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18/01/2000

**FINAL REPORT 1999**

**FC/RAF/96/001 PRODUCT AND DEVELOPMENT OF SISAL AND  
HENEQUEN  
UTILIZATION OF BOLE AND BOGAS AS ANIMAL FEED CONTRACT  
NO. 97/100**

**1.0 OBJECTIVE**

To develop viable animal feed rations using boles fresh and ensiled bogas to test the effectiveness of feeding dairy and beef cattle goats and sheep.

**2.0 INTRODUCTION**

Kilifi Plantations Limited was started in 1923 as a Sisal Estate. In 1993 dairy cattle and few beef were introduced as a diversification from the sisal mono culture crop. The estate is situated 60 kilometres North of Mombasa on both sides of the main Mombasa - Malindi Road. Total hectares is 2023 (5,000 acres): 324 ha on sisal and rest of the land carries 2,700 head of cattle. Most of the soil is sandy loam and sandy clays. Rainfall is bimodal: falling between April and June (Long rains) and October and December for short rains. Mean yearly rainfall is 1,150mm. The lowest mean monthly, temperature is in June at 25°C. The highest as at 34°C in March. There are a total of 550 personnel at the estate; including 20 senior and middle managers.

**3.0 Summary of Work Completed**

As communicated in our Interim and Draft Final Reports.

- 3.1) All buildings completed and commissioned
- 3.2) All machinery completed and commissioned
- 3.3) All animals obtained and feeding trials commenced.

#### Feeding Trial Start Dates

3.4	1)	Beef Animals	29/9/99
3.5	2)	Goats	29/9/99
3.6	3)	Dairy Animals	30/10/99

The above start dates were delayed from the original Project Targets due to modifications necessary to the Bogas producing machinery.

3.7	4)	Sheep	11/12/99
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This trial start date was delayed due to a Foot and Mouth quarantine in the area that the sheep were being kept.

#### 4.0 Trial Data

##### 4.1) BEEF ANIMALS

Total: 30 animals, split into three groups and each group containing 3 genotypes.

The three Groups were fed on:

- 4.1.1) Fresh Bogas                      Symbol F
- 4.1.2) Ensiled Bogas                      Symbol E
- 4.1.3) Grass                                      Symbol C

The genotypes in this group consisted of:

- 1) Friesian which means predominantly Friesian Blood
- 2) Sahiwal which means predominantly Sahiwal
- 3) Cross which means 33% Friesian, 33% Brown Swiss and 33% Sahiwal

The diet of each group is attached in Appendix 1

#### 4.1.2 General Observations

All animals adapted well to both the change in environment and diet, with very few health or nutrition problems.

#### 4.1.3 Weight Data

Each Group consists of 10 animals

##### 4.1.3.1 CONTROL (FED ON GRASS)

##### Weights in Kgs

	29/9/99	9/11/99	9/12/99	Difference	Gain/Day/Kgs
Friesian	88.7	109	121	+32.3	+ 0.46
Sahiwal	80.0	103.7	130	+ 50	+0.70
Cross	81.3	111	135.6	+54.3	+ 0.77

##### 4.1.3.3 FRESH BOGAS (FED ON FRESH BOGAS)

	29/9/99	9/11/99	9/12/99	Difference	Gain/Day/Kgs
F	89	118.7	135	+46	0.65
S	87.7	124	140	+ 52.3	0.74
C	84.7	114	135.6	50.9	+0.72

##### 4.1.3.3 ENSILED BOGAS (FED ON ENSILED BOGAS)

	29/9/99	9/11/99	9/12/99	Difference	Gain/Kgs
F	96.3	112.3	120.3	+24	+ 0.33
S	85.3	105.0	128.6	+43.3	+ 0.61
C	90.0	107.7	118.6	+ 28.6	+ 0.40

## 4.2. GOATS

4.2.1. The goats have had considerable problems with the original diet and we lost a total of 8 animals while adjusting the diet to suit them and during their acclimatisation to the new environment. The first major cause was an acidosis which was a result of too-high concentrate intake and not enough fibre. This was tackled by making the ration into a totally mixed one (TMR). There then followed a period where some goats refused to eat this TMR. They died of starvation.

We requested the KARI nutritionist Dr. R. Muinga to come and give us advice on this matter and her proposal (Letter appended) was to put all animals back onto full grass diet and then after two weeks of rumen stabilisation they were reintroduced to a 50/50 Bogas/Grass diet.

This diet has resulted in improved health of the goats and no more fatalities have occurred among the goats since then.

The Diets for the trials are included in Appendix 2

The post-mortems are included in Appendix 3

There were 14 goats in each group at the start, all of the same genotype.

There are after 8 deaths

11 animals in the Fresh Bogas Trial

11 animals in the Ensiled Bogas Trial

12 animals in the Control (Grass) Trial

**4.2.2.1 Control (Fed on Grass)**

12 Animals remaining in the Group

**4.2.2.2 Fresh (Fed on Fresh Sisal Bogas**

11 Animals in the Group

**4.2.2.3 Ensiled (Fed on Ensiled Bogas**

11 Animals in the Group

The weights are totaled for each group and the differences and gains are done in grams.

	29/9/99	9/11/99	9/12/99	Difference	Gain/Day/Animal
Control	199	213	182	-17 Kgs	- 22 gms
Fresh	245	225	185.5	-19.5 Kgs	- 25 gms
Ensiled	227	225	189.51	-22.5 Kgs	-29 gms

It must be said here that even the Control Group fed on grass has lost weight, so while the Bogas groups had greater losses, it can be deduced that goats are not suited to the type of Trial and as indicated in the Draft Final Report trial, we recommend that this part be terminated.

