Influence of Crop Stovers Preparation Strategy on Availability of Feeds Among Smallholder Dairy Cattle Farmers in Trans-Nzoia County, Kenya

*Okongo O. Patrick, Obara James and Kyule Miriam
Department of Agricultural Education and Extension,
Egerton University

***Corresponding author's email address:** osoropatrick64@gmail.com

Abstract

With the increasing scarcity of dairy cattle feeds farmers are turning to crop stovers in order to compliment the feed available for dairy cattle. Crop Stovers preparation involves making the crop stovers ready for use as dairy cattle feed. This involved cutting the stovers, crushing and mixing them with molasses with urea or urea alone for feeding dairy cattle. Therefore, this study examined the influence of crop stovers preparation strategy to overcome non availability of feeds among smallholder dairy cattle farmers in Cherangany, Kwanza and Kiminini Sub counties of Trans-Nzoia County. A multi stage proportionate stratified random sampling was used to select 121 smallholder dairy cattle farmers. Data was collected using a questionnaire and analyzed using percentages, mean standard deviation and regression analysis. The crop stovers preparation strategies considered were whole stovers, crushed and mixed with urea and molasses and crushed mixed with urea only. From the study it came out that during the rainy season 3.5 % of the crop stovers were either crushed, crushed and mixed with urea and molasses or crushed and mixed with urea only and 96.5% were not processed for feeding dairy cattle. However, during the dry season 53.4% of crop stovers were processed, while 46.6 % were used as dairy cattle feeds without any processing. The results also showed that during the dry season farmers prepared large quantities from maize stovers. At the same time, it also came out that farmers prepare less crop stovers during the rainy season and more during the dry season. The study also revealed that there were 65.3 % men and 34.7 % women who were engaged in smallholder dairy farming. Lastly, the study established that crop stovers preparation strategy does not influence availability of feeds.

Key words: Crop stovers, strategy, cattle feeds, smallholder, dairy, farmers

INTRODUCTION

Kenya's dairy industry is dynamic and plays an important economic and nutritional role in the lives of many people ranging from farmers to hawkers, processors and consumers (Wambugu *et al.,* 2011). The dairy industry is the single largest sub sector in Kenya and it contributes fourteen percent of the agricultural gross domestic product (Muriuki *et al.,* 2004). Feeds shortage is common in Kenya and farmers use various coping strategies to mitigate the feeds shortage namely, purchase forages and concentrates, use of dual-purpose crops from their fields such as leaf strips, thinnings, toppings, sweet potato vines and use conserved feeds (Karugia, 2011).

In Trans-Nzoia County smallholder dairy cattle farmers experience feeds shortage (Ministry of Livestock Development [MOLD], 2005) despite the various coping mechanisms that have been developed by Kenya Agricultural Research Institute (KARI) currently called Kenya Agricultural and Livestock Research Organization (KALRO (Muyekho *et al.,* 2006). According to Rees *et al.* (1998), farmers attributed the feeds shortage to small farm sizes and failure to plant improved grasses. For this study, the coping strategy to be considered is the crop stovers preparation

strategy. Therefore, the objective of the study was to establish the influence of crop stovers strategy on availability of feeds among smallholder dairy cattle farmers in Trans-Nzoia County

MATERIALS AND METHODS

Area description

The study was done in Cherangany, kwanza and Kiminini sub-Counties in Trans-Nzoia County. Trans Nzoia County is located between Mount Elgon and Nzoia and the headquarters is located at Kitale. The County borders Uasin Gishu to the East, Uganda to the West, West Pokot to the North and Bungoma County to the South. It's located at latitude 0^0 52` -$1^0$ 18`S and longitude 34^0 38`-3523`E. The county has an area of about 2460 km^2 with a bimodal rainfall pattern that ranges between 950 mm to 1250 mm annually. The altitude ranges between 1000 m to 1700 m above sea level. The County has three ecological main zones which are: Upper Humid (UH), Upper Midland (UM) and Tropical alpine (TA). The County in cosmopolitan with nearly all tribe in Kenya but majority are the Luhya community. A number of companies such as Kenya, Western, Elgon, Kapsara, New Kenya Cooperative Creameries (KCC), and various government institutions provide employment to many people living in the urban areas.

