CONTENTS

ACKNOWLEDGEM	ENT	iii
ABSTRACT		
ABSTRAK		
LIST OF FIGURES .		xvii
LIST OF TABL	ES	xix
CHAPTER 1:	INTRODUCTION	
1.1.	The ruminants	-
1.2.	Microbial activity in the rumen	2
1.3.	Rumen microbial population	3
1.3.1.	Rumen bacteria	4
1.3.2.	Rumen fungi	8
1.3.3.	Rumen protozoa	10
1.4.	Influence of diet on the microorganisms	
	in the rumen	13
1.5.	Degradation of feedstuff in the rumen	16
1.6.	Enzymatic hydrolysis of cellulose	17
1.6.1.	Basic mechanism	17
1.6.2.	Factors affecting the complexity of	
	Cellulase system	18
1.6.3.	Cellulases of the rumen bacteria	20
1.6.4.	Factors affecting the cellulolytic activity	У
	of the cellulolytic bacterial population	24
1.7.	Present programme	28
1.8.	Objectives of research	30

CHAPTER 2: CHARACTERIZATION OF RUMEN INGESTA FROM GOATS FED WITH P. PURPUREUM, P.PURPUREUM WITH VIGNA BEAN WASTES AND P. PURPUREUM WITH FOME-BASED CONCENTRATE

2.0.	INTRODUCTION	31
2.1.	BACTERIAL COUNT	32
2.1.1.	Materials and methods	32
2.1.la.	Rumen samples	32
2.1.1b.	Preparation of oxygen-free ${\rm CO}_2$	32
2.1.1c.	Preparation of pre-reduced dilution	
	solution	33
2.1.1d.	Media for roll-tube	34
2.1.1e.	Rumen content sampling and inoculum	
	preparation	36
2.1.1f.	Total viable and total cellulolytic	
	bacterial count	37
2.1.2	Results	37
2.2.	ANALYSES ON RUMEN INGESTA	4
2.2.1.	Total soluble sugar	40
2.2.1a.	Materials and methods	40
2.2.1b.	Results	- 41
2.2.2.	Volatile fatty acids contents	41
2.2.2a.	Materials and methods	41
2.2.2b.	Results	42
2.2.3.	Cellulolytic activity	46
2.2.3a.	Materials and methods	46
2.2.3a.1.	Cellulosic substrates	46
2 2 2 2	Management of cellulolytic activity	47

2.2.3b.	Results .	49
2.2.4.	рН	54
2.2.4a.	Materials and methods	54
2.2.4b.	Results	54
2.3.	DISCUSSION	56
	•	
CHAPTER 3: ISC	DLATION AND IDENTIFICATION OF CELLULOLYTIC	
RUN	EN BACTERIA	
	•	
3.0.	INTRODUCTION	63
3.1.	ISOLATION OF CELLULOLYTIC BACTERIA	64
3.1.1.	Materials and methods	64
3.2.	DETERMINATION OF CELLULOLYTIC ACTIVITY	66
3.2.1.	Materials and methods	66
3.2.2.	Results	66
3.3.	IDENTIFICATION OF CELLULOLYTIC BACTERIA	68
3.3.1.	Cellular morphology, Gram reaction, spore,	
	motility and catalase production	68
3.3.1.1.	Materials and methods	68
3.3.1.2.	Results	69
3.3.2.	VFA and alcohol production	71
3.3.2.1.	Materials and methods	71
3.3.2.2.	Results	71
3.3.3.	Carbohydrate fermentation	73
3.3.3.1.	Materials and methods	73
3.3.3.2.	Results	74
3.3.4.	Characterization of isolates	74
3.4.	DISCUSSION	78

CHAPTER 4: GROWTH AND CELLULOLYTIC ACTIVITY OF PURE CULTURES OF R.ALBUS, R. FLAVEFACIENS, F. SUCCINOGENES, B.FIBRISOLVENS, AND C. CELLOBIOPARUM IN POME, POME EXTRACTS AND POME EXTRACTS PLUS CELLULOSE

4.0.	INTRODUCTION	82
4.1.	NUTRIENT ANALYSIS OF POME	82
4.1.1.	Materials and methods	82
4.1.1a	Ash	83
4.1.1b	Fat	83
4.1.1c	Fibre	84
4.1.1d	Protein	8.5
4.1.le	Nitrogen-free extracts	8.6
4.1.1f	Soluble sugar	8.6
4.1.2.	Results	87
4.2.	GROWTH AND CELLULOLYTIC ACTIVITY	8.8
4.2.1	Materials and methods	8.8
4.2.1.1	Media preparation	88
4.2.1.2	Determination of Soluble sugar in	
	POME media	90
4.2.1.3	Preparation of inoculum	9(
4.2.1.4	Inoculation and incubation procedure	9:
4.2.1.5	Analyses of samples	9:
4.2.2	Results	9:
4.2.2.1	Soluble sugar in POME media	9:
4.2.2.2	Bacterial count	9
4.2.2.3	Cellulolytic activity	9
4.3.	DISCUSSION	9

