AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT (ATIP)

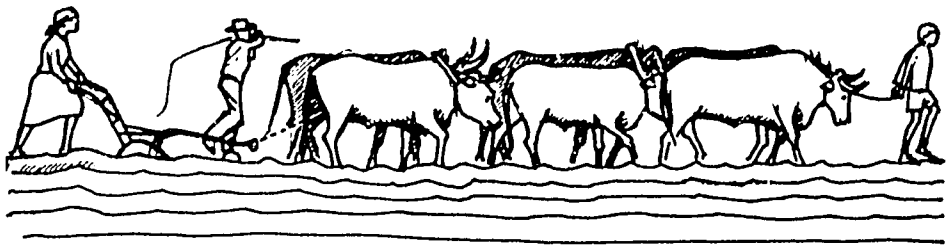
TECHNIQUES AND CONSIDERATIONS FOR KRAAL AND SHELTER CONSTRUCTION FOR SMALLSTOCK

BY

T. R. THEDFORD, K. M. KELEMOGILE, F. D. WORKMAN, AND J. A. BAATHODI

ATIP WORKING PAPER

ATIP WP-27



Agricultural Technology Improvement Project
Department of Agricultural Research
Ministry of Agriculture
P/B 0033
Gaborone
Botswana

Telephone 352381 Ext. 260
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DEPARTMENT OF AGRIC. RESEARCH
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ADDRESSES:

P/BAG 0033
GABORONE

P.O. BOX 10
MAHALAPYE

P.O. BOX 10275
TATITOWN (FRANCISTOWN)

PREFACE

ATIP research papers are prepared and circulated to make ATIP research findings and recommendations readily available in a timely manner to GOB personnel and researchers interested in Botswana farming systems. This paper has been reviewed by the Chief Animal Production Research Officer, in DAR, Dr. L. Setshwaelo. However, the opinions and observations are those of the researchers alone.

This paper was generated from data taken from costs and observations over an eighteen month period, August, 1988 until January, 1990, from structures built in Mathangwane, Marapong, and Matobo in the Tutume Agricultural District.

The authors positions at ATIP and current assignments are:

Dr. T. R. Thedford
Professor of Veterinary Medicine and Surgery
Oklahoma State University
Stillwater, O.K. 74078. U.S.A.

Dr. F. D. Worman
ATIP Agricultural Economist
Assistant Professor Department of Agricultural Economics
Kansas State University
Manhattan, Kansas. 66506. U.S.A.

Mr. K. M. Kelemogile
ATIP Technical Officer
Department of Agricultural Research
Ministry of Agriculture, Government of Botswana.

Mr. J. A. Baathodi
Enumerator
Department of Agricultural Research
Ministry of Agriculture, Government of Botswana.

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The authors also wish to acknowledge the contribution of Dr. R. Gray, Animal Scientist, formerly with ATIP, who initiated the work in kraal construction.

TECHNIQUES AND CONSIDERATIONS FOR KRAAL AND SHELTER CONSTRUCTION FOR SMALLSTOCK

CONTENTS

ABSTRACT	1
INTRODUCTION	1
OBJECTIVE	1
JUSTIFICATION	1
DESIGN AND APPROACH	2
RESULTS	2
CONSIDERATIONS FOR KRAAL AND SHELTER CONSTRUCTION	4
DISCUSSION AND CONCLUSIONS	5
REFERENCES.	7

TABLES

1.	LIST OF MATERIALS.	4
2.	LIST OF CONSTRUCTION MATERIAL PRICES.	4
3.	AVERAGE REQUIREMENT AND COST PER ITEM OF BUILDING MATERIALS	7

FIGURE

1.	SUGGESTED DESIGN OF KRAAL AND SHELTER	3

ABSTRACT

Several designs of kraal and shelter construction were looked at from the point of view of being easy and not too expensive to construct, being secure from predators, and providing adequate storage space for fodder and shelter from the elements. A design based on information gained from constructing nine sets of facilities and using materials both purchased and obtainable from the immediate area was selected. The following discussion describes the design and reasons for selection, and a list of materials used.

INTRODUCTION

The previous animal scientist assigned to this project (i.e., R. Gray) had started construction of several goat kraals and had promised most of the cooperating farmers assistance in constructing them. He left Botswana before this was completed. It was decided by the senior staff at Francistown that it was important to honour this commitment, therefore design and technical assistance was offered. Little in the way of monetary assistance, other than using those supplies already purchased, was provided.

