3. METHODOLOGY
4. RESULTS AND DISCUSSION
5. RECOMMENDATION AND CONCLUSION

INTRODUCTION

HISTORY

1920s

- Pineapple was an industry in Fiji dated back to the 1920s through the Colonial Sugar Refinery (CSR).
- Other big players at the time were the Hawaiian Pineapple Company and West Coast Pines Ltd who set up cannery at Dreketi, Macuata and at Votualevu, Nadi respectively.

1990

- Early 1990s - another attempt to revive this ancient industry. EU funded the project on fresh export to NZ.

Todate

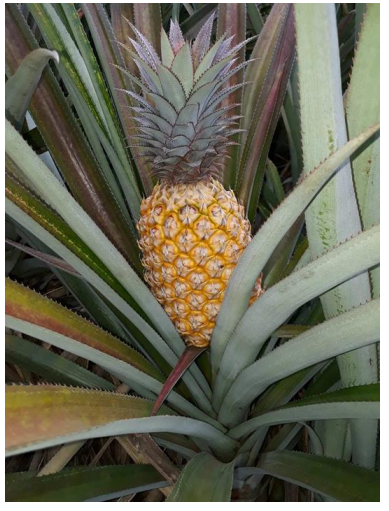
- Lately, the Pineapple Export pathway was developed through the Pacific Horticultural and Agricultural Market Access Project for the fresh export market to New Zealand with suppliers such as Turners and Growers.
- Agricultural Census (2009), 915 farmers producing 2,800 tonnes of pineapples annually under 1,100 acres. Pineapples are overwhelmingly sold on the local fresh fruit market for a value to farmers of about $2.4 million.
- There is huge demand locally compared to overseas market, resulted in NO export for the past 2-3 years.
- Furthermore, The Fruit processing company (AGRANA Fruits Ltd) is also processing pineapple juice.

INTRODUCTION

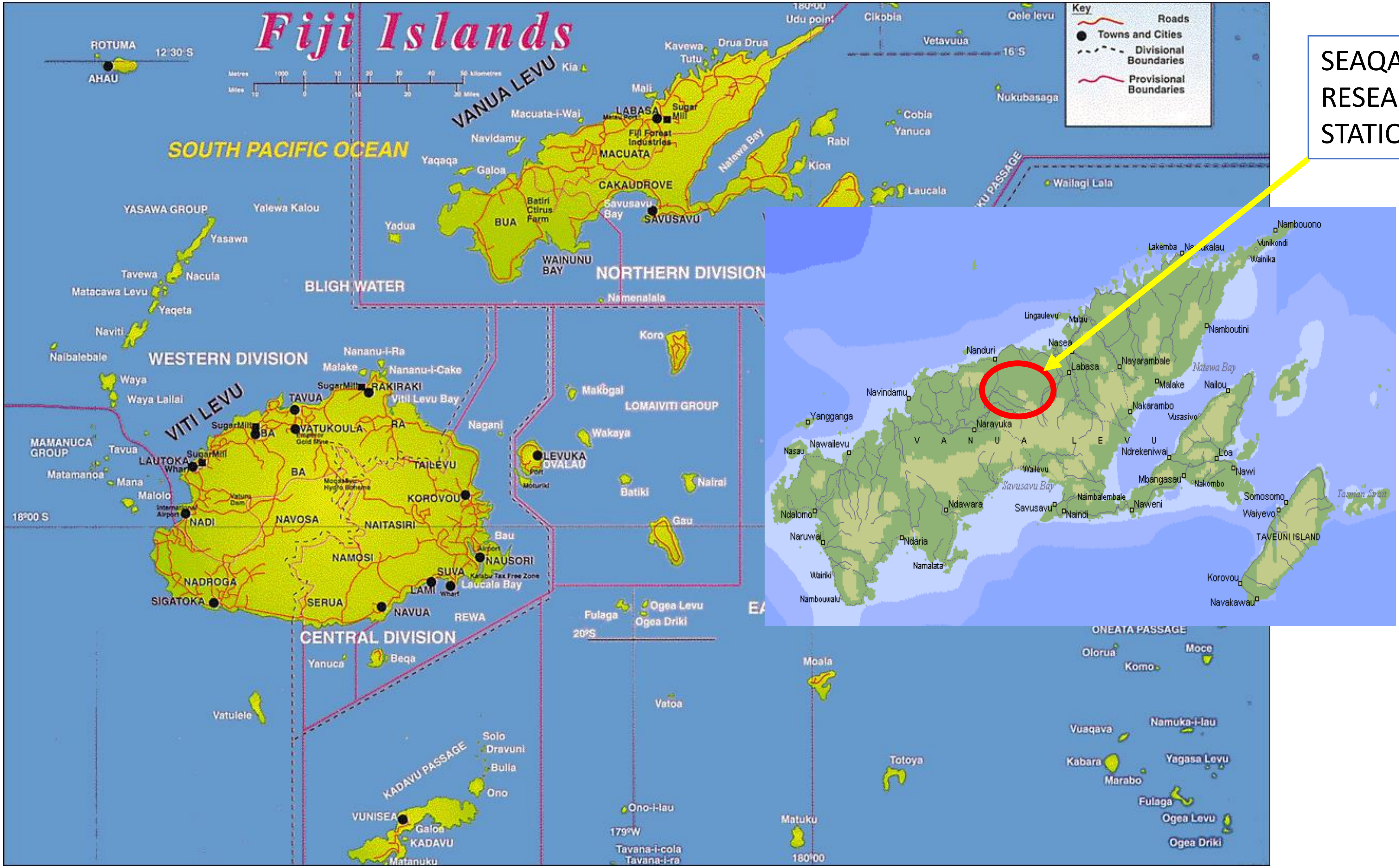
- PINEAPPLE CONTRIBUTION: CANNOT BE OVEREMPHASISED
  - Food and nutrition security
  - Income security
  - Contribution to Climate Change Combat Strategies – SLM, Drought tolerance crop, Cropping system, etc.
- Big Challenge - The market pull coupled with the seasonality of the crop.
- Solution: To produce the fruit all year round using Growth Regulators (GR).
- GR Availability - Currently, we have 3 Brand name of GR (Ethephon (48% 2-chloroethylphosphonic acid), Floraset (4% 1-naphthalene acetic acid) and EPGR 108 (10.8% 2-chloroethylphosphonic acid) in the market.