CHAPTER 5: DIGESTION OF P.PURPUREUM AND POME IN SEMI-BATCH FERMENTATION SYSTEM

5.0	INTRODUCTION	107
5.1	NUTRIENT ANALYSIS OF PENNISETUM PURPUREUM	108
5.1.1	Materials and methods	108
5.1.2	Results	108
5.2.	SEMI-BATCH FERMENTATION	109
5.2.1.	Materials and methods	109
5.2.1.1	Culture apparatus	109
5.2.1.2	Media preparation	113
5.2.1.3	Preparation of inoculum	115
5.2.1.4	Inoculation and fermentation procedure	115
5.2.1.5	Analyses of samples	116
5.2.2	RESULTS	117
5.2.2.1	Total viable and cellulolytic counts	117
5.2.2.2	Total soluble sugar	118
5.2.2.3	VFA concentration and pattern	122
5.2.2.4	Cellulolytic activity	123
5.3.	DISCUSSION	133
CHAPTER 6: GENE	ERAL DISCUSSION AND CONCLUSION	143
REFERENCES		155
COMMUNICATION		199

LIST OF FIGURES

Figure	2.1:	Total viable bacteria	3 !
Figure	2.2:	Total soluble sugar	4
Figure	2.3:	Total volatile fatty acids	4
Figure	2.4a:	Ruminal crude cellulase extracts on swollen cellulose	51
Figure	2.4b:	Ruminal crude cellulase extracts on crystalline cellulose	51
Figure	2.4c:	Crude cellulase extracts on POME fibres	52
Figure	2.4d:	Crude cellulase extracts on grass fibres	5.
Figure	4.la:	Growth of bacteria in POME extracts	94
Figure	4.1b:	Growth of bacteria in POME extracts plus celluloses	95
Figure	4.1c:	Growth of bacteria in POME	96
Figure	4.2a:	Cellulolytic activity in POME extracts	99
Figure	4.2b:	Cellulolytic activity in POME extracts plus cellulose	100

Figure	4.20:	Cellulolytic activity in POME .	101
Figure	5.1	Set-up of semi-batch fermentation	112
Figure		Total viable bacterial count in semi-batch fermentation	119
Figure	5.3:	Total viable celluolytic count in semi-batch fermentation	120
Figure	5.4:	Total soluble sugar in semi-batch fermentation	121
Figure		Total volatile fatty acids in semi-batch fermentation	124
Figure	5.6:	Acetic to propionic acid ratio	125
Figure	5.7a:	Cellulolytic activity for swollen cellulose	128
Figure	5.7b:	Cellulolytic activity for POME fibre	129
Figure	5.7c:	Cellulolytic activity for crystalline cellulose	130
Figure	5.7d:	Cellulolytic activity for grass fibre	131

LIST OF TABLES .

Table	2.1:	Count of total and cellulolytic	
		bacteria and percentage of	
		cellulolytic bacteria	38
		•	
Table	2.2:	molar $\mbox{\ensuremath{\$}}$ of major VFA at the different part	
		of rumen	45
Table	2.3:	pH at the different part of rumen	55
Table	3.1:	Cellulolytic activity of cellulolytic	
		bacterial isolates	67
Table	3.2:	Cell shape, Gram reaction, endospores,	
		motility and catalase reaction	70
Table	3.3:	Fermentation end products	7.2
Table	3.4:	Fermentation of carbohydrates	75
m - 1- 1 -	5.5.	Characterization of isolates	77
Table	3.3:	Characterization of isolates	1 /
Table	3 6.	Occurrence of cellulolytic bacteria in	
IdDIC	5.0.	the rumen of sheep with different diets	81
		the rame. Or broop with directions diets	01
Table	4.1:	Chemical constituents of POME	87
Table	4.2:	Total soluble sugar in POME media	92
		-	

14010 0.1.	chemical conservations of 1. purpareau	10.
Table 5.2a:	VFA in grass semi-batch system	12
Table 5.2b:	VFA in POME semi-batch system	12
Table 5.3:	Relative rate of digestion of different	

produced in semi-batch fermentation 132