

Extension strategies on utilization and conservation of sugarcane by-products dairy feed in Malava Sub-County, Kenya

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Abstract

The study assessed extension strategies for improving the utilization and conservation of sugarcane tops (SCTs) in dairy cattle feeding systems in Malava Sub County, Kenya, with emphasis on three administrative wards (West Kabras, Butali-Chegulo and South Kabras) of Malava Sub-County, Kenya. The area has two sugar factories hence sugarcane cash crop cultivation is dominant with bulk SCTs available after harvesting. A cross-sectional and observational studies was used and data collected from a 400 respondents selected through stratified random sampling using questionnaires, interviews, focus group discussion (FGD), key informants and observation checklists. Results indicated farmers in West Kabras preferred, farmer trainers, demonstrations, and dissemination facilitators strategies. Gender-based differences were evident with Men preferring Farmer trainer approach while women leaned towards dissemination facilitators. Demonstrations (75%) were dominantly accepted strategy in Butali-Chegulo, Despite the abundance of SCTs there is inadequate knowledge on improving its low nutritional quality. The study found varying preferences for extension strategies based on gender, age, and education. A strong positive correlation (Spearman's $\rho = 0.8$) was observed in ranking extension strategies across wards showing consistency in strategy preference pattern. The findings emphasize the importance of aligning extension approaches with demographic characteristics to improve the adoption of sugarcane byproducts in dairy feeding systems.

Keywords : Extension strategies, Sugarcane Tops (SCTs).

Stratégies d'extension sur l'utilisation et la conservation des sous-produits de la canne à sucre Aliments laitiers dans la sous-comté de Malava, Kenya

Résumé

Cette étude a évalué les stratégies de vulgarisation visant à améliorer l'utilisation et la conservation des feuilles de canne à sucre (SCTs) dans les systèmes d'alimentation des bovins laitiers du sous-comté de Malava, au Kenya, en mettant l'accent sur trois circonscriptions administratives (West Kabras, Butali-Chegulo et South Kabras). La zone abrite deux usines sucrières; par conséquent, la culture de la canne à sucre en tant que culture de rente y est dominante, ce qui entraîne une disponibilité abondante de feuilles de canne à sucre après la récolte. Une étude transversale et observationnelle a été menée, et les données ont été collectées auprès de 400 répondants sélectionnés par échantillonnage aléatoire stratifié, à l'aide de questionnaires, d'entretiens, de discussions de groupes focaux (FGD), d'informateurs clés et de listes de contrôle d'observation. Les résultats ont montré que les agriculteurs de West Kabras privilégiaient les stratégies de formateurs paysans, de démonstrations et de facilitateurs de diffusion, tandis que des différences fondées sur le genre étaient évidentes, les hommes préférant l'approche des formateurs paysans et les femmes s'orientant davantage vers les facilitateurs de diffusion. Les démonstrations (75 %) ont constitué la stratégie dominante acceptée à Butali-Chegulo; toutefois, malgré l'abondance des feuilles de canne à sucre dans cette zone, les connaissances relatives à l'amélioration de leur faible

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valeur nutritionnelle demeuraient insuffisantes. L'étude a également révélé des préférences variables en matière de stratégies de vulgarisation selon le genre, l'âge et le niveau d'éducation, et une forte corrélation positive (ρ de Spearman = 0,8) a été observée dans le classement des stratégies de vulgarisation entre les différentes circonscriptions, indiquant une cohérence des schémas de préférences stratégiques. Globalement, les résultats soulignent l'importance d'aligner les approches de vulgarisation sur les caractéristiques démographiques afin d'améliorer l'adoption des sous-produits de la canne à sucre dans les systèmes d'alimentation des bovins laitiers.

Mots clés: stratégies d'extension, hauts de canne à sucre (SCTS).

