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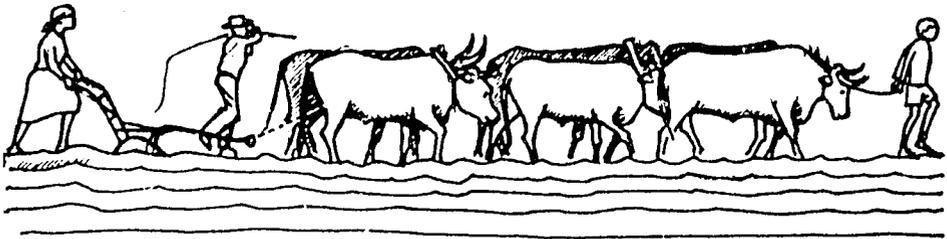
DRY LOT MILK PRODUCTION USING THREE GOAT TYPES
TUTUME AGRICULTURAL DISTRICT
1988 -1990

BY

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PREFACE

ATIP working papers are prepared and circulated to make ATIP research findings easily available to Government of Botswana personnel and researchers interested in Botswana farming systems. This working paper has been reviewed internally by ATIP staff and by the Chief Animal Production Research Officer, DAR, Dr. L. Setshwaelo.

This paper presents information gained from a researcher managed and implemented (RMRI) trial to establish production parameters, labour requirements, and feed costs when three distinct types of goats were maintained under drylot conditions. This trial was carried out in each of three villages in the Tutume Agricultural District from May 1989 to May 1990.

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**DRYLOT MILK PRODUCTION USING THREE GOAT TYPES
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CONTENTS

ABSTRACT	1
INTRODUCTION	1
OBJECTIVE	2
JUSTIFICATION	2
DESIGN	2
RESULTS	3
CONCLUSIONS	7
REFERENCES.	7

TABLES

1. Production Information for Each Goat	3
2. Production Information Per Doe, By Breed	4
3. Feed Intake Per Goat	5
4. Roughages Fed During Lactation To All Goats	5
5. Concentrates Fed During Lactation To All Goats	5
6. Feed Cost Per Litre Of Milk Produced Per Doe, By Breed	6
7. Total Costs Of Production Per Litre Of Milk	7

ABSTRACT

This paper presents information from a year long study which delineated production levels and costs of production for two breeds and two cross-breeds of goats. Total production and costs were also computed for the total lactation, and per litre of production. In addition, a selected list of possible constraints was developed.

INTRODUCTION

Diversification of production and increased opportunity to convert farm surplus into cash is of great importance to village agricultural development. Goat meat and milk is probably the most important source of animal protein for humans at the village level. At this time there is little conversion of this resource to cash (Thedford, Kelemogile and Worman, 1990a) either from the sale of milk products or from goats.

Goat populations around most villages will approach maximum numbers if farmers are to continue to raise them in the traditional manner -- that is, left free to forage for themselves on communal lands. By the end of most dry seasons, the animals lose considerable weight and have stripped all browse and grass for up to two to three kilometers from the village proper. Most kids (75 per cent) are born during the months of July to September (APRU, 1985), the peak of the dry season, and death losses are high. At present, Botswana probably has enough goats -- almost 1.7 million (DPS, 1990) -- to feed those seeking goat meat without causing unnecessary damage to the environment. However, to ensure that the future demand is satisfied and the environment is protected, better use must be made of this resource. Consequently traditional methods of raising and utilizing goats and goat products must be adapted. Needed changes include: improving the management procedures for both meat and milk production; decreasing the death losses, especially those in the first year of life; and subsequently increasing the off-take as these animals reach a reasonable point in maturity, i.e., 12 to 15 months old. Improving milk production can be accomplished, either by introducing milk goat types or, better still, cross-breeding or selecting for milk production from the Tswana breed. This could be accomplished relatively easily. Increased milk production could serve to:

- (a). Increase total milk production for human use, both fresh and soured, and for home use and sale.
- (b). Decrease kid mortality by making more milk available to the kids. This could be done by developing heavier milking dams, if they are to be milked in addition to raising kids, or by milking only a few does whose kids have been grafted to other does, thus allowing kids to travel to browse with their dams and consume the dams total milk production. This should increase total kid production and allow for a heavier kid at post-weaning time. This could also lead to the animals being presented for slaughter more quickly than previously.
- (c). Increase cash flow at the village level by selling surplus milk either fresh or, more likely, as madila, as well as having more goats to sell for slaughter at an earlier age. This should help reduce the stress and over use of the communal grazing and browsing areas.