**4.3. SHEEP**

4.3.1. The trial started on 9/12/99 after the delay caused due to a Foot and Mouth quarantine.

The total number of sheep which started the experiment was 42. However the sheep experienced exactly the same problems as the goats due to poor adaptation to the new environment and poor reaction to the diet.

We lost 5 animals in rapid succession. One due to asphyxiation, (strangled by restraining rope) and the rest due to acidosis.

Please see the post-mortem reports done by the Veterinarian. Appendix 4

Using the experience gained in the goat trial it was decided to change the diet immediately.

Another contributing factor was that the sheep were not accustomed to such large quantities of concentrates. We therefore changed the diet to allow for this.

Please see amended diet Appendix 5.1 and also the letter dated 5/1/00 from the Veterinarian. Appendix 5.2.

### **4.3 Weight Tables**

4.3.1 42 animals started the Trial 14 in each group.

There are remaining

11 in the Control Group (Grass Fed)

13 in the Fresh Bogas Group

13 in the Ensiled Bogas Group.

These are only one genotype of Sheep.

4.3.2.

	9/12/99	2/1/00	Difference	Gain/Day/Animal
Control	277.0	252.5	24.5	- 9.4 gms
Fresh Bogas	272.2	271.0	-1.5	- 4 gms
Ensiled	266.0	264.5	- 1.5	- 4 gms

From the first months data of this experiment, it appears that sheep are also temperamentally unsuited to this experiment and it may be advisable to curtail this section.

However, before this is done, we intend to return gradually to the fully recommended diet following the recommendations of the Veterinarian i.e. gradually

However, before this is done, we intend to return gradually to the fully recommended diet following the recommendations of the Veterinarian i.e. gradually increase the concentrates at a rate which allows the microorganisms in the sheep rumen to acclimatise.

When this has been done and the sheep have been fed on this diet for a month it will be possible to better assess the advisability of continuing with the Sheep Trial.

#### **4.4. DAIRY CATTLE**

4.4.1. As stated in the Draft Final Report, the cows adjusted well to the new diets although the rapid drop-off in production necessitated a re-organisation of the animals and a change in the diet. Following Dr. Muinga's recommendations all animals were fed grass for two weeks and then reorganised into three groups, graded within the groups by production.

The selection procedure was to choose:

- 1) The genotypes
- 2) To grade the genotypes by production
- 3) To allocate the highest producers in each genotypical group in rotation to each of the three Trial Groups e.g.
  - i) Highest Friesian Producer to Control (Grass) Group  
2nd Highest Friesian producer to Fresh Bogas Group  
3rd Highest Friesian producer to Ensiled Bogas Group
  - ii) Highest Sahiwal Producer to Fresh Bogas Group  
2nd Highest Sahiwal producer to Ensiled Bogas Group  
3rd Highest Sahiwal producer to Control (Grass) Group.
  - iii) Highest Cross Producer to Ensiled Bogas Group  
2nd Highest Cross Producer to Control (Grass) Group  
3rd Highest Cross Producer to Fresh Bogas Group.

This allocation continued until all animals were allocated to their respective groups.

There were a total of 36 animals in the Trial - 12 in each group.



Animals have been withdrawn due to health reasons specifically mastitis.

This has left animals split as follows:

10 Animals Control (Grass) Group

11 Animals Fresh Bogas Group

11 Animals Ensiled Bogas Group

#### **4.4.2. Production Statistics**

##### **4.4.2.1 Litres/Day**

	29/9/99	9/11/99	9/12/99	Difference
Control	11.96	10.33	10.38	- 1.6 Litres/Day
Fresh	13.3	8.5	10.1	- 3.2 Litres/Day
Ensiled	10.6	8.7	9.0	-1.6 Litres/Day

Please note here that the presentation format has been changed here from the Draft Final Report due to the reorganisation of the animals and the change in diet formulation.

Whilst the production figures show a decline, it should be noted that even the Control group declined and statistical analysis based on lactation length will give a more realistic comparison.

Appendix 6 shows all the individual daily production records.

Appendix 7.1 and 7.2 show the two diets used

#### **4.4.3. General Observations Dairy Animals**

As stated in the Draft Final Report, and also by Dr. Muinga we recommend that the Dairy feeding Trials only go through one lactation( one breeding cycle) due to the

problems that have occurred in getting the animals pregnant again. We have been unable to detect any heat signs and thus have not done any inseminations.

This means that these animals are already very late in getting pregnant and it is unlikely that they will be got in-calf until they are returned to their normal environment which will be after drying off.

It is estimated that the breeding cycle will then approach 600 days as opposed to the normal 400 days. We await further advice on this matter.

#### **4.4.4. Veterinarian Drug Costs**

Due to the unforeseen reaction of the goats and sheep to the diet and to the new environment we have incurred very high vet bills.