At the same time that the farmers were building their [illegible] research-demonstration kraal, including a shelter and fodder storage area, was constructed in the ATIP compound of each of the three villages. All of these kraals were built of native materials, as far as possible, and the costs were recorded. These compounds and shelters were designed to last at least 10 years, to be more secure than the typical thorn brush kraal constructed by most villagers for their goats, and to be built with as little cash outlay as possible.

Each of these kraals were subjectively evaluated to meet the expressed criteria and a number of suggestions resulted.

OBJECTIVE

The original objective of building goat kraals was obscured in the change of personnel in 1988, but initially arose out of a national meeting on goat research. The objective since that time was to develop a simple design for a kraal, which included shelter and fodder storage areas, that was safe, workable and as inexpensive as possible. With the expense factor being foremost in our mind, native materials and local labour were used wherever possible.

JUSTIFICATION

Thorn brush kraals do a credible job of containing goats. They do not however, offer shelter from either sun or rain, or provide a method of storing fodder for supplemental feeding of livestock.

Farmers produce a considerable quantity of valuable crop by-products from their farming operation each year. Maize and sorghum stover could be harvested and stored for future use if it could be kept away from the ground and out of rain. Dried groundnut vines, cowpea vines or purpose grown fodder crops such as lucerne, lab lab, or leucaena are all valuable high protein fodder crops that could be easily stored for more efficient use during the dry season. It is probably more important to keep fodder off the ground to protect it from termites than for it to be covered to protect it from rain, even though rain damage will greatly decrease the feeding value of the fodder.

With the improved facilities, better management would be encouraged, which in turn would have a positive effect on health and production. Less death loss and more productive animals usually lead to better utilization of the animals by their owners.

DESIGN AND APPROACH

Several designs were tried, and the following appears to be the most efficient and least expensive procedure to follow.

Numerous materials were tried for the different components of the building. Fencing wire of the diamond design, vertical mophane poles closely spaced and vertical mophane poles spaced at 4 to 6 cm. were used as fencing. Creosoted gum poles as well as mophane poles were used as fence posts and the same materials were used as flooring for the fodder storage area. Thatch, brush, and sheet iron were used as roofing materials.

All labour was hired on a contract basis except where the farmers did the labour themselves. Hired labour came from workmen who lived in the village and contracted for the job themselves.

All evaluations were made on a subjective basis. Construction costs were derived from actual costs of material used and for paid labour.

Plans were drawn up using figures for space allocation and design ideas from information provided by Haenlein and Ace (1984) in their handbook on goats. These ideas were modified to make them as simple and cost effective as possible, and the builders themselves were given as much latitude as they wanted, so long as they adhered to the basic design.

To assist the builders to understand what was wanted, a scale model was built using sticks for posts and string for wire. This proved very helpful to the builders and prevented any potential misunderstanding.

All native poles (mophane) that came in contact with the ground were treated with used crank case (motor) oil to retard damage by termites.

RESULTS

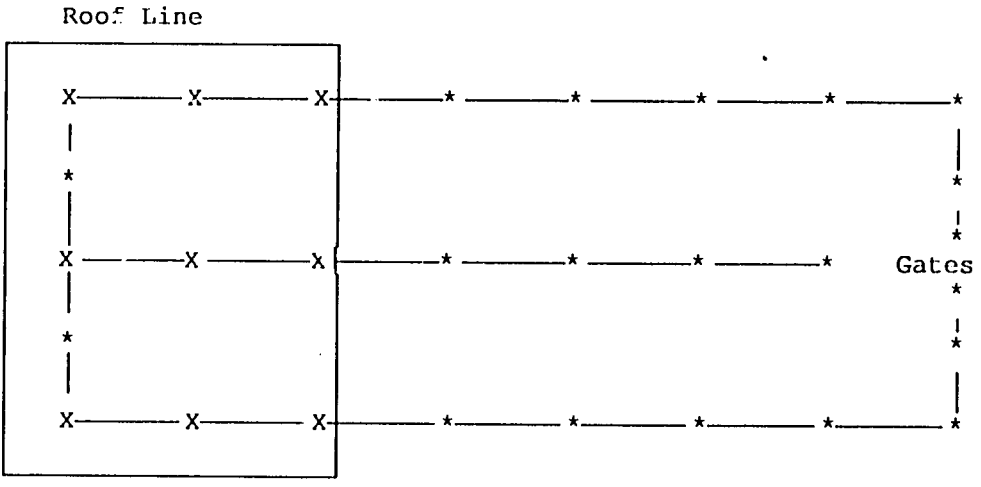
Three research and demonstration kraals were built, one each at the ATIP compounds in Mathangwane, Marapong, and Matobo. Six kraals were constructed near farmers' compounds, three each in the village of Mathangwane and Marapong. Three were offered at the village of Matobo; two were actually started but none were finished, probably due to labour demand on a government-sponsored labour-intensive road construction project in the village. It was very hard to get help of any kind at this time.