Research

- Ripley queen variety is the widely cultivated pineapple variety in Fiji.
- The research aims to evaluate the efficacy of these 3 Growth Regulator chemicals in the production of “Ripley Queen” pineapple and recommend the most efficient and affordable GR.
- The experiment was carried out at Seaqaqa Research Station in Vanua levu.



SEAQAQA RESEARCH STATION



LITERATURE REVIEW

1. **Ethephon (48% 2-chloroethylphosphonic acid)**

Ethylene, a gaseous plant hormone, is responsible for the initiation of reproductive development in pineapple. Reproductive development can be forced in pineapple (Ananas comosus var. comosus) throughout the year with ethylene (Maruthasalam, et. al, 2009).

Van Santen 2017 states that **2 Chloroethylphosphonic acids or Etyphon**, available as “Ethrel”, “Ethephon”, or “EPGR 10”. This is a world-wide used chemical for the harvest control in pineapple.

This chemical is used in combination with Urea-, and in some cases Boron -fertilizer.
It is thought to have a positive effect on the success of flower initiation, especially where a deficiency of this micro nutrient (B) can be expected and pH of mixture is rather low. This chemical and the fertilizers are mixed in water and sprayed in the direction of the heart the plants at a rate of approx. 35 to 50 ml per plant. Spray is preferably done in the afternoon, when the day cools off and the dark evening effect will follow.

LITERATURE REVIEW

2. Alpha-Naphtaline Acetic Acid or ANA

- Available direct under the name a.n.a or under a range of trade names eg. Floraset (4% 1-naphthalene acetic acid) (recommended as rooting media as well as flowering hormone. However this chemical is an auxin and is less effective in flower induction than the above mentioned ethephon, with fruiting rates varying over an unacceptable range between 30% to 70% effectiveness, which is too low and unreliable for commercial production.It will be better effective in the higher latitudes and used towards the shorter day periods. As a rooting hormone this chemical can be useful, and in the climates with distinct short days in the seasonal periods of the year it might work a bit more effective in the short-day periods just before the natural season (Van Santen, 2017).
- Danso et. Al, 2008, states that NAA is used in invitro production of pineapple plantlets. The transfer of one or two-month old cultured plantlets to solid MS medium supplemented with NAA or IBA alone or combination of NAA and IBA resulted in root production. The number of root produced per plantlet on a medium supplemented with a combination of NAA and IBA was comparably higher than when NAA or IBA alone were used.

