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Challenges of Stover Utilization among Smallholder Dairy Producers in Southern Zambia

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Abstract

The study assessed challenges of stover utilization among smallholder dairy producers in the Southern region of Zambia. The study was undertaken due to lack of information on the causes of decline in milk yield upon onset of dry season despite the abundance of crop residues on smallholder dairy farms. The objective of the study was to identify and rank the factors influencing the utilization of crop residues. A semi-structured questionnaire, interviews and focus group discussions were used to collect information from smallholder dairy farmers. Outcomes of the study provide relevant information for interventions and policy formulation for improvement of the dairy industry in Zambia. Ratings of reasons for poor utilization ranged from 67% for termite attack, poor quality and lack of knowledge to 42.8% for storage problem. Outcomes of this study have revealed that several factors affect the utilization of dry maize stover as feed for livestock. Poor quality, termite attack and lack of knowledge ranked highest in importance, followed by storage problems. A combination of termite attacks and storage problems were treated by some farmers as a single constraint in Southern Zambia. Adoption Rates for strategies of handling poor quality of maize stover were observed to be forage legume (100%), concentrate supplementation (58%), poultry waste (17%), overnight soaking in salty water (17%) molasses addition (8%), overnight soaking in water (8%), spent brewer's grains (0%), and urea treatment (0%). Most smallholder farmers lack knowledge of stover improvement technology.=

Keywords: Challenges; stover; utilization; smallholder; dairy

Abbreviations: WHO: World Health Organization; FAO: Food and Agriculture Organization; NGO: Non-governmental organization

Introduction

The success of a dairy industry will be judged by how much milk is produced by cows at farm level. Milk yield for each individual cow is influenced by several factors such as water, feed quality and quantity, genetic composition, temperature, and other factors such as stress level. Pandey and Voskuil [1] indicated that water is an important factor in milk production since milk contains 87% water. During plenty of farm resources, appropriate methods of improving resource utilization should be established. Lack of improvement in available farm resource utilization such as crop residues is limiting production. Appropriate feed processing technologies would translate into a high and predictable price of milk [2]. The depression of the curve in **figure 1** at Batoka Livestock Research Station shows the decline in milk yield during the dry season. Improvement in feeding strategies during the dry season could help to mitigate the loss in milk yield.

Milk Supply and Demand in Zambia

Despite its high potential, the dairy sub-sector in Zambia has over the years been unable to supply the much-needed milk with only an annual supply of about 125 million liters against a population of 12 million people in 2005. There was a shortfall of about 25% in the market [3]. Pandey and Voskuil [1] pointed out that the recommended annual consumption of milk by the WHO and FAO is 2000 million liters per year. This means that the national milk harvest falls far below the WHO and FAO recommended annual national consumption.

The United Nations Development Programme [4] indicated that small holders tend to disappear from dairy production in

crisis periods. Most of the time small holders are more vulnerable, as they took up dairy recently and did not have enough time to gather sufficient resources to pay back their debts and enlarge their herd.