The kraal design selected, Figure 1, provided enough room to hold a maximum of 54 goats allowing an average of one square meter per goat. The kraals were nine meters long by six meters wide, divided down the center length-wise to make two pens of equal size. A shelter across the end measured three meters deep by six meters wide. A storage "loft" providing eighteen cubic meters of storage space was suggested for each shelter. Three of the six farmers built fodder storage areas and all three of the ATIP research and demonstration kraals were built with storage areas.

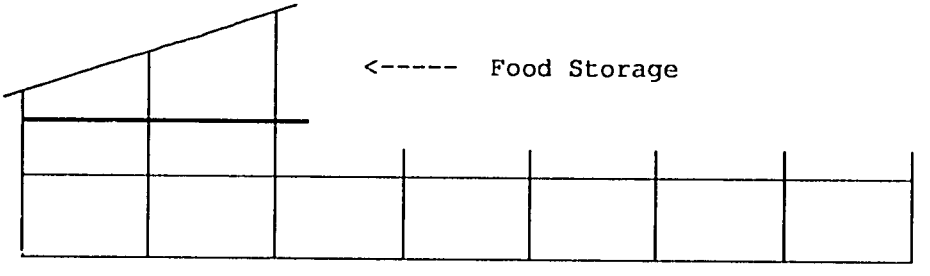
The materials used in the construction are listed in Table 1. The cost of these materials, as

FIGURE 1: SUGGESTED DESIGN OF KRAAL AND SHELTER

A. VIEW FROM THE TOP



B. VIEW FROM THE SIDE



seen in Table 2, were calculated at actual cost of procurement at retail price or the price required to cut poles as the case may be. Thatch, as a roofing alternative, was not used at this time as it was selling for two pula per small bundle and was thought to be too expensive. One farmer did however, use thatch that she had on hand and it proved very satisfactory as a roofing material, so long as the edge of the roof was high enough so that livestock could not reach it to eat it.

TABLE 1: LIST OF MATERIALS

KRAAL:		
	21 posts	2.0 meters long
	400 droppers	1.5 meters long
	8mm wire	150 meters
	2mm wire	25 kg.
	400mm staples	4 kg.
	Cement 50 kg. bags	2
SHELTER:		
	10 sheets roofing	4 meters long
	4 kg. of 150mm common nails	
	100 of 80mm roofing nails	
	3 posts	4.5 meters long -- front uprights
	3 posts	3.5 meters long -- middle uprights
	3 posts	2.5 meters long -- back uprights
	12 poles	3.5 meters long -- floor and roof supports
	6 poles	4.0 meters long[a] -- rafter supports
	10 poles	8.0 meters long[a] -- rafters
	80 poles	3.0 meters long -- flooring for loft

a. To get this length, smaller and shorter poles may be spliced together.

TABLE 2: LIST OF CONSTRUCTION MATERIAL PRICES

Galvanized Sheet Iron Roofing	P 6.85 per meter
Diamond Wire P67.74 for 30m.	P 2.26 per meter
4mm Heavy Wire	0.13t per meter
2mm Tie Wire	P 66.96 per 50 kg.
Treated Gum Poles -- 2m. long	P 3.55 each
Roofing Nails	P 10.15 per 100
150mm Common Nails	P 2.20 per kg.
Cement for Corners and Shelter	P 7.99 per bag
440mm Staples for Heavy Wire	P 2.64 per kg.
Mophane Poles -- All that were needed	P155.00
Labour -- Complete Job was Contracted	P 75.00

CONSIDERATIONS FOR KRAAL AND SHELTER CONSTRUCTION

The following is a list of site and construction criteria that should be considered when designing and building structures.