#### **4.4.4.0. COMMON FUND COMMODITY DRUG COSTS**

##### **4.4.4.1. OCTOBER 1999**

<b>Drug Brand Name</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Usage</b>	<b>Total Amount</b>
Super flexi Syringes	1 x 10 ml	350.00	1	350.00
Microscope Slides	1 x 72 pieces	475.00	1	475.00
Milking Salve	1 x 2 kg	197.50	1	197.50
Ectopor	1 x 0.5 Litres	990.00	5	4950.00
Colvasone	1 x 50 mls	280.00	1	280.00
Wound Spray	1 x 20 mls	253.00	1	253.00
Amoxwet	9 tablets	155.25	1	155.25
Albensole	1 x 1000 mls	1735.00	1	1735.00
Surgical gloves	1 Pair	13.00	1	13.00
Merikano	1 metre	75.00	2	<u>150.00</u>
				<b><u>8558.75</u></b>

4.4.4.2. NOVEMBER 1999

Drug Brand Name	Quantity	Unit Price	Usage	Total Amount
Milking Salve	1 x 2 kg	395.00	2	395.00
Dipal Concentrate	1 x 10 Lts	4480.00	4	1798.00
Ectopor	1 x 0.5 Lts	990.00	4	3960.00
Bayticol	1 x 1 Lts	2600.00	4	10,400.00
Agent	1 x 100 mls	620.00	2	1240.00
Oligovit	1 x 100 mls	232.00	2	464.00
Albenzole	1 x 1 Lts	1735.00	1	1735.00
Terrexine tubes	1 x 24	83.00	2	3984.00
Multipurpose	1 x 20 Lts	779.60	10	389.80
Merikano	1 x 1 metre	75.00	1	150.00
Disposal Syringes	1 x 20 mls	20.00	5	100.00
Disposal needles	1 x 18g	6.50	5	32.50
Total				24,642.30

4.4.4.3. DECEMBER 1999

<b>Drug Brand</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Usage</b>	<b>Total Amount</b>
Milking Salve	1 x 2 kgs	395.00	2	395.00
Dipal Concentrate	1 x 10 Lts	448.00	3	1344.00
Bayticol	1 x 1 Lts	2600.00	2	5200.00
Wound Spray	1 x 140 g	253.00	1	253.00
Albenzole 10%	1 x 1 Lt	1735.00	2	3470.00
Ectopor	1 x 0.5 Lt	990.00	4	3960.00
Multipurpose	1 x 20 Lts	779.00	7	272.86
Merikano Cloth	Metre	75.00	4	300.00
Disposal Syringes	1 x 20 ml	20.00	8	160.00
<b>Total</b>				<b>15354.86</b>

#### 4.4.4.4 THESE COSTS WERE NOT BUDGETED FOR

### 5.0 BOGAS MACHINERY

All this machinery is now fully operational.

Various running repairs and alterations have been done.

Dr Mutuli has unfortunately not contacted us again with his recommendations or a drawing.

We will continue to push him.

In the meantime we will continue to make the appropriate and necessary improvements.

### 6.0 Miscellaneous

6.1 Mrs R. Viegas - Assumpcao visited the project in December for inspection and consultation.

6.2 Mr. J. Tipape accompanied Mrs. Viegas - Assumpcao and also visited the project in his role of National Coordinating Officer.

6.3 Dr. Twahir was accepted as the project Veterinarian in place of Dr. Catherine Kalua.

### 7.0 Works Program and Budget

The works program and Budget for 2000 was submitted to Vienna for perusal and approval prior to submission of the Draft Final Report in November 1999.

An updated version of the program is enclosed. Appendix 8

### 8.0 Finance

We have received two payments during the year.

\$ 33000-00 purchase of Animals

\$ 30000-00 Submission of Interim Report

We enclose our Invoice for US\$ 9,680 as per contract on submission of the Final Report.

## APPENDIX 1

### BEEF COWS

#### 1. CONTROL

#### Diet for a Beef Cow

Weight : 200 kg                      Weight change :            1.00 kg/day  
 Milk Yield : 0 kg/day      Milk fat : 1.00%      Milk protein : 1.00%  
 Weeks into lactation : 0              Weeks pregnant : 0  
 Group quantities for 1 head over 1 days

Feed	Amount Fresh	(kg) Dry	Price /t	Group Quantities (Fresh Weight)	
2	SISAL BOLES	2.00	0.50	10.00	2.00 kg
16	MOLASSES CANE	0.80	0.60	275.00	0.80 kg
18	MAIZE GERM MEAL	0.50	0.44	233.00	0.50 kg
13	MAIZE BRAN	0.60	0.51	200.00	0.60 kg
14	WHEAT BRAN	3.10	2.73	233.00	3.10 kg
19	UREA	0.04	0.04	1469.00	0.04 kg
6	PANICUM INFESTUM	18.00	3.60	5.00	18.00 kg
9	COTTON SEED CAKE	0.20	0.18	585.00	0.20 kg
<b>TOTAL</b>		<b>25.24</b>	<b>8.60</b>		<b>0.03 tonnes</b>

Diet cost is 1.46 per day                      ( for 1 head over 1 day)  
 Diet is 118% of ad-lib dry matter intake (7.3kg per day)  
 Concentrate DM : 5.0 kg  
 Diet M/D : 9.2 MJ/kg  
 Concentrate M/D : 11.3 MJ/kg  
 Crude Protein (all feeds) : 135 g/kg  
 Concentrate crude protein : 142 g/kg  
 Long roughage : 42%  
 Fat concentrate : 20 g/kg

#### DIET ANALYSIS                      (Daily basis)

	Animal Diet requires	Supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	79	79 MJ		+ 5%	*
ERDP	775	779 g	(**)		
DUP	0	206 g	(*)		
Calcium (Ca)	27	47 g			
Phosphorus (P)	24	51 g	(*)		
Magnesium (Mg)	4	28 g	(*)		
Sodium (Na)	2	22 g			
Copper (Cu)	87	47 mg			
Cobalt (Co)	1	0 mg			40 mg

### Diet for a Beef Cow

Weight 200 kg      Weight change : 1.00 kg/day  
 Milk Yield : 0 kg/day      Milk fat : 1.00%      Milk protein : 1.00%  
 Weeks into lactation : 0      Weeks pregnant : 0  
 Group quantities for 1 head over 1 days