Trans-Nzoia County has five sub counties namely Saboti, Endebess, Cherangany, Kiminini and Kwanza. The sub counties arable land makes agriculture the top economic activity, where maize is widely practiced at commercial level. Other crops include wheat, coffee and beans. Commercial business is also very significant to the county's economy. There's dairy farming and tourism due to an array of touring sites. Dairy enterprise is the second most popular enterprise to maize. Other animals found in the county include poultry, bees, pigs, sheep and goats. The soils are predominantly humic ferrasols (Jaetzold and Schmit, 1995).

Methodology

The target population was 24,890 dairy farmers and the accessible population was 13,971 smallholder dairy farmers. From these using proportionate stratified random sampling 121 farmers were selected from Waitaluk ward in Kiminini sub county, Kaplamai ward in Cherangany sub county and Kwanza ward in Kwanza sub county. Primary data collection was done using a questionnaire. The data that was collected were on quantities in kilogrammes of crop stovers prepared whole, crop stovers crushed and mixed with molasses and urea and crop stovers crushed and mixed with urea for feeding dairy cattle. The other data that was collected were on farmer social economic characteristics namely age, gender, source of income, educational level and household head.

Data analysis was done with the statistical package for social sciences (SPSS). Descriptive statistics i.e., percentages, means and Standard deviation were used in describing the social economic characteristics of smallhoder dairy farmers and feeds availability. Regression analysis was used to show the influence of crop stovers preparation strategy on feeds availability.

RESULTS AND DISCUSSIONS

Gender of smallholder dairy farmers

Table 1: Gender of the Smallholder dairy cattle farmers (n = 121)

Gender	Frequency	Percentage n=120
Male	79	65.3
Female	42	34.7
Total	120	100

From the study as shown on table 1 there were 65.3 percent male while 34.7 percent female who were involved in smallholder dairy cattle farming. This agrees with Njuki and Sanginga (2013) on their study on women, livestock ownership and markets which shows that dairy cows are an asset for both rural men and women in East Africa and women own fewer productive exotic or hybrid breeds than men. The finding also concurs with that of Belay and Oljira (2016), who found that men constitute 57 percent while women constitute 43 percent in agricultural activities in a study done in Ethiopia. There are fewer women in dairy farming than men likely because men are probably are the main decision makers and women own fewer resources to invest (World Bank, FAO and IFAD, 2009). This can also be attributed to gender roles in the community where men do more rigorous work while women do light work. However, Herath (2007), in studies done in Nepal on women in livestock development in Asia found that ninety percent of women compared to seventy five percent of men are engaged in agricultural production.

Table 2: Age of smallholder dairy cattle farmers

Age	Frequency	Percentage n=120
30 years and below	7	5.8
31-40	43	35.5
41-50	35	28.9
Above 50 years	36	29.8

From the table 2, it can be seen that majority of the farmers were in the age brackets of 31-40 years and 41-50 years (74.4 %) while the age category of 30 years and below were the least (5.8%). Age contributes to application of new strategies in crop stover away from the traditional methods. This agrees with study done by Sharma (2016) on the effect of age and educational level of dairy farmers on knowledge and adoption of dairy farming practices in Kapurthala district of Punjab India who found that farmers who were 30 years and below were 20%, between 30-40 years were 32.5% and who were 40 years and above were 47.5%. He noted that the young age farmers are not interested in performing agricultural related activities because of low profitability, high initial investment capital and high labour-intensive tasks particularly at small level in the village.