METHODOLOGY

	ACTIVITIES	TIME
1	SOIL	pH – 5.6; EC – 0.06; N% - 0.2; Olsen P – 1.0mg/kg; K - 0.20 me/100g
2	WEATHER	Temp – 18.9 - 29.1; Rainfall - 17.5mm; Rainfall days – 4; Humidity - 71
3	CROP	Pineapple – “Ripley queen” (Planting material – Plantlets (350 - 400g)
4	DESIGN	RCBD (FACTORIAL)
5	TREATMENTS	GR – 3 WITH 4 LEVELS (Ethphon & Floraset - 5ml/; 10ml; 15ml/10L/water); EPGR108 (30ml, 35ml, 40ml/10L water) Mixture – Chemical + 10g Borax + 50g Urea + 10L water; 50ml/plant
6	REPLICATION	3
7	DATE OF PLANTING	JUNE 2014
8	MAINTENANCE	BASAL – Mill Mud 5tonnes/ha, **Super phosphate:** 250kg. SIDE DRESS: **Urea:** 110kg/ha at 1 month after planting. **NPK:** 13:13:21 at 250kg/ha at 4 months interval after planting. Weed Control: As and When required
9	GR APPLICATION	JUNE 2015 when D-leaf (Longest leaf) is 90-100cm; at 5-6pm
10	DATA VARIABLES	Date of fruit initiation; Date of harvest; Total fruit weight (Fruit & crown weight); Total Fruit length (Fruit & crown), Circumference; Brix using Refractometer.
11	HARVESTING	When the fruit is 85-90% ripeness

RESULTS - ANOVA

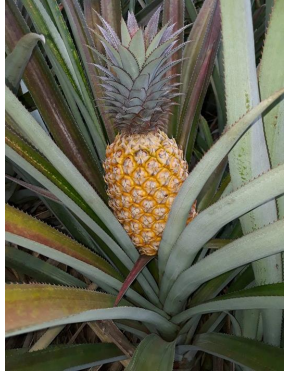
ANALYSIS OF VARIANCE SUMMARY TABLE

F-PROBABLIITY VALUES FOR EACH EFFECT IN THE MODEL.

VARIATE	GRAND MEAN (N= 36)		STANDARD DEVIATION	C OF V SD/MEAN %	HORMONE$	REP	TRT$
	NO. OBS.		BASED ON TOTAL SS	BASED ON RESID SS				
DTH	36	159.14	9.7926	8.6569	5.4	0.2983	0.0078	0.4659
NOF	36	15.000	0.00000	0.00000	0.0	1.0000	1.0000	1.0000
TFW	36	1075.1	101.49	97.821	9.1	0.3942	0.6830	0.0961
FW	36	918.36	97.816	98.142	10.7	0.8446	0.5859	0.1740
CW	36	159.17	23.624	17.313	10.9	0.0024	0.0035	0.0672
TFL	36	35.086	1.5800	1.0449	3.0	0.0454	0.0000	0.0312
FL	36	14.541	0.88228	0.93834	6.5	0.8662	0.5749	0.6876
CL	36	20.498	1.6543	1.2981	6.3	0.1666	0.0005	0.2354
CM	36	34.381	0.85177	0.68218	2.0	0.0506	0.1164	0.0061
BRIX	36	16.418	0.74558	0.71492	4.4	0.4519	0.3969	0.1132

THERE IS SIGNIFICANCE DIFFERENCE IN THE FOLLOWING:

CW – CROWN WEIGHT
TFL – TOTAL FRUIT LENGTH
CM – FRUIT CIRCUMFERENCE



TRT$	NOS	DTH	NOF	TFW	FW
Control	9	161.889	15.0000	1009.63	864.888
Level-A	9	155.556	15.0000	1115.62	932.526
Level-B	9	160.333	15.0000	1111.56	968.496
Level-C	9	158.778	15.0000	1063.64	907.519
SE(N= 9)		2.88564	0.000000	32.6069	32.7139
5%LSD 28DF		8.35906	0.000000	94.4550	94.7649

TRT$	NOS	CW	TFL	FL	CL
Control	9	146.222	34.1322	14.3259	19.7185
Level-A	9	168.578	35.4963	14.6519	20.8370
Level-B	9	162.068	35.4279	14.7972	20.6085
Level-C	9	159.825	35.2889	14.3889	20.8259
SE(N= 9)		5.77084	0.348315	0.312778	0.432694
5%LSD 28DF		16.7168	1.00899	0.906049	1.25342