INTRODUCTION

Sugarcane by-products hold a significant role in the Kenyan economy and dairy agricultural sector. After harvesting, utilization and conservation of sugarcane tops remain largely unexploited (Mutege et al., 2018). Studies by Ogutu et al. (2019) report that SCTs can be processed into quality livestock feed, which reduces dependency on high costly feed alternatives. However, despite their potential, SCTs have low nutritional quality yet dominantly utilized in their raw form by dairy livestock farmers in the study area (Muyekho et al., 2015). This has resulted in significant wastage due to inefficient utilization of SCTs. To address this problem, it requires strengthening agricultural extension services and implementing effective strategies focused on improving feed to influence farmers to adopt modern feed utilization and conservation technologies. Studies by Kimaro et al., 2016 and

Narain et al., 2016 have shown, for the effectiveness of extensional strategies there is need to evaluate different demographic characteristics in the population like age, gender, experience and level of education. For example, use of media as a strategy is dependent on level of education while peer training and personal knowledge dependent on experience and old age (Hruska 2020) This research therefore evaluates the extension strategies currently available in Malava Sub-County and their effectiveness in improving utilization and conservation of sugarcane by-product in smallholder dairy farmers with particular emphasis on how farmer demographic characteristics, strategy preferences and technical and organizational capacities of farming communities influence adoption and valorization practices.

MATERIAL AND METHODS

1. Description of the study area

The study was done in Kenya, Kakamega County, Malava Sub-County. The area predominantly an agricultural rural setup. The main cash crop is sugarcane which is given large acreage as compared to food crops (Nambiro, 2008). Malava Sub-County has seven administrative wards with two having sugarcane factories. Malava Sub-County has a population size of 51,083 households as per the Kenya population and housing census 2019 (KNBS, 2019) Data was collected from three

wards, West Kabras which hosts west sugar factory, Butali-Chegulo (Butali sugar) and South Kabras which has no sugar factory. A pilot study was carried out in Chemuche ward to assess the validity and reliability of the research instruments.

2. Sampling design

Descriptive research design was employed to capture different perspectives on utilization and conservation of SCTs in smallholder farmers. A multistage sampling

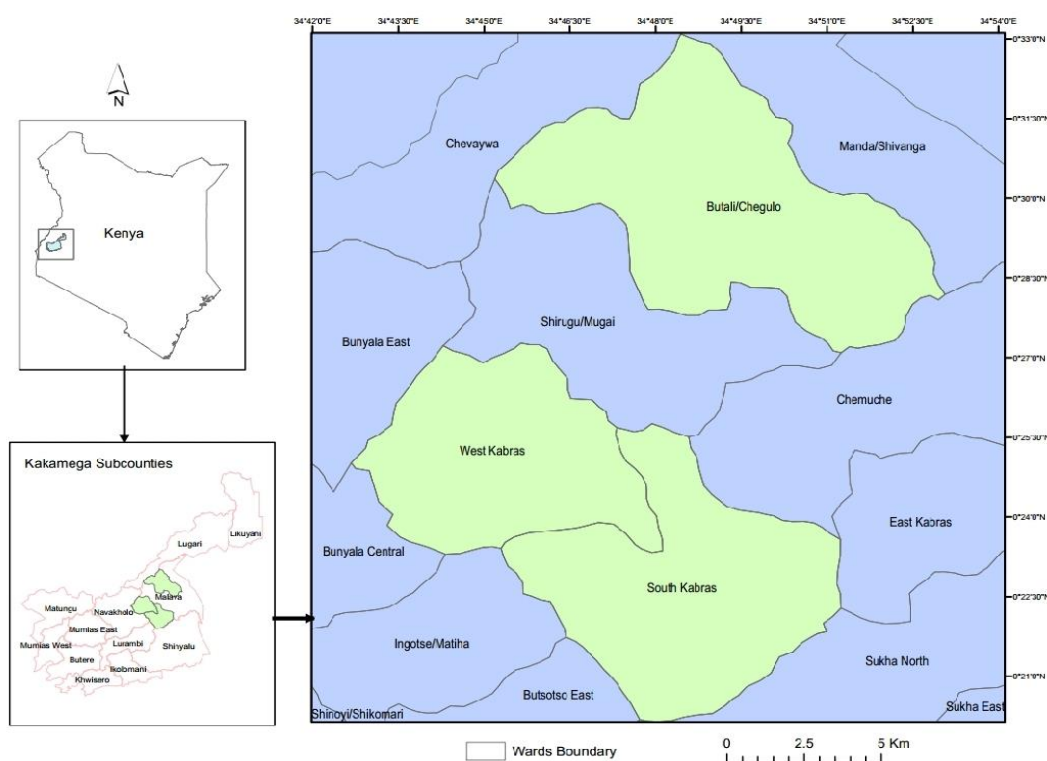
approach was used. First, wards were Purposively selected based on intensity of sugarcane production and dairy cattle farming activities. Simple random sampling was then used to select 400 smallholder farmers for the survey to ensure representativeness across different demographic categories. Purposive sampling was used to select participants for FGD. The number of participants required per FGD is 12-16 farmers (Lukuyu et al., 2019). A total of 28 small-scale dairy farmer's participants were selected and 3 extensional officers (west Kabras 17 and Butali-Chegulo 15). The extensional officers were intentionally included to add insights into existing extensional strategies. Each FGD lasted 60-90 minutes (Joyner-Payne, 2020) and moderated using a structured FGD guide. This research