Feed	Amount (Fresh)	kg Dry	Price /t	Group Quantities (Fresh weight)
2 SISAL BOLES	4.50	1.13	10.00	4.50 kg
16 MOLASSES CANE	0.30	0.23	275.00	0.30 kg
18 MAIZE GERM MEAL	0.40	0.35	233.00	0.40 kg
13 MAIZE BRAN	1.00	0.85	200.00	1.00 kg
14 WHEAT BRAN	3.00	2.64	233.00	3.00 kg
19 UREA	0.07	0.07	1460.00	0.07 kg
22 Sisal Bogas or Ensiled	10.00	1.80	5.00	10.00 kg
6 PANICUM INFESTUM	5.00	1.00	5.00	5.00 kg
9 COTTON SEED CAKE	0.30	0.28	585.00	0.30 kg
<b>TOTALS</b>	<b>24.57</b>	<b>8.34</b>		<b>0.02 tonnes</b>

Diet cost is 1.47 per day ( 1 for 1 head over 1 days)  
 Diet is 114% of ad-lib dry matter intake (7.3 kg per day)

Concentrate DM : 7.3 kg  
 Diet M/D : 9.5 MJ/kg  
 Concentrate M/D : 10.0 MJ/kg  
 Crude protein (all feeds) : 141 g/kg  
 Concentrate crude protein : 121 g/kg  
 Long roughage : 12%  
 Fat concentration : 26 g/kg

### DIET ANALYSIS (Daily basis)

	Animal requires	Diet supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	79	79 MJ	(**)	+ 5	
ERDP	783	797 G	(*)		
DUP	0	229 g			
Calcium (Ca)	27	128 g	(*)		
Phosphorus (P)	24	50 g	(*)		
Magnesium (Mg)	4	39 g	(**)		
Sodium (Na)	2	11 g	(*)		
Copper (Cu)	87	19 mg			68 mg
Cobalt (Co)	1	0 mg			1 mg

**APPENDIX 2**

**FEED PLAN**

**1. CONTROL**

Diet prepared for :

Diet for a Lamb ..... Entire Male

Diet for a Goat .....Entire Male

Weight : 12 kg      Weigh change : 0.10 kg/day

Group quantities for 1 head over 1 days

Feed	Amount	(kg)	Price	Group Quantities
	Fresh	Dry	/t	(Fresh weight)
6 Panicum Infestum	2.00	0.40	5.00	2.00 kg
13 Maize Bran	0.10	0.09	115.0	0.10 kg
14 WHEAT BRAN	0.10	0.09	190.00	0.10 kg
<b>TOTALS</b>	<b>2.20</b>	<b>0.57</b>		<b>0.00 tonnes</b>

Diet cost is 0.04 per day ( 0.41 per kg ) ( 0 for 1 head over 1 days)

Diet is 217% of ad-lib dry matter intake (0.3 kg per day)

Concentrate DM	:	0.2 kg
Diet M/D	:	7.8 MJ/kg
Concentrate M/d	:	10.6 MJ/kg
Crude protein (all feeds)	:	114 g/kg
Concentrate crude protein	:	159 g/kg
Long roughage	:	70%
Fat concentration	:	8 g/kg

**DIET ANALYSIS (Daily basis)**

	Animal Diet requires	Supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	5	4 MJ		+5%	
ERDP	41	43 g			
DUP	34	10 g			
Calcium (Ca)	2	2 g			1 g
Phosphorus (P)	1	3 g			
Magnesium (Mg)	0	1 g	(*)		
Sodium (Na)	0	2 g	(*)		
Cooper (Cu)	2	0 g			2 mg
Cobalt (Co)	0	0 g			



**GOATS**  
**Fresh and Ensiled Bogas**

Diet for a Lamb ..... Entire Male

Diet for a Goat ..... Entire Male

Weight : 8 kg                      Weight change : 0.10 kg/day

Group quantities for 1 head over 1 days

Feed	Amount Fresh	(kg) Dry	Price /t	Group Quantities (Fresh weight)
22 Sisal Bogass	1.00	0.18	5.00	1.00 kg
13 MAIZE BRAN	0.10	0.09	200.00	0.10 kg
14 WHEAT BRAN	0.25	0.22	233.00	0.25 kg
<b>TOTAL</b>	<b>1.35</b>	<b>0.49</b>		<b>0.00 tonnes</b>

Diet cost is 0.08 per day ( 0.83 per kg)                      ( 0 for 1 head over 1 days)

Diet is 109% of ad-lib dry matter intake (o.4 kg per day)

Concentrate DM	:	0.5 kg
Diet M/D	:	9.6 MJ/kg
Concentrate M/D	:	9.6 MJ/kg
Crude protein (all feeds)	:	128 g/kg
Concentrate crude protein	:	128 g/kg
Long roughage	:	0 %
Fat concentration	:	35 g/kg

**DIET ANALYSIS                      (Daily basis)**

	Animal Diet requires	supplies	Excess	Scale factors	Minerall deficit
	=====	=====	=====	=====	=====
Metabolisable Energy	3	5 MJ	(**)	+ 5%	
ERDP	42	42 g			
DUP	31	13 g	(**)		
Calccium (Ca)	3	7 g	(*)		
Phosphorus (P)	2	4 g	(*)		
Magnesium	0	3 g	(*)		
Sodium (Na)	0	0 g			
Copper (Cu)	3	0 mg			3 mg
Cobalt (Co)	0	0 mg			