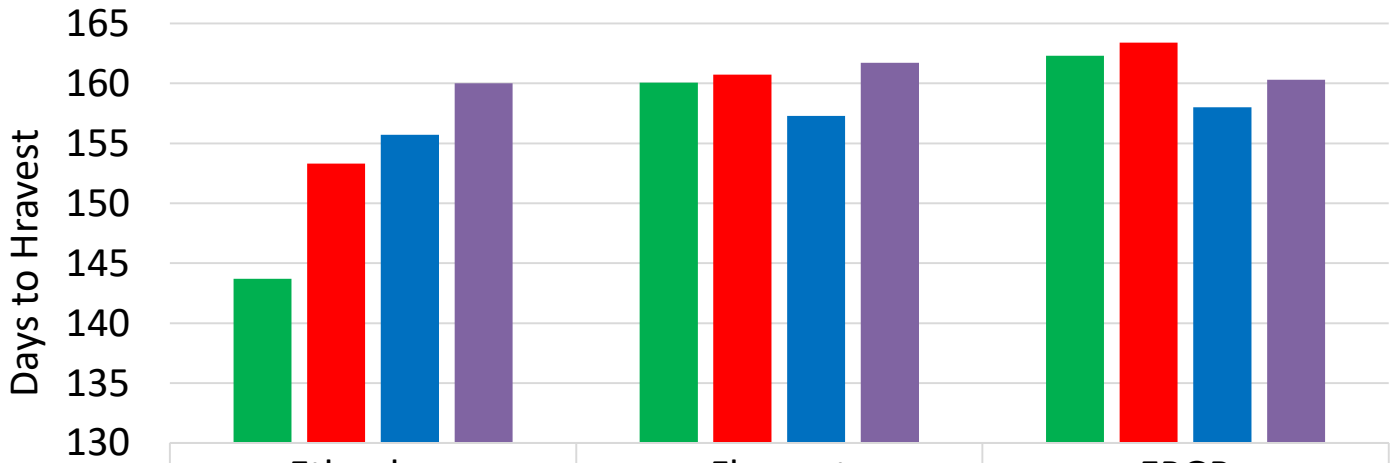
TRT$	NOS	CM	BRIX
Control	9	33.6670	16.8285
Level-A	9	34.6519	16.5844
Level-B	9	34.8399	16.0718
Level-C	9	34.3640	16.1883
SE(N= 9)		0.227393	0.238306
5%LSD 28DF		0.658706	0.690320

HORMONE$	NOS	DTH	NOF	TFW	FW
Ethaphone	12	156.000	15.0000	1056.00	911.672
Floraset	12	160.000	15.0000	1062.36	911.511
EPGR 108	12	161.417	15.0000	1106.99	931.889
SE(N= 12)		2.49904	0.000000	28.2384	28.3311
5%LSD 28DF		7.23916	0.000000	81.8004	82.0688

HORMONE$	NOS	CW	TFL	FL	CL
Ethaphone	12	151.222	34.4492	14.4250	19.9083
Floraset	12	151.198	35.3154	14.5756	20.7120
EPGR 108	12	175.100	35.4944	14.6222	20.8722
SE(N= 12)		4.99770	0.301650	0.270874	0.374724
5%LSD 28DF		14.4772	0.873812	0.784661	1.08549

HORMONE$	NOS	CM	BRIX
Ethaphone	12	34.4392	16.5081
Floraset	12	33.9974	16.2028
EPGR 108	12	34.7056	16.5439
SE(N= 12)		0.196928	0.206379
5%LSD 28DF		0.570456	0.597835