ensured that individuals who took part in the field survey were not included in FGD to reduce bias (Rabiee, 2004).

3. Data analysis

The study used both quantitative and qualitative data analysis. Quantitative data from field survey was used to give a summary of demographic and preference to extensional strategies using descriptive statistics like percentages while qualitative data from FGDs, participant's responses were recorded so as to identify recurring themes on extension and feed conservation and later categorized and interpreted. Pearson rank correlation was additionally employed to determine the statistical measure of agreement in extensional strategies ranking patterns.

Figure 1 : Map of Malava Sub-County



RESULTS AND DISCUSSION

1. Demographic Characteristics of the Focus Group Discussion

1.1. Gender and Education

17 participants were present in West Kabras, of which 23.5% were male and 76.5 % were female, while in Butali-Chegulo, 15 were present, out of which 40% were male and 60% female. The total percentage of females in the FGDs was higher at 68.8% females and 31.2% males. These results are similar to those of Muyekho et al. (2015), who explain that females dominate livestock farming activities. These results are also supported by Njarui et al. (2012), who observed that women traditionally carry primary livestock and crop production activities. Kimaro et al. (2015) findings in the Arumeru district, Tanzania, also affirm that

women carry more burden in dairy farming activities while men and children are less involved. Therefore, extension approaches should target women as the main actors in dairy development taking into account their time constraints in terms of access to extension trainings.

Most farmers in the FGDs attained secondary education, with 52.9% in West Kabras and 46.7% in the Butali-Chegulo ward. This indicates that farmers in the study area can make sound decisions for efficient dairy farming management. This finding differs from those reported by Kimaro et al. (2015), where most farmers in the Arumeru district, Tanzania, had primary education equally suitable for improving basic literacy.

Table 1: Respondents gender and educational levels in FGD in Malava sub County

Parameter	West Kabras (n =17)		Butali-Chegulo (n =15)	Percentage (%)
Gender in FGD		%		%
Male	4	23.5	6	40
Female	13	76.5	9	60
Education level in FGD				
Primary	4	23.5	3	20
Secondary	9	52.9	7	46.7
Tertiary	4	23.5	5	33.3

1.2. Title Age of respondents in FGD

Participants ages in the FGD ranged from 21-56 years (Mean=38.9). Most participants were aged between 30-39 (43.8%). This is the middle-aged population in their prime working years. Such an age group is pivotal in contributing to a country's economic growth and development (World Bank, 2018; AFDB, 2020). This finding is supported by results reported by Narain et al. (2016), where the age group 31-35 in India had a higher percent chance of involvement in farming than the age

group 20-29. In the current study, the age group 21-29 was 34 %. According to Narain et al. (2016), such an age group represents the youthful population more inclined to the non-farm sector for earnings. In Kenya, according to census results,2019, the youth make up 75 % of the country's population (KNBS, 2019). The respondents aged above 40 years were only 21.9% of the older population. These people have enough experience in adopting new technologies, especially technologies at testing when of potential benefits (Ainembabazi et al., 2014).