Table 3: Level of education of smallholder dairy cattle farmers

Highest level of education	Frequency	Percentage n-121
None	2	1.7
Primary	45	37.2
Secondary	49	40.5
University/College	25	20.6
Total	121	100

Information on education is important because in theory education is supposed to improve productivity in all spheres of activities including agriculture (Asadullah and Rahman, 2006). Education improves access to information, new ideas and may make a farmer more receptive to advice from extension agents and be able to deal with technical recommendations that require certain level of numeracy or literacy, (Reimers and Klassen, 2012).

From table 3 above majority of the respondents had secondary education (40.5 %), followed by those with primary level (37.2%), then university or college level of education (20.7%) and finally those without any form of education (1.7%). This concurs with studies that were done by Kiptot, Franzel, Sinja and Nangole (2015) on preference and adoption of livestock feed practices among farmers in dairy management groups in Kenya where those farmers with secondary education were 44.4%, those with primary education were 30.6 %, those with university or college were 17.2 % and those who didn't have any formal education were 2.8%. Further, Asadullah *et al.* (2006) found out in Bangladesh that farmers with primary and secondary

education levels had a significant effect on agricultural productivity than those without any formal education and university education level. Abdulai and Huffman (2014) also found a positive relationship between education level of farmers and impact of soil and water conservation technology. However, Coelli, Rahman and Thirstle (2002) on studies on technical allocative, cost and scale efficiencies in Bangladesh rice cultivation, Narayanamoorthy (2000) on farmers education and productivity of crop in India and Wadud and White (2000) on their studies on farm household efficiency in Bangladesh found no positive relationship with farmer level of education. Hasnah and Coelli (2004) found a negative relationship between farmers education level and farm efficiency on their studies on assessing the performance of nucleus estate and smallholder scheme for oil palm production west Sumatra.

Table 4: Other sources of income

Have other sources of income	Frequency	Percentage n=121
Yes	52	43
No	69	57
Total	121	100

From the results in table 4 it was found that those without any source of income except dairy farming were 57 % while those with other sources were 43%. This can be due to farmers taking dairy farming as their main source of income while those with other sources of income do not have enough time to engage in farming. This concurs with studies by Kuyiah, Obare, Herero and Waithaka (2006) on agricultural, income risks and rural poverty dynamics in Vihiga and Kilifi districts in Kenya who found out that agricultural enterprise constitute about 60% of the total income for farmers while the other sources accounted for 40%. Also, a report by ILRI,2014, shows that in Senzi ward of Marani sub-County, Kisii County, Kenya the major income for smallholder dairy farmers was dairy farming accounting for fourty two percent, while cash crops accounted for fourty percent and others twelve percent. However, work done by Nedela, Grosu and Shamsuddoha, 2009 in Chittagong division in Bangladesh in their study on dairy farming -an alternative income generation activity in Bangladesh, income from dairy farming was not the highest as it came out that vegetable farming accounted for twenty six percent of their income, dairy farming accounted for twenty three percent, bamboo works and handicraft accounted for sixteen percent, weaving twelve percent, and poultry twenty three percent.

Sources of crop stovers

Table 5: Sources of crop Stovers (n = 121)

Source	Frequency	Percentage
Own farm	115	95.0
Gift (neighbor, friend, relative)	12	0.1
Bought	32	0.2

The unaccounted 4.7% is as a result of the fact that the farmers had other alternative sources.