TIME TAKEN FROM APPLICATION OF TREATMENT TO HARVEST

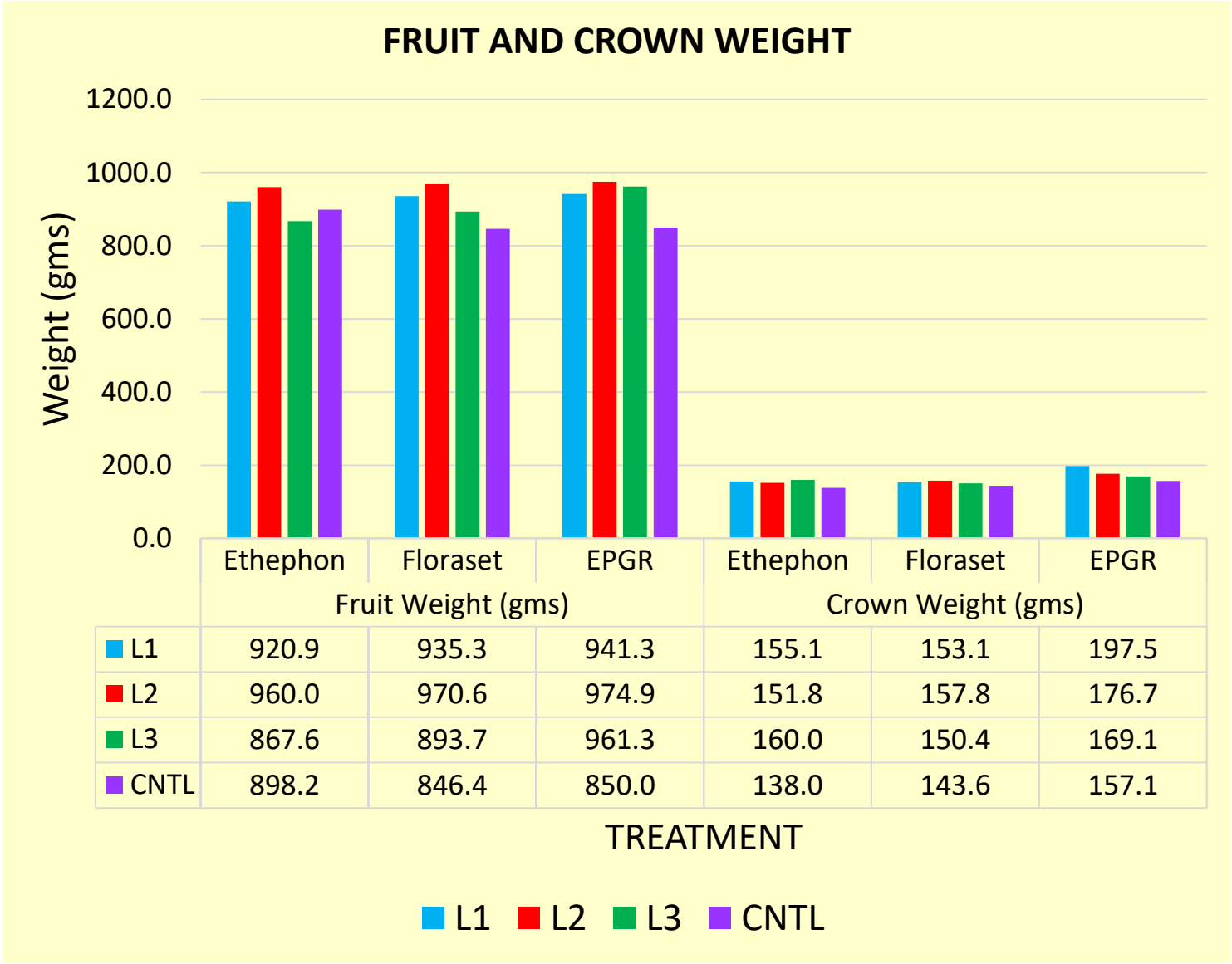


	Ethephon	Floraset	EPGR
L1	143.7	160.1	162.3
L2	153.3	160.7	163.4
L3	155.7	157.27	158
CNTL	160	161.7	160.3

TRT$	NOS	DTH
Control	9	161.889
Level-A	9	155.556
Level-B	9	160.333
Level-C	9	158.778
SE(N= 9)		2.88564
5%LSD 28DF		8.35906

THE RESULT SHOWS THAT THE TREATMENTS HAVE SOME EFFECTS ON THE TIME TAKEN FROM APPLICATION TO HARVEST i.e. SHORTER DURATION FOR ETHEPHON AND FLORASET.