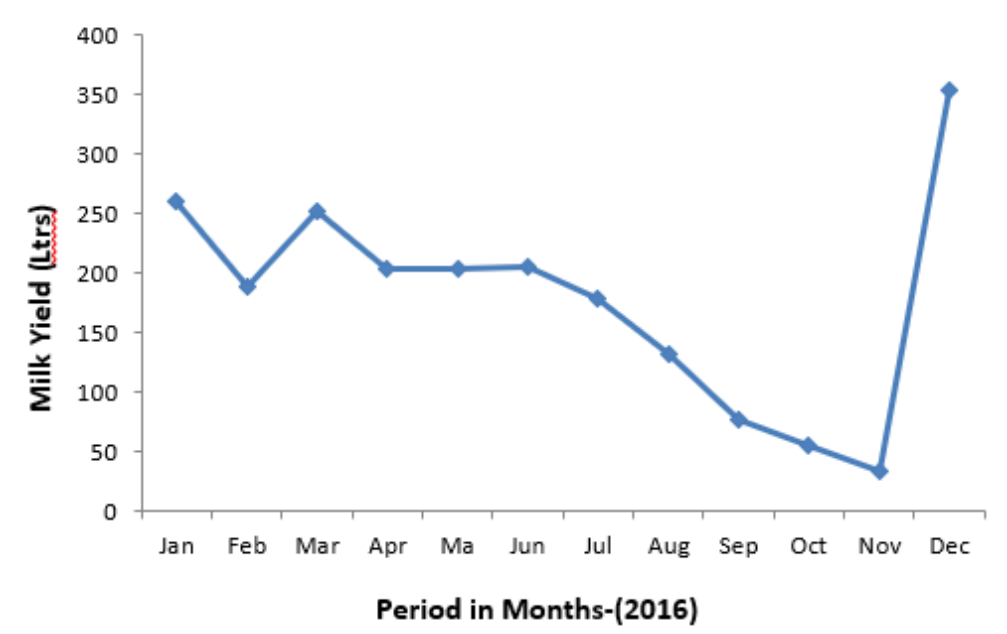

Figure 1: Mean Monthly Milk Yields at Batoka Livestock Research Station

It was concluded by Mumba, Pandey, and Van der jagt [5], that a substantial amount of milk can be obtained from traditional cattle farmers to meet the demand for raw milk in the country and to enhance the utilization capacity of milk processors if appropriate technology is employed by smallholder dairy farmers. Supplementing maize stover with suitable sources of nitrogen and energy such as legume stover may constitute the only cheap feeding strategy in conventional tropical dairy production systems.

Factors Affecting Stover Quality and Utilization

Studies by Syomiti, Wanyoike, Wahome and Kuria [6] revealed that the efficiency with which the available stover is utilized is compromised by poor handling before feeding. Urea, a cheap source of ammonia for the chemical treatment of poor-quality crop residues, was poorly adopted by farmers. Other strategies adopted by farmers to overcome the identified constraint of low quality, such as supplementation with molasses, were also inappropriate.

Syomiti et al. [6] further observed that the major factors affecting the utilization of dry Maize stover as feed for livestock ranged from stover quality to handling technology. The storage problem of the stover ranked first in importance with an average of 37%, followed by poor quality (31%) and then by termite attacks during storage (20%). A combination of termite attacks and storage problems were treated by some farmers in the Thika district as a single constraint, and this accounted for 13%. The proportion of respondents citing poor quality and storage problems as constraints to efficient utilization of maize stover was higher in Kiambu than Thika. This may be explained by the fact that the constraint of feed inadequacy is more critical due to smaller land holdings averaging about 1-2 acres in the Kiambu district, as compared to an average of approximately 4 acres in the Thika district [6]. Thus, in Kiambu, maize stover as a resource for animal production is more important than any of the other constraints. Wealth, climate and local conditions, farming system, access to resources, location of land and marketing infrastructure are important determinants in utilization of forage resources available on small holdings [7].

Mukumbuta and Yambayamba [8] reported that effects of dry season on livestock nutrition in Zambia are serious and it is vital to devise concerted strategies to maintain production levels during the dry season. Effects of drought do not only affect smallholder dairy farmers but also large farms and agricultural research institutions. The challenge to researchers, extensionists, scientists, NGOs and policy makers is how to help farmers manipulate factors under their control, using the resources available on farm to achieve profitable milk production [7].

Statement of the Problem

Drought occurrence and prolonged dry periods in many parts of Africa are not uncommon. Generally, it has led to poverty

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at both household and national level. This results from reduced livestock performance and high mortality because of increased malnutrition. Consequently, smallholder farmers experience perpetual annual loss of income. This has led to increased food insecurity and poverty.

The main constraint in livestock production under the smallholder sector in Zambia is shortage of feed. The volume of milk sales shrinks during winter and the hot dry season (August to October) due to poor feed quality and smallholder farmers have no nutrition or feeding technology to mitigate the effect of seasonal change on their business. However, while it is acknowledged that feed is a major problem in livestock production, at the same time there are vast quantities of under-utilized feed resources such as grass during the rainy season, crop residues and leguminous plants. For example, Li, Xu, Liu, and Wang [9] reported that in 1996 there was 2.9 million metric tons of maize stover that was produced. According to Areghore [10], the maize stover produced annually in Zambia accounts for more than 60% of crop residues produced under the smallholder sector. Other crop residues reported include sorghum stover (78,000 metric tons), wheat stover (51,000) metric tons) and rice (17,000 metric tons).

Dzowela [11] reported that little information is available on the extent to which smallholder farmers in Zambia use crop residue in livestock feed. He went further to indicate that it is unlikely that these resources are under-utilized. Even when they are utilized, farmers may not be able to incorporate them effectively year-round in livestock feeding programs because they lack suitable storage facilities and technical know-how on treatment, processing methods and ration formulation. The real problem is that much of this stover goes to waste. Many smallholder farmers do not look at crop residues as animal feed resource that can be improved in terms of quality so that they become more valuable to animals. Rather, they look at them as a nuisance and simply leave them in the field to rot and later burn them. Similarly, the vast natural grasses in the rangelands are left to dry up thereby losing nutritional value completely. Furthermore, most smallholder farmers do not grow any fodder crops that can be used for supplementation during the dry season. The consequence of all these is that the animals under the smallholder sector do not receive adequate nutrition thereby severely affecting their productivity: daily gains are unacceptably low; fertility level is very low thereby significantly affecting reproduction; immunity becomes adversely affected leaving the animals vulnerable to different types of diseases; the end products (meat and milk) are of very low quality and therefore cannot fetch good prices on the market. With all these problems, the ultimate is that smallholder livestock farmers are faced with high levels of poverty and the problem seems to be perpetual. For smallholder farmers with limited production capacity, finding enough feed in the winter months to maintain good milk production is always a problem. Many are forced to buy hay, concentrates or silage just to keep their animals alive and are unable to benefit due to the higher prices paid for animal feed in the winter months [12]. The purpose of the study was to evaluate the main factors affecting stover utilization among smallholder dairy producers in Southern Zambia:

Materials and Methods

Study Site

The study was carried out on a livestock breeding farm of Golden Valley Agricultural Research Trust-Livestock Centre near Batoka town. Batoka town lies 290 km South of Lusaka along the Great North Road. It lies at an altitude of 1 400 m above sea level, latitude of 16°48' 54" E and longitude of 26°58' 36" S. The research site is in Region I and IIa of the Zambian Agro-ecological Zone which receives an average annual rainfall of between 800 mm and 1 500 mm. The ambient temperature varies between 14°C and 28°C. Soil types range from loam to clay loam. According to the central statistics census record of 2012 [13] Batoka had a population of 180, 673 (2010 Census CSO) whose main activity is livestock farming.

The climate is sub-equatorial characterized by one rainy season (from November to March) and one cool dry season (April to July) and one hot dry season (August to October). Agriculture is oriented towards food crops such as maize, tubers and legumes. The animal species kept are cattle, sheep, goats, pigs, and poultry (guinea fowl, chicken, pigeon, duck, turkey).

The study commenced in November 2016 with the growing of maize by 60 farmers who supply milk to Batoka Dairy Co-operative Society. A semi-structured questionnaire was pre-tested and later administered to the farmers to record and classify factors influencing stover utilization among smallholder dairy producers in Southern Zambia.

Results

Through interaction with farmers, challenges faced by dairy farmers and value of indigenous knowledge on livestock feeding was gathered and recorded. Follow-ups to individual farms revealed several contributing factors to the poor performance of the dairy industry in Southern Zambia. These included- lack of investment capital, poor nutrition, high cost of dairy breeds, lack of training in animal husbandry, poor marketing, and lack of veterinary services.

Utilization of Maize Stover

Outcomes of focus group discussion revealed that smallholder dairy farmers do not fully utilize maize stover. They reported that they do not see any feeding value and that burning these materials improves soil fertility. These outcomes are in consonance with those of Urio and Kategile [14], who reported that the use of maize stover as a ruminant feed is limited to large scale farms where adequate quantities are produced and grinding mills are available. Reasons for poor utilization of maize stover among smallholder farmers in Batoka varied among farms (Table 1). Ratings of reasons for poor utilization ranged from 67% for termite attack, poor quality and lack of knowledge to 42.8% for storage problem (Table 1).

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Table 1: Rating of Constraints to Utilization of Maize Stover (% of respondents)

Limiting Factors to Stover Utilization									
		PQ	(%)	TA	(%)	SP	(%)	LK	(%)
Rank	Top	8	67	8	67	5	42	8	67
	Medium	2	17	1	8	5	42	0	0
	Low	2	17	3	25	2	17	4	33
Total		12	100	12	100	12	100	12	100

Strategies for Improving Quality of Maize Stover

The adoption rates for the various methods of handling the poor quality of Maize Stover are presented in Table 2 and Figure 2 below. Most smallholder farms used forage legumes to supplement the poor quality of maize stover. No technology was used to improve the form in which the legume stover was offered. The legume stover was offered in its natural raw form.