(a). The structure should be built on a slight slope with the shelter on the highest part.

(b). Back of the shelter, i.e., slope of the roof, should face the direction of the prevailing wind and rain. In our area this is the north east.

(c). The roof line should extend over the feed storage area by 0.5 to 1 meter on all sides to protect the fodder from blowing rain and to keep runoff water away from the

kraal.

(d). The draining side or rear of the shelter could be guttered to collect rain water for animal and/or household use. Otherwise the soil should be channeled so that the rain water will drain away from the kraal.

(e). The minimum area per animal when using the kraal for night bedding only should be approximately 0.75 square meters for individual goats. For does and kids, assuming an average of 1.5 kids per doe, this should be increased to 1.25 to 1.5 square meters per unit for night housing. For most situations an average space allowance of 1 square meter per goat is acceptable.

(f). If the kraal can be sloped from the middle to the outside it will increase drainage and facilitate cleaning. Kraals should be cleaned every month or two depending on the number of goats kept in the kraal. Removing the manure regularly will allow it to be composted for about one year, thereby destroying parasite eggs and noxious weed or tree seed, thus making the manure more valuable as a fertilizer source.

(g). Each cubic meter of fodder storage will hold approximately 40 kg. of fairly well packed fodder[1]. If milking does are isolated and supplemented at night, they should be fed about 1.5 percent of their body weight per head each day. If the average weight is 38 kg., that would amount to about 0.5 kg. per head per day. To supplement each milking doe, she would require 90 kg. of fodder for a 180 day lactation. This would require about 2.25 cubic meters of fodder storage per supplemented goat. A triangular shaped shed of 6 meters by 3 meters by 2 meters high in front, would contain about 18 cubic meters of storage space or enough fodder to supplement 8 milking does for 180 days.

DISCUSSION AND CONCLUSIONS

Kraal construction for night protection from predators of smallstock has been a traditional practice in Botswana. Materials used have primarily been thorn bushes and limbs cut from acacia trees. In some cases logs were used. There is still plenty of thorn brush available and it will probably continue to be used by many farmers. However, as these farmers are now living in villages and do not move from place to place as they have done in the past, more permanent structures seem more practical.

In some village areas building materials are becoming more difficult to obtain. If larger, longing lasting materials, such as, logs or poles rather than brush, can be utilized and treated so that termites do not destroy the wood, it is reasonable to assume a minimum of ten years of use can be gained from such a structure. Over the long-term this decreases the labour and capital investment, per year, in building facilities.

Farmers are depending more and more on the protein supplied to their families from their smallstock. Makhwaje (1986) notes that 84 percent of all village farmers keep goats and most of these are kept in or near the village. Nearly all of these farmers milk goats for home consumption of fresh and soured milk. Some farmers convert their excess production into cash by selling soured milk to their neighbours. Goats are slaughtered for home

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[1]. These data were supplied by the Fodder/Forage Specialist at ALDEP and are based on actual measurement and weight of stored dry fodder at the Impala Rural Training Centre in Francistown.

consumption and recently larger numbers are being sold commercially as slaughter animals to local butcheries or to the Botswana Meat Commission (BMC). The sale of animals to BMC is likely to increase with the recent completion of the BMC plant at Francistown, which intends to slaughter approximately 2000 smallstock each week.

As people progress toward a cash economy the possibility of converting smallstock resources to cash is likely to become more important. The realization of cash value of goats for sale as meat, and milk as a cash source, should increase the farmer's concerns for husbandry practices that will conserve those resources and generate cash flow.

Improved kraals, shelters, and fodder storage facilities should allow the farmer to decrease some of the hazards of production, such as wet and chilled young kids on the occasions when rain falls at night, especially while kids are three months of age or less. Also, if supplemental feeding of those does who are being milked is practiced, a storage area for fodder is necessary. The recommended type of construction is durable, relatively inexpensive, especially if local materials and farm source labour are used, and fulfills the requirements of containment, protection, shelter and storage.