FRUIT AND CROWN WEIGHT

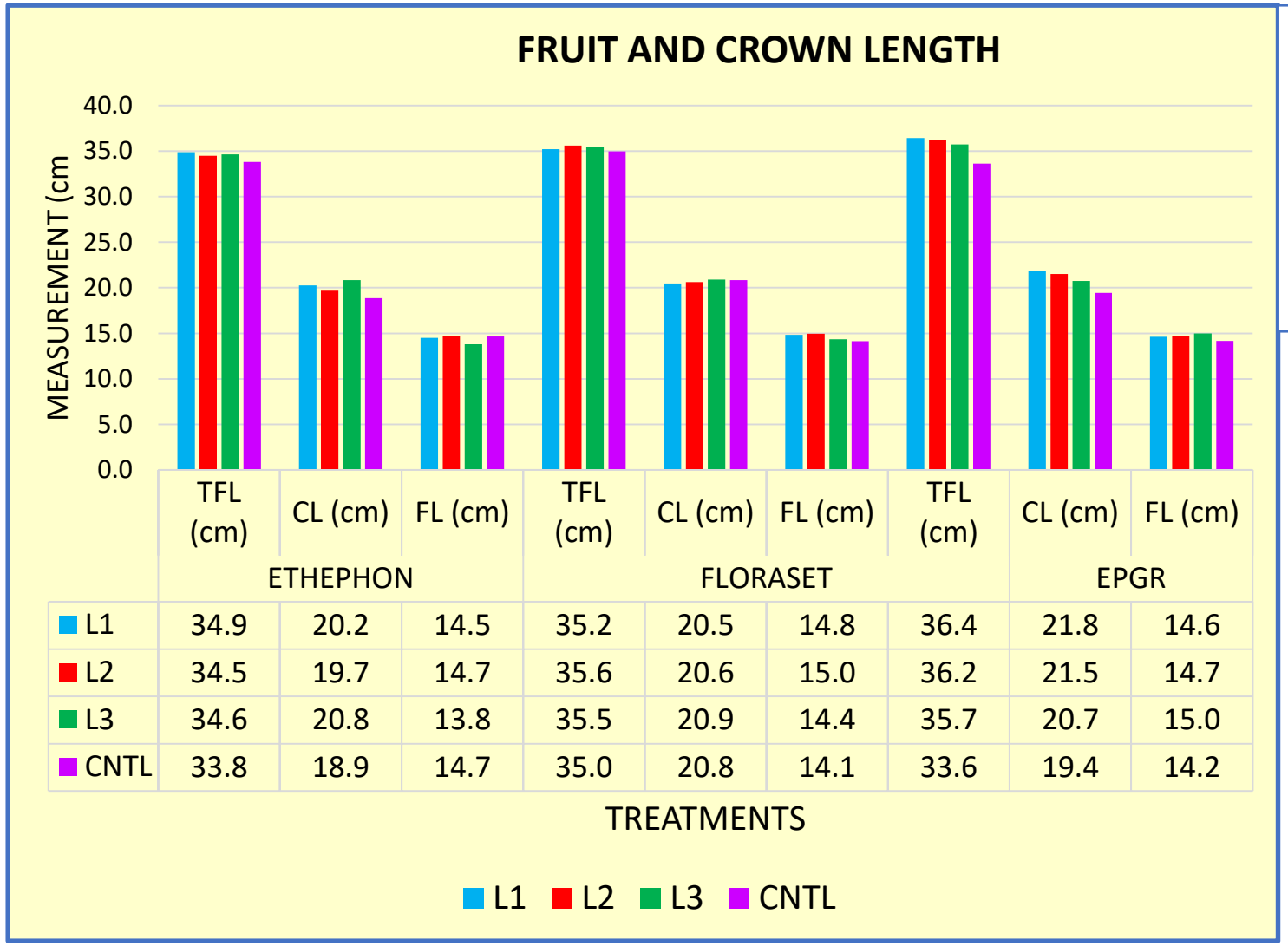


HORMONE	NOS	TFW	FW	CW
Ethaphon	12	1056.00	911.672	151.222
Floraset	12	1062.36	911.511	151.198
EPGR 108	12	1106.99	931.889	175.100
SE(N= 12)		28.2384	28.3311	4.99770
5%LSD 28DF		81.8004	82.0688	14.4772

GR	Ethephon		Floraset		EPGR108	
TRT	TFW (gms)	% Crown weight	TFW (gms)	% Crown weight	TFW (gms)	% Crown weight
L1	1119.6	14.0	1088.4	14.5	1138.8	17.6
L2	1056.2	14.4	1127.0	13.3	1151.6	15.5
L3	1016.4	15.8	1044.0	13.7	1130.4	15.2
CNTL	1031.8	13.4	990.0	14.1	1007.1	15.6

FLORASET - L2 HAS A LOWER CROWN WEIGHT COMPARED WITH THE CONTROL.