Types of crops stovers

Table 6: Type of crop stovers (n = 121)

Type	Frequency	Percentage
Green maize thinning	48	39.7
Sweet potato vines	27	22.3
Banana residues (leaves, stem)	31	25.6
Maize stovers	101	83.5
Maize cobs	87	71.9
Beans straws/haulms	28	23.1
Weeds	31	25.6
Wheat straws	27	22.3
Millet	19	15.7
Sorghum	22	18.2
Forages from common properties	38	31.4
Others	7	5.8

From table 6 the study revealed that majority of the farmers (83.5 %) used maize stovers and 5.8 % of the farmers used other types of crops stovers. The percentages do not add up to 100 percent because the farmers used more than one type of crop stover. The above results compare well with studies by Nyaata, Dorward and Keatinge (2000), who on their studies on availability and use of dry season feed resources on smallholder dairy farms in central Kenya found out 100 percent of farmers used maize stovers, a concurrence of 98 percent of farmers used banana leaves and pseudo stems, a concurrence of 51 percent of the farmers used weeds and a concurrence of 22 percent of the farmers used sweet potato vines.

Quantity of crop stovers prepared per season

Table 7: Quantities of crop stovers prepared by season (n = 121)

Crop stovers product	Quantity prepared in Kilogrammes	
	Rainy season	Dry season
Green maize thinning	252,180	0
Banana residue (peels, leaves, pseudo stems),	47,665	87,425
Sweet potato peels/ vines	13,522	19,625
Forage from common properties	368,125	61,880
Irish potato peels	140	250
Maize stovers	8,250	325,410
Maize cobs whole	20	1000
Wheat straw/haulm	0	0
Bean straw/haulm	2,310	15,850
Weeds	115,580	600
Crushed maize stovers	14,110	185610
Crushed treated (with urea and molasses) maize stovers	1,200	54800
Crushed maize cobs	415	10700

The results in table 7 shows that farmers prepared 368,125 kilogrammes of crop stovers forage from common properties as the largest quantity during the rainy season, they prepared 252,180 kilogrammes of green maize thinnings, they collected 115,580 kilogrammes of weeds, 47, they

prepared 665 kilogrammes of banana residues, they prepared 14,110 Kilogrammes of crushed maize stovers ,they collected 8250 kilogrammes of maize stovers whole, they prepared 1200 kilogrammes of crushed maize stovers treated with urea and molasses, they prepared 2310 kilogrammes of bean straws/haulms, they prepared 415 kilogrammes of crushed maize cobs, prepared 140 kilogrammes of Irish potatoes peels, they collected 20 kilogrammes of whole maize cobs and they didn't prepare any wheat straws. From the results farmers prepared more forages from common properties, maize thinning and weeds during the rainy season because probably because they were in plenty. However, during the dry season, the farmers prepared 325,410 Kilogrammes of maize stovers as the largest quantity.

This is because most probably maize stovers were readily available to farmers after maize harvesting during the dry season. Then they also prepared 185,610 kilogrammes of crushed maize stovers, they prepared 87,425 kilogrammes of banana residues, they prepared 61880 kilogrammes forages from common properties, they prepared 54,800 kilogrammes of crushed maize stovers treated with urea and molasses, they prepared 19,625 kilogrammes forages from sweet potato vines and peels, they prepared 15,850 kilogrammes of forages from bean straws/haulms, prepared 10,700 kilogrammes of forage from crushed maize cobs,100 kilogrammes from whole maize cobs, 600 kilogrammes from weeds 250 kilogrammes from Irish potato peels and they did not prepare any wheat straws and green maize thinning. Wheat straws are not common as the smallholder dairy farmers rarely engage in wheat farming. Green maize thinning is also rare during the dry season as this is off season for maize growing.

Difference in quantities of crop stovers prepared by season

Table 8: Difference in quantities of crop stovers prepared by season

Season	n	Mean	SD	Df	t-value	p-value
Rainy	121	13024.52	5061.53	242	3.308	.001
Dry	121	11028.82	4291.67			

From the study the mean (M = 13024.52, SD = 5061.53) quantity of crop stovers prepared during the rainy season was higher than that (M = 11028.82, SD = 4291.67) of the dry season. The results further indicate that the difference between the two means was statistically significant at .05 level, t (231) = 6.357, p>.05. This means that smallholder dairy cattle farmers have a tendency of preparing more quantities of crop stovers during the rainy seasons.