Of the kraals and shelters built by ATIP, the best combination of materials and supplies was determined to be post and pole construction of local mophane trees. These could either have the bark peeled or left on depending on the farmer's preference. Fence construction was deemed best when using mophane droppers, closely spaced together and attached to three horizontal, 4 mm. wires by using 2mm. wire as tie wires. Floor construction for the fodder loft was made of mophane poles and the roofing used was galvanized sheet iron. Sheet iron was used because thatch had become more expensive, per square meter, than iron sheets. If thatch or grass can be locally obtained it will work equally well, and should be used. The materials and supplies suggested are listed in Table 3. Prices prevailing at the time of construction are also listed in Table 3.

The selection of materials was based on those thought to be the most economical for the value. Although treated gum poles and diamond wire were used in constructing some of the kraals, they were deemed too expensive for the average farmer. One of the participants however, purchased diamond wire and put it up in preference to mophane poles.

To prevent termite damage to the mophane poles, all parts that entered or touched the ground were soaked with used motor oil which was obtained at no cost from the Central Transport Organization (CTO) in Francistown. We have found this to be a good deterrent to termites damage.

The cost of this kraal and shelter building in 1989, when all inputs were purchased, was P637.37. If the farmer furnished his own labour for pole cutting and construction, and used iron sheets for the roof, the cost was reduced to P407.37. When all native materials were used and all labour for procurement of materials and construction were provided by the farmer, the cost was reduced to P88.92.

To put these costs into perspective, i.e., value in goats, the P637.37 could be related to thirteen, P50.00 goats (about what a 1 to 1-1/2 year old goat is worth) or eight large slaughter goats valued at P80.00 each. The least expensive kraal, P88.92, could be paid for by less than two P50.00 goats and slightly more than one, P80.00 goat. When average death losses reported by both APRU (Senyatso, 1984) and ATIP (Grey, 1987), run from 9 percent to 64 percent and the average number of goats owned in Tutume Agriculture District is slightly over 22 head and when the breeding herd is 58 percent of that 22 head or 13 does of breeding age, then a birth rate of approximately 125 percent would give 16 kids born per year. With a death loss of 64 percent (Grey and Baathodi, 1988) this would equal

10 kids per year. If this number could be reduced by 50 percent with improved husbandry practices, an additional five goats per year would be available to generate cash. With five additional goats per year, the most expensive kraal could be repaid in about three years. This is an excellent pay back time on any farm enterprise.

TABLE 3: AVERAGE REQUIREMENT AND COST PER ITEM OF BUILDING MATERIALS

Roofing -- 4 meters long @ P30.83 per sheet -- 10 sheets	P308.30[b]
Mophane Poles and Droppers	P155.00[a]
4mm Heavy Wire @ 0.13t per meter -- 150 meters	P 20.10
2mm Tie Wire -- 25 kg. @ P66.96 per 50 kg.	P 33.48[b]
Roofing Nails -- @ P10.15 per 100 -- 100	P 10.15[b]
150 mm. Common Nails -- @ P2.64 per kg. -- 4 kg.	P 8.80
400 mm. Staples @ P2.64 per kg. -- 4 kg.	P 10.56
Cement @ P7.99 per 50 kg. -- 100 kg. or 2 bags	P 15.98[a]
Labour	P 75.00[a]
PRICE WHEN ALL INPUTS WERE PURCHASED	P637.37
IF FARMER DID ALL OR PART OF THE WORK HIMSELF:	
By removing those costs marked [a], cost if farmer cuts poles and builds it himself/herself	P407.37
By removing those costs marked [a] and [b], cost if farmer cuts poles and builds it himself/herself, and uses native thatch or grass for roofing, and collects it and roofs it himself/herself	P 88.92

Improved housing has yet to be shown to reduce death loss. However, with annual death losses of kids above 50 percent it is obvious that there is room for improvement. Most of these losses appear to be related to management and husbandry, including poor nutrition of the dam as well as the kid, severe external parasite infestation, occasionally internal parasitism and stress-related diseases. Housing, and the protection it offers, obviously relates to this problem. If these death losses could be brought more in line with those of developing countries who have improved their management and husbandry practices, below 25 percent, (Wilson, 1989), it would be of great benefit to the village farmers of Botswana.

It is assumed that by improving the design and construction of smallstock shelters and containment facilities the management and husbandry levels of farmers would be enhanced. This design is simple and offers some distinct advantages in permanence, feed storage capacity, and shelter. While there are other designs that will work as well as this one, it is offered as a starting place and to encourage continued work in this endeavor.

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