With these ideas in mind this preliminary study was undertaken. It was hoped that this project would serve to lay the foundation for further investigations and to encourage work to be carried out on improving the indigenous Tswana goat breed.

OBJECTIVE

The objective of this researcher managed, and implemented (RMRI) trial was to ascertain the possible production, and cost and time of production, under drylot conditions, for three types of goats, i.e., pure Saanen, pure Tswana and cross-breeds (two Tswana x Boer and one Saanen x Boer).

JUSTIFICATION

Most village farmers keep goats.¹ These goats are kept as a source of meat, milk and cash. Many of the farmers milk goats for home use, and some sell surplus milk as madila (Thedford et al., 1990a). The production per goat is small and usually varies proportionally with the availability of grazing. There appears to be no sociological problem in using goats' milk either fresh or soured. It would be beneficial if an acceptable technology could be found to decrease the number of goats required for milking, or to increase production of a few goats so as to provide family needs for milk. This could mean a stabilization of goat numbers, yet provide an increase in both milk and meat production. Increased milk production, per doe, would mean that fewer does would have to be milked to obtain the required amount for the family. More meat could be produced by decreasing death loss of kids caused by malnutrition. It is thought that the major cause of kid malnutrition is due to milk overtake for human consumption.

DESIGN

A kraal was built at each of the three villages where ATIP operates, i.e., Matobo, Mathangwane, and Marapong, in the Tutume Agricultural District. These kraals were constructed of various materials in an attempt to see what design and materials for construction were best suited for the area.²

Four bred female goats were purchased to place in each of these kraals. As they kidded, the kids were left to nurse for one week and then moved from the area to be raised on a different farm. Two average Tswana goats were placed, along with one pure Saanen doe and a cross-bred doe, in each village. Two villages had one Tswana cross Boer each, and one had a Saanen cross Boer. These animals were maintained in drylot conditions, except in one instance when feed supplies were exhausted, and they were allowed to graze within the compound for four hours per week.

The animals used were not selected for their milking ability and were purchased and included in the trial because of availability. The cross-breeds were used to demonstrate the value of cross-breeding -- not any specific cross -- hence the inclusion of the single Saanen x Boer doe and her records. Continued work is being pursued by APRU and the farming systems research team on the Tswana x Saanen cross-breeds, and the evaluation of their ability to economically produce milk.

1. Makhwaje (1986) estimated that 87 percent of the farmers in the three Tutume District study villages keep goats.

2. See Thedford et al. (1990b) for information on this project.

The allotted rations were calculated to provide about five per cent of body weight in dry matter and to furnish adequate protein and energy to meet the goats' maintenance and production requirements. This was a rough estimate because of the varying supply and quality of feed available, and because an attempt was made to use feed that could be obtained locally, i.e., either from village lands or the Francistown area. The feed was provided twice a day and was weighed, and the details recorded each time. Water was supplied on ad lib basis.

The goats were milked twice a day and the production measured volumetrically. The does were dried off when production dropped below 50 millilitres per day, except for two Saanen and one cross-breed which were dried off May 1, 1990, when data collection stopped, and they were thought to be within 60 days of kidding.

Once a week all labour inputs were timed, i.e., times required for milking, feeding, watering, and cleaning of the kraals. The milking and feeding times were recorded as a.m. and p.m. times, in minutes, per day. Watering and cleaning times were recorded as minutes per week. Herding, when it was practiced, was also recorded in minutes per week.

The ration being fed was recorded as total Grain #1 and Grain #2 and Hay #1 and Hay #2 fed per animal, per week. The name of the feed was also recorded.

Days in milk production were recorded and used in the subsequent analysis to determine the cost of feed per day, and the cost of production per litre of milk.

RESULTS

The production record of each goat is reported in Table 1. These data were divided into days in milk, total lactation production in the morning, total lactation production in the afternoon, and per cent of total production for each milking. Also included were total lactation for the trial, and weekly mean and daily mean production for each goat.