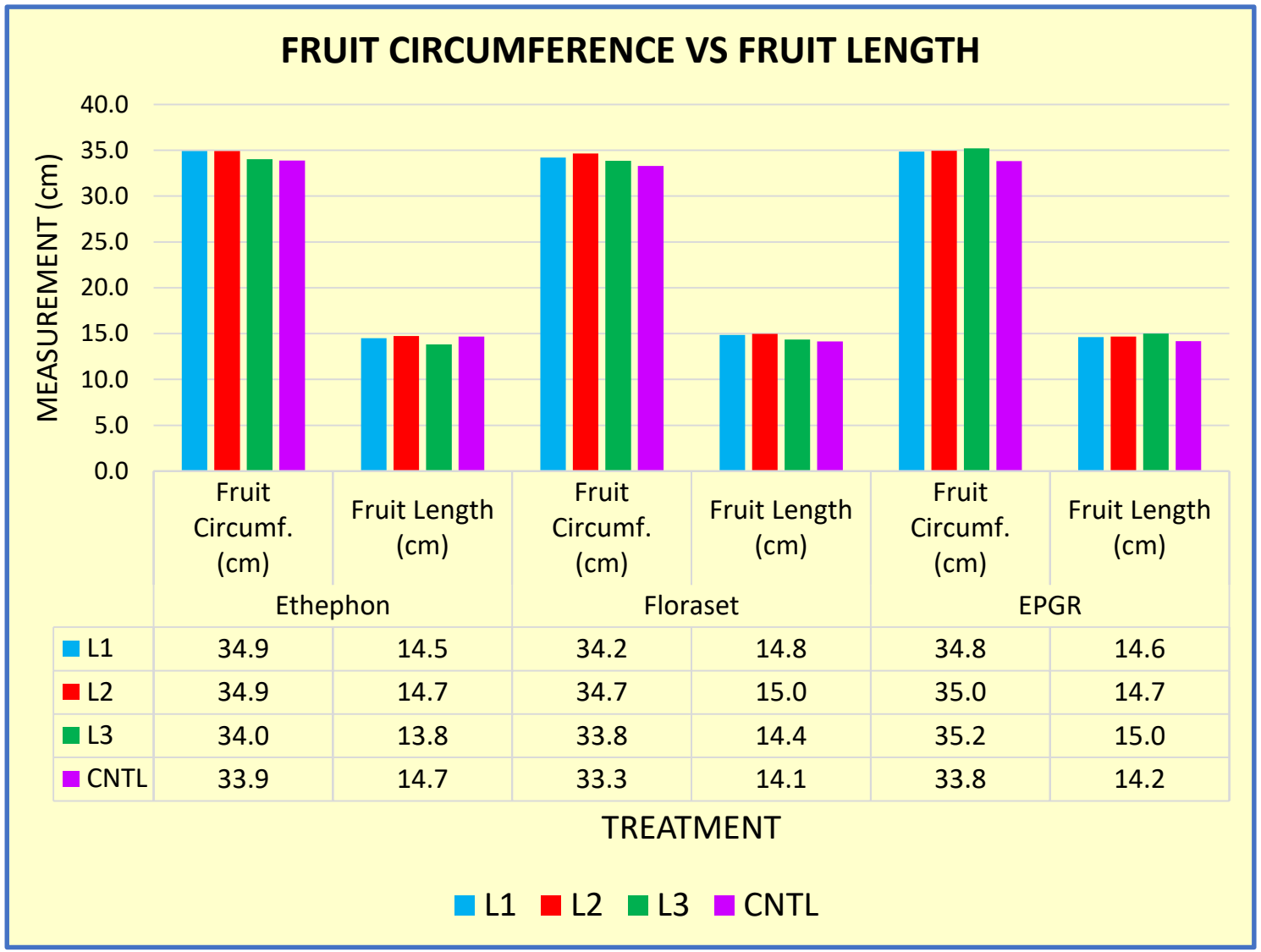
CROWN AND FRUIT LENGTH



TRT$	NOS	TFL	FL	CL
Control	9	34.1322	14.3259	19.7185
Level-A	9	35.4963	14.6519	20.8370
Level-B	9	35.4279	14.7972	20.6085
Level-C	9	35.2889	14.3889	20.8259
SE(N= 9)		0.348315	0.312778	0.432694
5%LSD 28DF		1.00899	0.906049	1.25342

THERE IS A SIGNIFICANT DIFFERENCE IN THE TOTAL FRUIT LENGTH BETWEEN THE TREATMENTS AND THE CONTROL.