## APPENDIX 3

### GOATS

#### REPORT ON DEATHS OF CFC ANIMALS FOR OCTOBER 1999

1. 7th October 1999  
ID : B 027  
History : "sudden death"  
Necropsy findings : - Abundant froth in the trachea, bronchi and bronchioles.  
Ensiled Bogas : - Eccymotic hemorrhages on the epicardium and endocardium.  
: - Hemorrhages in the lung parenchyma.  
: - Linear hemorrhages on the muscosal folds of the abomasum and small intestines.  
Diagnosis : - acute penumonia
2. 18th October 1999  
ID : A 07  
History : - Collapse and loss of consciousness.  
Fresh Bogas : - Treated with 3.0cc Atropine sulphate, 3.0 cc dexamethasone  
Necropsy findings : - Hemorrhage in the tracheal mucosa.  
: - Rumenal mucosa peels off easily.  
Diagnosis : - Acute grain overload (lactic acidosis)
3. 21st October 1999  
ID : C 030  
History : "sudden death"  
Necropsy findings : - Froth in the trachea.  
Ensiled Bogas : - Congested lungs  
: - Rumenal mucosa peels off easily  
Diagnosis : - Acute grain overload (lactic acidosis)
4. 27th October 1999  
ID : C 037  
History : destroyed  
Reason : - Fracture of the femur  
Ensiled Bogas
5. 29th October 1999  
ID : C 42  
History : - Collapse and recumbence.  
Fresh Bogas : - Treated with 3.0cc dexamethasone, 3.0cc tetracycline 20% (LA)  
Necropsy findings : - Petechial hemorrhages on the epicardium.  
: - Congestion of the liver and kidneys.  
: - Hemorrhages on the gastrointestinal mucosa.  
: - Heavy infestation of worms (mainly hemonchus) in the abomasum and leech-like worms in the rumen.  
: - Bubbling cecal contents.  
Diagnosis : - Acute grain overload (lactic acidosis).  
: - Worm infestation.  
Cause of death : - Heart failure.

## REPORT ON DEATHS OF CFC ANIMALS FOR 1ST - 11TH NOVEMBER 1999

### 1. 4th November 1999

ID : B 021  
History :  
Fresh Bogas :  
- Progressive loss of condition.  
- Unwilling to feed on sisal waste.  
- Treated with 5.0cc multivitamin injection,  
500mg Amoxicillin tablet for 3 days.  
Necropsy findings :  
- Emaciated carcass.  
- Sunken and pale eyes.  
- Pale viscera.  
- Empty intestines.  
- Hemonchus worms in the abomasum.  
Diagnosis :  
- Starvation.

### 2. 8th November 1999

ID : - A 02  
History :  
Ensiled Bogas :  
- Loss of condition.  
- Reduced feed intake.  
- Watery diarrhea  
- Treatd with 5.0cc, multivatmin,  
500mg Amoxicillin tablets for 3 days, 5.0cc  
Gentamycin I/M injection for 3 days.  
Necropsy findings :  
- Emaciated carcass.  
- Sunken and pale eyes.  
- Empty intestines.  
Diagnosis :  
- Starvation

### 3. 22nd November 1999.

ID : Goat A14  
History :  
- Exhibited a reduction in appetite from the start of the experiment.  
- General body weakness.  
- Bloofy and mucoid diarrhea.  
- Typical strongyle eggs in microscopy of fecal sample.  
Necropsy findings :  
- abundant froth in the trachea, bronchi and bronchioles  
- Accumu;ation of pericardial  
fluid.  
Diagnosis :  
Pneumonia and helminthiasis



Abdallah Said Twahir, BVM, MBA  
Company Veterinarian.

## APPENDIX 4

### REPORT ON DEATHS OF CFC ANIMALS FOR DECEMBER 1999

#### **1. 11th December 1999**

ID and species : Ovine SC42  
History : Found dyspnoeic and with the tether rope on the wall. Treated with 3.0cc dexamethasone and antibiotics (3.0cc Quinabic) but later died.  
Necropsy findings : Froth in the trachea and marked congestion of tissues in the neck region.  
Diagnosis : Asphyxiation.

#### **2. 21st December 1999**

ID and species : Ovine SC 41  
History : Abdominal distention starting on 19th December. Later became dull and anorexic. Used a large gauge needle to let out gas trapped in the rumen. Treated with 3.0cc Gentamycin and stop bloat. Further developments included recurrence of bloat, stiff gait, ataxia and recumbence followed by death.  
Necropsy findings : Hemorrhages on the mucosal surface of the trachea and on the epicardium. Barber's pole worms (Hemonchus species) found in the abomasum.  
Diagnosis : Lactic acidosis.

#### **3. 22nd December 1999**

ID and species : Ovine SC 33  
History : Abdominal distention starting 20th December. Later became dull and anorexic. Used a large guage needle to puncture the left paralumbar region to let out gas trapped in the rumen. Treated with 3.0cc Gentamycin and stop bloat. Further developments included stiff gait, ataxia and recumbence followed by death.  
Necropsy findings : Hemorrhages on the epicardium.  
Diagnosis : Lactic acidosis.

4. **28th December 1999**

ID and species : Ovine SB 20  
History : Abdominal distention starting on 21st December.  
Used a large guage needle to puncute the left paralumbar region to let out gas trapped in the rumen. Treated with 4.0cc Tetracycline 20% and stop bloat. Further developments included stiff gait, kicking at the belly, recumbence and death.

Necropsy findings : Froth in the trachea and bronchioles, hemorrhages on the epicardium.

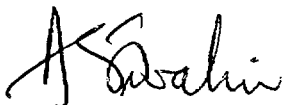
Diagnosis : :Lactic acidosis.