TABLE 1. PRODUCTION INFORMATION FOR EACH GOAT

GOAT #	DAYS IN MILK	TOTAL A.M. PROD ml	MEAN A.M. WEEKLY PROD ml	PERCENT A.M.	TOTAL P.M. PROD ml	MEAN P.M. WEEKLY PROD ml	PERCENT P.M.	LACTATION TOTAL PROD ml	MEAN WEEKLY PROD ml	MEAN DAILY PROD ml	BREED
4085 ^a	0	0	0	0	0	0	0	0	0	0	TSWANA
4145	137	11255	81.4	61.68	5675	41.38	35.32	16930	124	124	TSWANA
4287	184	86400	469.6	62.69	36250	197.0	37.41	86650	2444	2444	TSWANA
4398	257	31425	122.3	63.63	18090	70.35	46.37	49425	1029	192	TSWANA
4585	187	53050	283.2	60.96	33800	180.8	39.64	86850	2413	464	TSWANA
7026	286	268910	940.3	66.53	132475	463.9	33.47	401385	7109	1566	SAANEN X BOER
7047 ^b	91	12315	135.3	70.91	5820	63.9	29.69	18135	533	199	TSWANA
7065 ^b	138	186460	1351.1	65.50	100750	729.7	33.50	287210	13677	2081	SAANEN
7076	122	231350	1896.2	58.03	173200	1419.7	41.92	404550	8795	1256	SAANEN
7106	324	295810	913.0	68.06	140425	432.6	31.64	446235	8554	1346	SAANEN
7115	247	131420	532.1	66.23	66470	269.4	33.72	197890	4398	801	TSWANA X BOER
7214	271	86600	319.2	61.06	54825	202.3	38.94	141425	3626	522	TSWANA X BOER

a #4085 died while giving birth

b #7065 died of rumen acidosis

One goat never did produce as she was early in gestation when purchased and died giving birth. One other doe died of rumen acidosis from over eating the concentrate. She had however already been in production 138 days. Her record was included in the analysis. Daily mean total milk production varied from 124 millilitres minimum to a maximum of 464

millilitres for Tswana goats. Daily means for Saanen does ranged from 1256 millilitres per day to 2081 millilitres per day. The cross-bred goats ranged from 522 millilitres to 1566 millilitres.

The same data were compiled for each of the four breed types of goats and are presented in Table 2.

There are several interesting points in this set of data.

- (a). All breeds and individuals had about the same morning (64 percent) and evening (36 percent) percentage production.
- (b). The Tswana does had the fewest average days in milk per doe, 171 compared to cross-breeds with 256 and 259 days, and the Saanens with 261. One of the Saanen does only had a 138 day lactation because of her death. None of the does were dried off until their production dropped below 50 millilitres per day.
- (c). Mean daily milk production by breed was especially interesting in that the leading average was produced by the Saanen x Boer doe, closely followed by the pure Saanen.
- (d). Tswana cross goats produced twice as much as the pure breed Tswana. This was due in part to the fact that there was a 66 percent increase in the number of days that the cross breeds can be milked.

TABLE 2. PRODUCTION INFORMATION PER DOE, BY BREED

	TSWANA	SAANEN	TSWANA X BOER	SAANEN X BOER	ALL BREEDS
NUMBER IN BREED	5	3	2	1	12
DAYS IN MILK PER DOE	171	261	259	256	201
MEAN WEEKLY A.M. PRODUCTION ml.	762	6047	2595	5114	2935
PERCENT A.M.	62.87	63.26	64.25	66.33	63.96
MEAN WEEKLY P.M. PRODUCTION ml.	450	3512	1444	2596	1654
PERCENT P.M.	37.13	36.74	35.75	33.67	36.04
MEAN WEEKLY PRODUCTION ml.	1211	9559	4039	7709	4589
MEAN DAILY PRODUCTION ml.	294	1439	655	1566	878

In considering feed intake per goat (Table 3), the amount of each type of feed, fed to each goat per week, was summed to obtain total weekly hay and grain intake. Then the total intake of hay and grain (in kilogrammes) was calculated for the lactation period. These figures were later used in determining the cost of feed used in production. Table 3 shows that there were wide variations in the amount of feed consumed. In part, the variation is attributable to the differences in goat size and the type of feed used. The supply of feed was not always consistent and the quality also varied. Additionally, in some instances there was considerable waste. This waste was not considered when calculating the cost per litre of milk.