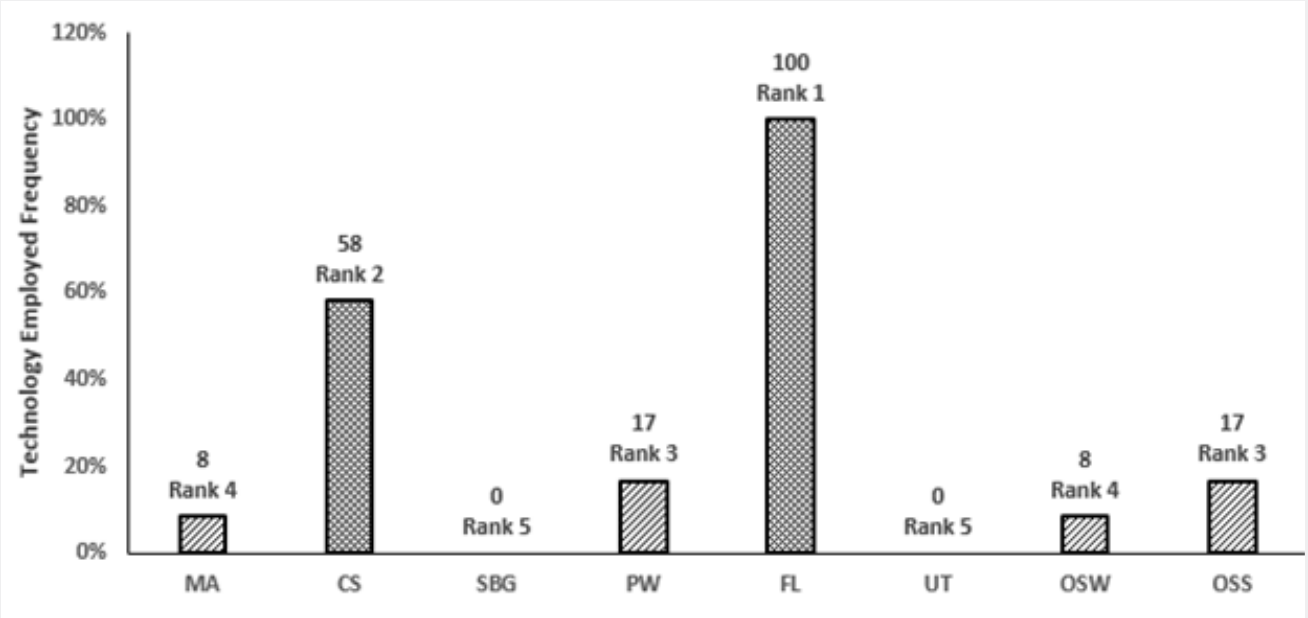

Figure 2: Farmer Strategies for Handling Poor Quality of Stover

Table 2: Adoption Rates for Strategies of Handling Poor Quality of Maize Stover (% respondents)

Technology employed to mitigate feed shortage																	
		MA (%)		CS (%)		SBG (%)		PW (%)		FL (%)		UT (%)		OSW (%)		OSS (%)	
Response	Yes	1	8	7	58	0	0	2	17	12	100	0	0	1	8	2	17
	No	11	92	5	42	12	100	10	83	0	0	12	100	11	92	10	83
Total		12	100	12	100	12	100	12	100	12	100	12	100	12	100	12	100
Rank		4		2		5		3		1		5		4		3	

Discussion

Ørskov [15] emphasized that the most important single factor in addressing small-holder challenges is the correct identification of constraints. It is further emphasized that this can only be done by understanding and involving the target group, otherwise the wrong constraints are often identified. The cost of new technologies must be recovered in a guaranteed sale of the excess produced. Improvements in resources are most readily accepted by producers of milk when resources are limiting production

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and when a high and predictable price of milk can be obtained. Appropriate methods of improving resource utilization are cardinal but it is emphasized that such technologies should only be attempted when resource utilization or availability is identified as the first constraint.

Maize being the staple food is the most popular crop among smallholder farmers in Southern Zambia and provides the much needed stover during the dry season. A visit to farms revealed that most of the maize stover is left unutilized in the field after harvesting. Farmers attributed their failure to maximize the utilization of this material to lack of post-harvest technology for value addition and stover handling. The study has also shown that when stover is used on smallholder farms, no value addition or nutritive improvement is used and the stover was fed to animals in its poor quality. This results in no significant improvement in milk yield on smallholder dairy farms.

Cereal crop residues are available in abundance to all farmers and since they are low in crude protein content, there is need to supplement them with high protein legumes (soybean and groundnut). The feeding systems based on natural grazing (summer) and feeding of conserved crop residues (winter) are the most practical strategies.

Conclusion

The study has indicated that farmers lack technology for improving the quality of abundant maize stover for supplementation during dry periods. It was observed during the study that to improve the quality of maize stover farmers use legume forages. These forages such as soybean and groundnut stover are offered in the poor natural raw form without processing and with no observation of species nutrient requirements. This lack of technology does not result in significant improvement in the nutritive value of the maize stover offered to cows.

In addition, farmers should be trained in livestock feeding and utilization of abundant stover available on their smallholder farms. This training should be done in cooperation with the dairy cooperative and should be performed at a level that would achieve the highest adoption rate by farmers.

Outcomes of this study have revealed that several factors affect the utilization of dry maize stover as feed for livestock. Poor quality, termite attack and lack of knowledge ranked first in importance, followed by storage problems. A combination of termite attacks and storage problems were treated by some farmers as a single constraint in Batoka district.

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