5. **29th December 1999**

ID and species : Ovine SA 10  
History : Abdominal distention starting on 21st December.  
Used a large guage needle to puncture the left paralumbar region to let out gass trapped in the rumen. Treated with 3.0cc Tetracycline 20% and stop bloat. Further developments included stiffness, recumbence and death.

Necropsy findings : Hemorrhages on the epicardium.

Diagnosis : Lactic acidosis



Abdallah Said Twahir, BVM, MBA  
**Company Veterinarian**

**APPENDIX 5.1**  
**GOATS**  
**Fresh and Ensiled Bogas**

**FEED PLAN**

Diet prepared for :  
Diet for a Lamb ..... Entire Male  
Diet for a Goat ..... Entire Male

Weight : 12 kg      Weight change : 0.10 kg/day  
Group quantities for 1 head over 1 days

Feed	Amount Fresh	(kg)		Price /t	Group Quantities (Fresh weight)	
		Dry				
6 Panicum infestum	1.00	0.20		5.00	1.00	kg
22 Sisal Bogas	1.11	0.20		3.00	1.11	kg
13 Maize Bran	0.10	0.09		115.00	0.10	kg
14 Wheat Bran	0.10	0.09		190.00	0.10	kg
<b>TOTALS</b>	<b>2.31</b>	<b>2.31</b>			<b>0.00</b>	<b>tones</b>

Diet cost is 0.04 per day (0.39 per kg) (0 for 1 head over 1 days)  
Diet is 136% of ad-lib dry matter intake (0.4 kg per day)

Concentrate dm : 0.4 kg  
Diet M/D : 8.1 MJ/kg  
Concentrate M/D : 9.0 MJ/kg  
Crude protein (all feeds) : 102 g/kg  
Concentrate crude protein : 107 g/kg  
Long roughage : 35%  
Fat concentration : 18 g/kg

**DIET ANALYSIS (Daily basis)**

	Animal Diet requires	supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	4	5 MJ		+ 5%	
ERDP	43	39 g			
DUP	36	11 g			
Calcium (Ca)	2	8 g	(*)		
Phosphorus (P)	2	2 g			
Magnesium (Mg)	0	3 g	(*)		
Sodium (Na)	0	2 g	(*)		
Copper (Cu)	3	0 g			
Cobalt (Co)	0	0 g			2 mg



**KILIFI PLANTATIONS LTD  
EXTENSION SERVICES DEPARTMENT**

**INTERNAL MEMORANDUM**

To	: Livestock Manager	From	: Company Veterinarian
Date	: January 05, 2000	Reference No	: ESD/2000-01-05/cfc- sheep
Subject	: CFC Sheep		

When the sheep were brought into the CFC experiment, there were high incidences of deaths (three). Some sheep were afflicted with a condition characterised by lethargy, inappetence and general weakness. This observation was not confined to any particular treatment group. The only common thing in all the treatments was the concentrate feeding. My verbal instructions were to withdraw concentrate feeding from all the sheep for at least a week and then re-introduce it gradually over a period of time, say, four weeks. This is so that the rumen micro-organisms may acclimatise to the level and type of concentrate feeding in the feed trials.

These instructions were issued in the last week of December 1999.

**Abdallah Said Twahir (Dr.)**

## APPENDIX 6

### C.F.C

Date	Cows	Scale	Av.
01/11/99	31	340	10.97
02/11/99	31	320	10.32
03/11/99	31	338	10.90
04/11/99	31	317	10.23
05/11/99	31	320	10.32

Date	Cows	C	E	F	Total Scale	Total A.V.
06/11/99	31	88	105	117	310	10.00
07/11/99	32	85	104	116	305	9.84
08/11/99	31	90	109	126	325	10.48
09/11/99	32	9.77	8.73	9.67	300	9.38
10/11/99	31	9.44	9.36	9.50	302	9.74
11/11/99	30	11.43	9.50	10.00	305	10.17
12/11/99	30	10.71	9.00	9.62	290	9.67
13/11/99	30	11.00	8.40	8.77	275	9.17
14/11/99	30	9.29	8.40	8.92	265	8.83
15/11/99	30	10.00	7.30	8.23	250	8.33
16/11/99	30	8.43	7.50	7.85	236	7.87
17/11/99	30	10.23	7.40	8.00	250	8.33
18/11/99	30	9.43	6.80	7.78	235	7.83
19/11/99	30	10.86	6.80	8.92	260	8.67
20/11/99	30	8.86	6.40	7.61	225	7.50
21/11/99	30	11.00	8.40	8.77	275	9.17
22/11/99	30	12.14	8.50	9.23	290	9.67
23/11/99	30	11.29	8.60	10.77	305	10.17
24/11/99	30	12.14	8.09	11.67	314	10.47
25/11/99	30	11.43	9.91	9.75	306	10.20
26/11/99	30	12.28	10.45	10.42	326	10.87
27/11/99	30	12.57	10.73	10.75	335	11.17
28/11/99	30	13.14	9.82	10.75	330	11.00
29/11/99	31	12.43	11.00	11.88	350	11.29
30/11/99	30	12.43	10.64	12.17	350	11.67
	913				8,949	9.80