Table 2: Age group of respondents in FGD in Malava Sub County

Age group	No. of respondents	Percentage (%)
21-29	11	34.4
30-39	14	43.8
Above 40	7	21.9
Total	32	100

1.3. Source of income

Summary of the economic activities of participants in FGD was analyzed and presented in table 6.3. From the data, sugarcane cropping (cash crop) takes the greatest percentage 62.5%, food crops farming and private job 25% while very few farmers earn income from business (0.03%) and dairy farming (0.9%). Participants in the FGD all agreed they keep improved cattle breeds although the milk yields obtained cannot sustain their daily expenditure. They supplement income generation with other

agricultural enterprises like maize farming, poultry keeping and cash crops. This results are in agreement with Lukuyu et al. (2019) study in western Kenya that reported that majority of farmers are keeping improved dairy breeds (Ayrshire and Friesian) but very low yields of milk is realized. The result is also affirmed by findings from Kirui et al. (2021) in Nandi County where majority of farmers (98.6%) keep cattle improved breeds per household with low milk production.

Table 3: Sources of income of respondents in FGD in Malava Sub County

Sources	No. of respondents	percentage
Dairy	3	0.9
Sugarcane (cash crop)	20	62.5
Business	1	0.03
Food crop farming +private job	8	25
Total	32	100

2. Effect of gender on respondents' preference of extensional strategies

Table 4 presents data on the influence of gender of respondents in FGD on preference of the extensional strategies. On average majority of farmers in West Kabras preferred Farmers trainer strategy (68.1%), followed by demonstration 60.6%, dissemination facilitators 59.6%, personal knowledge 31.7% and the least preferred was media at 7.7%. in terms of gender preference farmer trainer and demonstration had the highest proportion of male respondents (75%), while female respondents dominated in dissemination facilitators strategy (69.2%) and personal knowledge (38.4%). According to (Makori (2007) 25% of farmers in Kenya who have received training on silage making process

have adopted the technology increasing yields. Female participants in FGD in West Kabras said;

“As women majority of us choose personal knowledge and dissemination facilitators strategy since we are left to work in the farms, if this training and demonstration is carried out men attend living us behind yet we do majority of the farming activities”

On average majority of farmers in Butali-Chegulo preferred demonstration (75%), Farmer trainer 63.9%, dissemination facilitators 44.5%, personal knowledge 27.6% and the least preferred was media at 19.6%. In terms of gender male dominated in all the strategies in preference, except personal knowledge 33.3% and media 19.5%.

Table 4: Effect of gender on respondents' preference of extensional strategies.

Extension source	West Kabras (n= 17)			Butali-Chegulo (n =15)		
	Participant %	Participant %	Average %	Participant %	Participant %	Average %
Gender	Male	Female		Male	Female	
Farmer trainer	75	61.2	68.1	78.3	44.4	63.9
Demonstration	70	46.1	60.6	83.3	66.7	75
Dissemination	50	69.2	59.6	66.7	22.2	44.5
facilitator						
Personal	25	38.4	31.7	22.2	33.3	27.6
knowledge						
Media	25	7.7	16.4	22.2	16.7	19.5

**Media (Tv, radio programs and newspapers)

There were more male (25%) in west Kabras and Butali-Chegulo (22.2%) who preferred media as a source of information. These findings agree with those from Idowu et al. (2021) in Nigeria and Ragasa (2014) where in male dominated in media usage of media than female as source of information in their farms. Farmer trainer was also dominated by male 75% West Kabras and 83.3% Butali-Chegulo, majority of female participants in FGD were in agreement that they are restricted from mobility by their spouse with men owning and in control of all the resources these findings are similar to those by Dayanandan, (2011) where men have

more extension opportunities than females since are given less extension contact resulting to minimum training. These findings are also affirmed by Njuguna-Mungai et al. (2022) in Ethiopia and Kenya where there are farm activities assigned to gender, in Ethiopia men are involved in forage harvesting, chopping while in Kenya female dominated in decision making. Men use machinery in feed chopping while female are involved in manual tasks, weeding, milking, washing milking utensils and rarely do they participate in activities that give them access to technical information (Wanjiku, 2007 and Carngie et al. 2020).