The Influence of preparation of crop stovers on availability of feeds was established using regression. It involved regression of the quantity of crop stover products prepared during the rainy and dry seasons combined and the feeds availability index. The results of the regression test are in Table 9.

Table 9: Regression test results between quantity of stovers and availability of feeds during the rainy season

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
(Constant)	1.471	.042		35.247	.000
Quantitity of stover products prepared during rainy season	-5.054E-006	.000	-.153	-1.692	.093
$R = -.153$, $R^2 = .023$, $F(1, 119) = 2.861$, $p > .05$					

The result of the regression test in Table 10 above reveals that the relationship between crop stovers preparation during rainy and feeds availability was negative ($r = -.153$, $p > .05$. This means that farmers prepare less crop stovers during rainy season. The results further reveal that the crop stovers explained only 2.3% ($R^2 = .023$) variation in availability of feeds. The variation was however not statistically significant, $F(1, 119) = 2.861$, $p > .05$.

Table 10: Regression test results between quantity of stovers and availability of feeds during the dry season

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
(Constant)	1.470	.042		35.248	.000
Quantity of stover products prepared during dry season	-5.868E-006	.000	-.151	-1.665	.099
$r = -.151$, $R^2 = .023$, $F(1, 119) = 2.771$, $p > .05$					

Table 10 above shows that the relationship between the quantity of crop stovers prepared during the dry season and feeds availability was negative but not statistically significant at the .05 level ($r = -.151$, $p > .05$). Table 11 also show that the crop stovers explained only 2.3% ($R^2 = .023$) variation in availability of feeds. The variation was however not statistically significant, $F(1, 119) = 2.771$, $p > .05$. The results suggest that crops stovers preparation do not affect availability of feeds.

Table 11: Regression test results between quantity of crop stovers and availability of feeds during the rainy and dry seasons combined

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	B	Std. Error	Beta		
(Constant)	1.471	.042		35.115	.000
Quantity of stover products prepared during the two seasons combined	-2.743E-006	.000	-.153	-1.688	.094
$R = -153$, $R^2 = .023$, $F(1, 119) = 2.848$, $p > .05$					

The results in Table 11 above indicate that the relationship between the quantity of crop stovers prepared during the rainy and dry seasons combined and feeds availability was negative but not statistically significant at the .05 level ($r = -.153$, $p > .05$). The negatively relationship implies that farmers prepare less stovers when the level of feeds availability is high. The results further indicate that the crop stovers explained 2.3% ($R^2 = .023$) variation in feeds availability. The variation was however not statistically significant, $F(1, 119) = 2.848$, $p > .05$. i.e the computed P-value was 0.094 which is more than the level of significance set at 0.05. This is an indication that crops stovers do not influence availability of feeds. On the basis of these results the first null hypothesis which states that crop stovers do not significantly influence availability of feeds was accepted. Thus, it was concluded that crop stovers preparation strategy does not statistically influence availability of feeds among smallholder dairy cattle farmers in Trans-Nzoia County.

This result conforms with the findings of Haule (2017), who found a similar relationship. In his study on the assessment of the extent of utilizing crop residue as ruminant feed in crop livestock farming systems in Babati district Tanzania, he found out that the level of contribution of crop residue as animal feed was low.

CONCLUSION AND RECOMMENDATIONS

The study sought to establish the crop stover strategies. It was established that 95 % of the farmers got their crop stovers from their own farms and 9.9 % got theirs from neighbours or relatives. The main crop stover is maize and millet stovers. It was also established that farmers prepared large quantities of crop stovers from common properties like rods during the rainy season while they did not prepare any crop stovers from wheat straws. The results also showed that during the dry season, farmers prepared large quantities from maize stovers. Further from this study it also came out that farmers prepare less crop stovers during the rainy season and more during the dry season. It also established that crop stovers preparation strategy does not influence availability of feeds.