TABLE 3: FEED INTAKE PER GOAT

GOAT NUMBER	WEEKLY TOTAL HAY INTAKE-KG	WEEKLY TOTAL GRAIN INTAKE-KG	TOTAL LACTATION HAY INTAKE-KG	TOTAL LACTATION GRAIN INTAKE-KG
4085	0.00	0.00	0.00	0.00
4135	7.68	1.61	253.43	54.75
4287	6.49	3.89	201.19	116.77
4408	12.56	2.38	539.88	76.12
4585	6.22	3.48	211.47	104.47
7026	5.82	3.13	279.44	140.89
7047	5.63	1.13	189.14	36.25
7065	18.36	3.19	385.60	66.93
7076	8.82	4.62	309.01	147.95
7106	9.26	4.96	435.02	178.53
7115	8.69	3.83	338.95	107.31
7214	8.82	4.66	308.76	135.23

In order to calculate feed costs, the available data for roughages and types fed (Table 4), and concentrates and types fed (Table 5) were used. The amount of roughages and concentrates fed per week to all goats was determined for the first and second feeds, and were totaled for the lactation.

To determine the cost of feed, and thus the cost of milk per litre, the following procedure was used. The total kilogrammes of each major feed ingredient was divided by the total kilogrammes of roughage or grain fed to all goats. The resulting percentage was multiplied by the average price per kilogramme of each of the major feed ingredients. The resulting figures were added together to obtain the price per kilogramme of hay and grain fed. The average price for grain was P0.17 per kilogramme, and the average cost for hay was P0.1625 per kilogramme.

To determine the cost per litre of milk, the total hay fed per lactation was multiplied by 0.1625, and the total grain consumed per lactation was multiplied by 0.17. These total costs of feed were added together and divided by the total production in litres.

TABLE 4: ROUGHAGES FED DURING LACTATION TO ALL GOATS

FEED	FED AS 1ST ROUGHAGE KG	MEAN PER WK KG	FED AS 2ND ROUGHAGE KG	MEAN PER WK KG	TOTAL KG FOR LACTATION	PERCENT OF ALL FODDER
LAB LAB HAY	1201.62	10.38	118.84	5.30	1623.46	29
COW PEA HAY	5.00	2.50	0.00	0.00	5.00	<1
DRY CROP FODDER	1050.24	5.87	51.38	2.34	1101.62	20
LEUCAENA FRESH	3.00	1.00	30.16	3.35	33.16	<1
LEUCERNE HAY	1453.90	8.87	181.01	5.59	1934.91	35
DRY GROUND NUT	733.88	12.23	127.76	5.55	861.64	15
GRASS HAY	0.00	0.00	28.30	4.72	28.30	<1

TABLE 5: CONCENTRATES FED DURING LACTATION TO ALL GOATS

FEED	FED AS 1ST ROUGHAGE KG	MEAN PER WK KG	FED AS 2ND ROUGHAGE KG	MEAN PER WK KG	TOTAL KG FOR LACTATION	PERCENT OF ALL FODDER
BRAN	1464.71	3.73	57.28	3.58	1521.99	86
DROUGHT CUBES	124.74	3.56	87.22	1.86	211.96	12
WASTE GRAIN	0.00	0.00	26.40	1.20	26.40	2

Table 6 indicates the total hay and grain consumed by breeds, the costs of these inputs and the feed cost per litre of milk produced.