## APPENDIX 6

### C.F.C

Date	Cows In:-			Total Cows	Averages			Total Scale	Total Average
	F	E	C		F	E	C		
01/12/99	12	11	8	31	12.00	10.91	12.00	360	11.61
02/12/99	12	11	8	31	12.42	11.00	11.13	359	11.58
03/12/99	12	11	8	31	13.17	11.91	12.00	385	12.42
04/12/99	12	11	8	31	12.75	9.45	14.13	370	11.93
05/12/99	12	11	8	31	12.00	10.91	12.00	360	11.61
06/12/99	12	11	8	31	11.33	10.18	9.63	325	10.48
07/12/99	12	11	8	31	11.75	9.18	9.75	320	10.32
08/12/99	12	11	8	31	10.50	10.09	10.13	318	10.26
09/12/99	12	11	8	31	10.08	8.82	10.88	305	9.84
10/12/99	12	11	8	31	8.83	9.09	10.50	290	9.35
11/12/99	12	11	8	31	9.25	7.81	11.37	288	9.29
12/12/99	12	11	9	32	9.25	8.36	9.11	285	8.91
13/12/99	12	11	9	32	9.00	9.09	10.22	300	9.38
14/12/99	12	11	9	32	8.33	7.54	8.00	250	7.81
15/12/99	12	11	9	32	9.75	8.64	9.22	295	9.22
16/12/99	12	11	9	32	8.58	8.18	10.63	278	8.69
17/12/99	12	11	9	32	8.58	8.64	10.00	288	9.00
18/12/99	12	11	9	32	8.75	8.27	8.75	275	8.59
19/12/99	12	11	9	32	10.25	9.18	9.22	307	9.59
20/12/99	12	11	9	32	9.50	8.91	9.78	300	9.38
21/12/99	12	11	9	32	9.75	8.36	10.67	305	9.53
22/12/99	12	11	9	32	9.58	10.09	10.11	307	9.59
23/12/99	12	11	9	32	10.00	9.36	8.00	295	9.22
24/12/99	12	11	9	32	10.00	8.45	10.11	304	9.50
25/12/99	12	11	9	32	10.33	8.36	8.78	295	9.22
26/12/99	12	11	9	32	9.83	10.64	8.89	315	9.84
27/12/99	12	11	9	32	10.17	9.00	8.44	300	9.38
28/12/99	12	11	9	32	8.83	9.00	8.33	280	8.75
29/12/99	12	11	9	32	10.08	8.91	7.89	290	9.06
30/12/99	12	11	9	32	8.83	8.64	8.78	280	8.75
31/12/99	12	11	9	32	9.33	8.09	7.67	270	8.44
				981				9,499	9.68

**APPENDIX 7.1**

**1. CONTROL**

Diet prepared for :

Diet for a Dairy Cow

Weight : 425 kg Weight change : 0.00 kg/day

Milk Yield : 15 kg/day Milk fat : 4.20% Milk protein : 3.20%

Weeks into lactation : 18 Weeks pregnant : 8

Group quantities for 1 head over 1 days

	Feed	Amount Fresh	(kg) Dry	Price /t	Group Quantities (Fresh weight)
1	COPRA CAKE	0.50	0.44	400.00	0.50 kg
2	SISAL BOLES	1.00	0.25	10.00	1.00 KG
13	MAIZE BRAN	1.50	1.31	175.00	1.50 kg
16	MOLASSES CANE	1.50	1.13	306.25	1.50 kg
25	LIMESTONE	10.00g	9.80g	100.00	0.01 kg
19	UREA	0.06	0.06	1050.00	0.06 kg
28	KPL SILAGE-JULY 92	28.00	7.00	15.00	28.00 kg
35	MACLIK PLUS	0.30	0.30	900.00	0.30 kg
18	MAIZE GERM MEAL	1.50	1.32	150.00	1.50 kg
9	COTTON SEED CAKE	1.00	0.93	400.00	1.00 kg
14	WHEAT BRAN	1.00	0.88	155.50	1.00 kg
<b>TOTAL</b>		<b>36.37</b>	<b>13.61</b>		<b>0.04 tonnes</b>

Diet cost is 2.47 per day ( 2 for 1 head over 1 days)

Diet is 113% of ad-lib dry matter intake ( 12.1 kg per day)

Concentrate Dm	:	6.2 kg
Diet M/D	:	9.8 MJ/kg
Concentrate M/D	:	12.8 MJ/kg
Crude protein (all feeds)	:	102 g/kg
Concentrate crude protein	:	126 g/kg
Long roughage	:	51 %
Fat concentration	:	39 g/kg

**DIET ANALYSIS (Daily basis)**

	Animal requires	Diet supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	135	134 MJ		+5%	
ERDP	1257	785 g			
DUP	387	327 g			
Calcium (Ca)	42	72 g			
Phosphorus (P)	46	60 g			
Magnesium (Mg)	19	31 g			
Sodium (Na)	13	49 g	(*)		
Copper (Cu)	145	130 mg			14 mg
Cobalt (Co)	1	6 mg			

**APPENDIX 7.2**  
**Fresh and Ensiled Bogas**

Diet Prepared for :

Diet for a Dairy Cow

Weight : 425 kg      Weight change : 0.00 kg/day  
Milk Yield : 15 kg/day    Milk fat : 4.20%    Milk protein : 3.20%  
Weeks into lactation : 18      Week pregnant : 8  
Group quantities for 1 head over 1 days

	Feed	Amount (kg)		Price /t	Group Quantities (Fresh weight)
		Fresh	Dry		
1	COPRA CAKE	0.50	0.44	400.00	0.50 kg
2	SISAL BOLES	1.00	0.25	10.00	1.00 kg
13	MAIZE BRAN	1.50	1.31	175.00	1.50 kg
16	MOLASSES CANE	1.50	1.13	306.25	1.50 kg
25	LIMESTONE	0.10	0.10	100.00	0.10 kg
19	UREA	0.06	0.06	1050.00	0.06 kg
28	KPL SILAGE - JULY 92	14.00	3.50	15.00	14.00 kg
35	MACLIK PLUS	0.30	0.30	900.00	0.30 kg
18	MAIZE GERM MEAL	1.50	1.32	150.00	1.50 kg
9	COTTON SEED CAKE	1.00	0.93	400.00	1.00 kg
14	WHEAT BRAN	2.00	1.76	155.50	2.00 kg
22	Sisal Bogas	14.00	2.52	3.00	14.00 kg
<b>TOTAL</b>		<b>37.46</b>	<b>13.60</b>		<b>0.04 tonnes</b>