Based on the study findings and conclusion, the following recommendations can be suggested

i. There should be improvement of crop stovers preparation on availability of feeds. To achieve this county government and other stakeholders should engage in capacity building of the farmers so that they know when and how to prepare and store the crop stovers for usage during the period of feeds scarcity.
ii. Further studies should be done on Crop stovers preparation strategies to determine whether they address concerns on feed availability.
iii. Extension services should be up scaled in order to disseminate innovations on crop stovers strategies from research stations.

REFERENCES

Abdulai, A. & Huffman, W, E. (2014). *The adoption and impact of soil and waterconservation technology.an endogenous switching regression application*. Land econ 90(1) 26-43. retrieved on 4/12/2019 from http://www.econpapers.repec.org/about.htm.

Asadullah, N., M. & Rahman, S. (2006). *Farm Productivity and efficiency in rural Bangladesh: the role of education revisited*. retrieved on 16/12/2019 from http://www.researchgate.net/publication/235//559.

Belay, F. & Oljiria, A. (2016). Gender Role in Agricultural Activities in Ethiopia.*County Review*

Coelli, T., Rahman, S., & Thirtle (2002). *Technical allocative, cost and scale efficiencies in Bangladesh rice cultivation: a non parametic approach*. J. agric econ.53(3) 607-626.retrieved from http://www.online library.willey.com. http: doi.org/10.111/j.1477-9552.2002.tbooo4o.x

Haule, I., A. (2017). 'Assessment of the extent of utilizing crop residue as ruminant feed in crop livestock farming systems in Babati district Tanzania'. Thesis submitted to Sokoine university of Agriculture morogo Tanzania. downloaded from http//www.suaire.ac.tz. on 10/9.2019.

Hasnah, E., F. & Coelli, T. (2004*). Assessing the performance of nucleus estate and smallholder scheme for oil palm production in west Sumatra*. *A stochastic frontier analysis.* Agricultural systems 79(1).17-30. retrieved from http://www.researchgate.net/publication/2222/5930.

IRLI, 2014. *Assessing the dairy value chain and potential to enhance productivity through improved feeding in Marani sub county, Kisii County, Kenya*. Retrieved from http://www.irli.org on 5/3/2020.

Kuyiah, J., W., Obare, G., A., Herero, M. & Waithaka, N., M. (2006). *Agricultural, Income risks and rural poverty dynamics. Strategies of smallholder producers in Kenya*. Proceedings of the International association of agricultural economists. August 12-18,2006, Gold Coast Australia. retrieved from http://www.researchgate.net/publication/23511673.on 22/12/2019 at 11.20am.

Kiptot, E., Franzel, S., Sinja, J. & Nangole, E. (2015). *Prefference and adoption of livestock feed practices among farmers in dairy management groups in Kenya*. ICRAF working paper.No.208.Nairobi, World Agroforestry centre DOI:http;//dx.doi.org/10.5716/WPI.pdf.rerieved on 8/12/2019.

Narayanamoorthy, A. (2000). Farmers' education and productivity of crops: a new approach. *India journal of agricultural economics*.55(3) 511-519.retrieved from http://www.researchgate.net/publication/28863.

Nedela, A., Grosu, V. & Shamsuddoha, M. (2009). Dairy farming – alternative income generation activity in Bangladesh. Retrieved from http://www.researchgate.net/publication/228282350.

Njuki J. & Sanginga, P., C., 2003). *Women, Livestock ownership and markets: Bridging the gender gap in Eastern and Southern Africa*. London Uk: Routledge.derived from http://hdl.handle.net.10568/34088 on 10/3/2018.

Sharma, M. (2016). *Effect of age and educational level of dairy farmers on knowledge and adoption of dairy farming practices in Kapurtha district of Punjab, India. International journal of Farm Sciences* 6(4):254-262-, 2016.Retrieved on 6/12/2019 from http://www.researchgate.net/publication/31190q-154.