TABLE 6: FEED COST PER LITRE OF MILK PRODUCED PER DOE, BY BREED

	TSWANA	SAANEN	TSWANA X BOER	SAANEN X BOER	ALL BREEDS
NUMBER OF GOATS	5	3	2	1	11
TOTAL KG HAY DURING LACTATION	277	377	324	279	313
COST OF HAY IN PULA	45.05	61.21	52.65	45.34	50.86
TOTAL KG GRAIN DURING LACTATION	77.60	131	121	141	106
COST OF GRAIN IN PULA	13.19	22.27	20.66	23.97	18.00
TOTAL LITRES MILK PRODUCED	50.40	376.00	169.50	401	192.70
TOTAL FEED COST IN PULA	58.24	83.48	73.31	69.31	68.87
FEED COST PER LITRE OF MILK	1.16	0.22	0.43	0.17	0.36

The time required to manage these goats was averaged between all villages and all goats. The following mean times were recorded:

- (a). Watering 1.42 minutes per day, per goat.
- (b). Cleaning 1.59 minutes per day, per goat.
- (c). A.M. Milking 2.70 minutes per day, per goat.
- (d). P.M. Milking 2.02 minutes per day, per goat.
- (e). A.M. Feeding 8.72 minutes per day, per goat.
- (f). P.M. Feeding 7.86 minutes per day, per goat.
- (g). Herding When done, required 10.13 minutes per goat, per day.

The above quoted figures totaled to a work requirement of 24.31 minutes per head, per day for each goat being milked when herding was not being practiced. With herding, the time requirement was 34.44 minutes per head, per day.

In valuing the labour for keeping milk goats in drylot, using the time frame quoted above and the Government of Botswana (GOB) minimum wage of P1.20 per hour¹, the cost for labour to keep each goat was P0.4862 per goat, per day. Using the average days in milk for all breeds (201 days), labour costs were P97.73 per head, per lactation. If herding were practiced, an additional P40.72 would be added to the cost.

To calculate the total cost per litre of milk produced, including labour, the GOB minimum wage was used. This value for labour was considerably higher than the prevailing wage in the villages, but was used because it is a standard published figure. Table 7 gives the average total cost of milk, including feed and labour, by breed and for all breeds combined.

¹. Based on a minimum wage of P9.60 per eight hour day.

TABLE 7: TOTAL COST OF PRODUCTION PER LITRE OF MILK

BREED	TOTAL PRODUCTION (LITRES)	PER LITRE PRODUCED				
		FEED COST PULA	LABOUR		TOTAL	
			NO HERDING PULA	HERDING PULA	NO HERDING PULA	HERDING PULA
TSWANA	252	1.16	0.39	0.55	1.55	1.71
SAANEN	1128	0.22	0.04	0.12	0.26	0.34
TSWANA-BOER	339	0.43	0.14	0.41	0.57	0.84
SAANEN-BOER	401	0.17	0.12	0.35	0.29	0.52
ALL BREEDS	2120	0.36	0.05	0.07	0.41	0.43

CONCLUSIONS

From the information presented in Table 7, which is in fact a summation of all data in this paper, it is apparent that if the retail price for milk were placed at P1.00 per litre, which is considerably below the retail price in the Francistown area (P1.63 average), then milking goats could be a successful enterprise, providing straight bred Tswana goats were not used.

It appears from the data presented that the individuals of the Tswana breed that were tested in this trial did not respond to intensified management and increased nutrition as far as milk production is concerned.

However, any procedure to increase milk production of Tswana goats could make milking these animals a viable enterprise. This could include selection from within the breed which has not been attempted, or by cross-breeding as has been demonstrated with the Tswana x Boer cross-breed. A Tswana x Saanen cross-breed should also prove very productive.

When comparing production achieved under traditional methods with the drylot method, the mean increase in production was 14 percent, i.e., from 258 millilitres per day to 294 millilitres per day (Theford et al., 1990a).

To promote milk production as a viable enterprise, a number of constraints must be overcome. These are listed below, but not necessarily in order of priority:

- (a). Improved breeding management either through cross-breeding or selection for the specific purpose from the indigenous goats.
- (b). Improved husbandry.
- (c). Improved pasture management and fodder production.
- (d). Improved storage for feed.
- (e). Improved housing and facilities for goats.
- (f). Increased farmer knowledge of animal nutrition, feeds and feeding.
- (g). Development of an educational programme on sanitation and hygiene of milk production.
- (h). Development of marketing strategies and regulations for marketing procedures.

If these constraints are addressed and further research is conducted into the breeding of a goat that can produce more milk, then a small dairy enterprise, using goats, would be a viable technological advancement.

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