FRUIT CIRCUMFERENCE VS FRUIT LENGTH



TRT$	NOS	CM	FL
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Level-A	9	34.6519	14.6519
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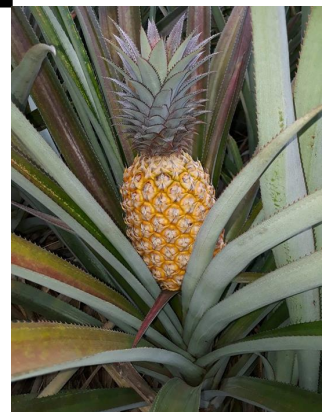
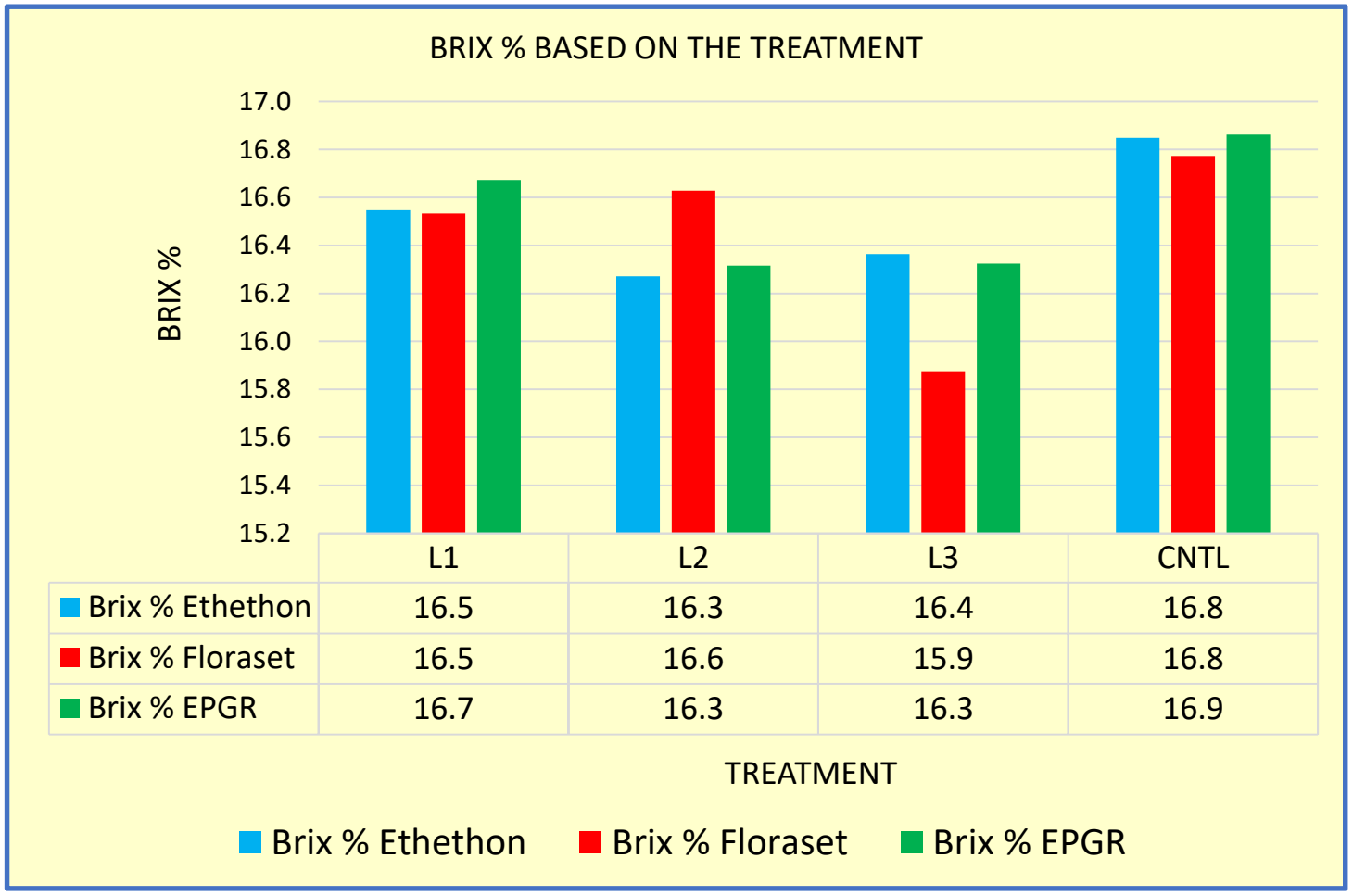
Level-C	9	34.3640	14.3889
SE(N= 9)		0.227393	0.312778
5%LSD 28DF		0.658706	0.906049

THE TREATMENTS ARE SHOWING SOME EFFECTS ON THE FRUIT LENGTH AND CIRCUMFERENCE COMPARED TO THE CONTROL, ESPECIALLY FOR FLORASET AND EPR108.

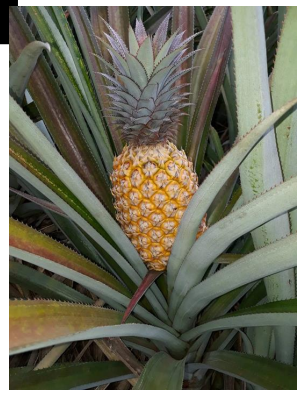


SWEETNESS OF THE FRUIT



TRT$	NOS	BRIX
Control	9	16.8285
Level-A	9	16.5844
Level-B	9	16.0718
Level-C	9	16.1883
SE(N= 9)		0.238306
5%LSD 28DF		0.690320

THE TREATMENTS DO NOT HAVE ANY EFFECT ON THE SWEETNESS ON THE PINEAPPLE FRUIT.



RECOMMENDATION & CONCLUSION

1. Results have proved that the 3 GRs induces flowering and better yield in RQ variety.
2. EPGR108 and Ethephon produces promising results in terms of no. days taken from GR application to harvest.
3. Floraset (a rooting GR) - proved to produce good results in terms of flower induction and yield.
4. Prospectus:
    1. Experiment to include the other two varieties, Smooth cayenne and Veimama.
    2. Evaluation of the GRs on ratoon crops (1 & 2)
    3. Experiment to incorporate with monthly planting of pineapple to determine the most appropriate period (month) for off-season production.
    4. GRs to be tested on alluvial soil type and in intermediate climatic zone.
    5. Experiment to further into post-harvest - shelf life & fruit quality
    6. Need to conduct residual test on the MRL of the chemical
    7. Conduct economic analysis of the treatments based on the production life of the crop.

VINAKA VAKALEVU

THANK YOU