Diet cost is 2.46 per day ( 2 for 1 head over 1 days)  
Diet is 70% of ad-lib dry matter intake ( 12.7 kg per day)

Concentrate DM	:	9.6 kg
Diet M/D	:	10.0 MJ/kg
Concentrate M/D	:	11.3 MJ/kg
Crude protein (all feeds)	:	107 g/kg
Concentrate crude protein	:	111 g/kg
Long roughage	:	26%
Fat concentration	:	43 g/kg

**DIET ANALYSIS (Daily basis)**

	Animal requires	Diet supplies	Excess	Scale factors	Mineral deficit
Metabolisable Energy	134	136 MJ		+ 5%	
ERDP	1307	886 g			
DUP	322	332 g			
Calcium (Ca)	43	193 g	(*)		
Phosphorus (P)	48	74 g			
Magnesium (Mg)	19	56 g	(*)		
Sodium (Na)	13	54 g	(*)		
Copper (Cu)	153	132 mg			20 mg
Cobalt (Co)	1	6 mg			

Appendix 8

FINAL1999WPLAN

Activities	1999				2000			
	1	2	3	4	1	2	3	4
Equipment construction								
Ensiling pit construction								
Dairy and Beef building								
Goat and sheep building								
Enlargement of buildings								
Ensiling bogass								
Selection and Purchase of animals								
Dairy cows feed trials								
Beef cattle feed trials								
Goats feed trials								
Sheep feed trials								
Analysis								
Veterinary evaluation								
Collection of data								
Analysis of data								
Tecno-economic analysis								
Reports								
Final report								



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27 NOV 1999

REF: KLF/PL/I/VOL.I/11

25th November 1999

The Managing Director,  
Kilifi Plantation Ltd,  
Private Bag,  
KILIFI

**RE: VISIT TO DISCUSS THE BOGAS FEEDING TRIAL**

Discussion with the Managing Director, Betty and the Vet on the above were held in Kilifi Plantation on 16th November, 1999.

The following were noted and comments made:

1. The goats had been on the experimental diet for about six weeks. Some goats had died from acidosis since they preferred to eat the concentrate and not the bogas or the silage in the control diet. Some goats probably died of starvation since they refused to eat any of the feed offered.
2. The dairy and beef cattle did not seem to have problems with the diets offered although milk production had dropped.
3. The original treatment diets had some proportion of pastures but after some advise by the Biometrician these were changed to sole bogas plus a concentrate.
4. Due to confinement of the cows in individual feeding stalls, ovulation could not be easily detected.

From work carried out elsewhere (Ref with Kilifi Plantation), it was recommended that animals fed bogas should be offered 25% grass in the total diet to maintain normal rumen activity.

It was recommended that the current trial should include some grass. Bogas should be used to replace part of the grass in the control diet. An earlier proposed diet had

4kg DM grass for the control and about 2kg bogas and 2kg grass for the treatment diet. I would consider this a better option than having sole bogas. The difference between the two treatment diets should be the nature (fresh, ensiled) of the bogas but the quantities offered should be similar.

These treatments will answer the questions:

1. What is the effect of replacing -----% grass in the diet of goats, beef & dairy cows on the milk production and weight change?
2. Is the effect different between fresh and ensiled bogas?

If animals were not a limiting factor, the best experiment should have had increasing levels of bogas from the control. For example 0,25, 50, 75 and 100% bogas. This would tell us the best level to use after which that level would be used to compare fresh and ensiled bogas. This experiment however requires five groups of animals. The question could have been answered in an experiment lasting 12-14 weeks. The best diet could then be used to monitor the effect of bogas on reproduction.

The current experiment was planned to last 2 years to capture reproductive performance. Now that heat detection is proving to be a problem, it is unlikely that this objective will be achieved. It might be necessary to spend some more money on ensuring the cows ovulate and that they are served. If this is done artificially, then it will mask any effect due to treatment diets. Is it possible to keep track of ovulation through close monitoring of individual cows? If cows are given treatment diets immediately after calving, there will be good data after 12-14 weeks on the effect of diet on milk yield and live weight changes. After that cows can be allowed to graze, in a group of six, in a paddock where bogas is provided in a feed trough. Something similar to what you did with the beef animals earlier on. You could then have three groups of six cows for each treatment (6X3 for fresh bogas and 6x3 for ensiled bogas). Another set of 6X3 under your normal management could be used as the control. These can then be monitored for a period of two years (if they eat the bogas) to monitor reproductive performance. For the goats, sheep and beef, I would consider the six months more than adequate since you are not after their reproductive performance.

These are thoughts and by no means the gospel. They should help you decide what treatments, length of experiment to adopt depending on what the original objectives of CFC was.



for. R.W. Muinga  
RRC Mtwapa

9. **Conclusion**

The experiment progresses fairly well.

However, it appears that the small ruminants, goats and sheep, are not suited to (a) the test environment and (b) the Sisal Bogas.

The request for termination of these parts of the Trial are with UNIDO.

The Large remnants, Dairy Cows and Beef Animals are doing well but it is obvious that Bogas is best suited as a "Bulker" forage, not as an only forage.

We also await confirmation of the 200 Budget from UNIDO.