3. Effect of age on respondents' preference of extensional strategies

Table 5 presents data on the effect of age of respondents in FGD on preference of the extensional strategies. Participants of age group 21-29 years old preferred media (72.7%) and demonstration 54.5%. they least preferred farmer trainer. According to Hruska, (2020) in United States young people are very active in social media and usage decreases with age increase. This also agree with Narain et al. (2016) findings in India where such age group represented the youthful population who are more inclined to non-farm sector for earnings. That explain why they less prefer personal knowledge (27.3%) since they lack adequate

experience. One participant from this age group said;

“Most of us are still schooling and therefore we cannot be selected in farmer trainer programs”

“Personal knowledge is suitable among our parents who have a long experience with farming, we depend on information from them especially practical skills”

Participants in age group 30-39 years old preferred farmers' trainer (57.1%) and demonstration (57.1%), dissemination facilitators (42.9%), personal knowledge (35.7%) and least preferred media (21.4%).According to Narain et al. (2016) age group 31-35 in India had higher percent chance involvement in farming than those age group of

20-29. These findings explain age group 20-29 represented the youthful population who are more inclined to non-farm sector for earnings.

Participants in age group 40 years old and above preferred Personal knowledge 85.7%, farmer trainer (71.4%), dissemination facilitators (71.4%), demonstration and least

preferred media 14.3%. One participant from this age group said;

“Majority of us have been in farming for long, we have enough experience therefore we depend on personal knowledge, train this middle aged and let them come teach us”

Table 5: Effect of age on respondents’ preference of extensional strategies.

	Age group of respondents’		
	21-29 Years old (%)	30-39 Years old (%)	Above 40 Years old (%)
Strategies			
Farmer trainer	18.2	57.1	71.4
Demonstration	54.5	57.1	57.1
Dissemination facilitator	27.3	42.9	71.4
Personal knowledge	27.3	35.7	85.7
Media	72.7	21.4	14.3

** Media (Tv, radio programs and newspapers)

4. Effect of education level on respondents’ preference of extensional strategies

Table 6 presents data on the effect of education level of respondents in FGD on preference of the extensional strategies. Participants who only attained primary level education preferred demonstration 85.7%, farmers’ trainer 71.4% and personal knowledge 71.4%, dissemination facilitators 57.1% while very few chose media(Radio). Farmer to farmer exchange and trained when strengthened by extension services and mentorship it will significantly benefit farmers (Koskei et al. 2020). Personal knowledge is determined by experience, most of this farmers have been practicing dairy farming for long periods. According to Ainembabazi et al. (2014) in Uganda personal knowledge (experience) is critical in adopting a given technology especially when testing its potential benefits. Participants who attained secondary level education preferred demonstration 68.8% and least preferred personal knowledge 12.5%. majority of farmers in this group said;

“Let the county train all farmers, we are all voters therefore we require equal treatment farmer trainer is not a good strategy since it only selects few farmers who are trained, then come and train us. we can all receive training in nyumba kumi households”

Participants who attained tertiary level education preferred media (77.8%), demonstration (55.6%), Dissemination facilitator (55.6%) and least preferred farmer trainer 11.1% and personal knowledge 11.1%. these findings agree with those from Mwololo et al. (2019) where farmer trainer (42%), farmer field schools (32%)and mass media (13%) were preferred as extension methods. One participant in this group said;

“The media is a key player in sourcing information, we source agriculture information online or through radio and Tv programs, we only wish we get practical demonstrations so that we can put those theoretical skills in practical”

According to extensional officer in Butali-Chegulo level of education is vital in acquiring knowledge though when it comes to

application the less educated use information given than the educated. This is in agreement with Sharma, (2016) findings adoption of

knowledge acquired is less in highly educated persons.

Table 6: Effect of education level on respondents' preference of extensional strategies

	Education level of respondents'		
	Primary level (%)	Secondary level (%)	Tertiary level (%)
Strategies			
Farmer trainer	71.4	18.8	11.1
Demonstration	85.7	68.8	55.6
Dissemination facilitator	57.1	37.5	55.6
Personal knowledge	71.4	12.5	11.1
Media	14.3	25	77.8

Source: Researcher (2025) **Media (Tv, radio programs and newspapers)

5. Extensional strategies rank in Malava Sub County

Table 7. presents data on the extensional strategy ranks based on order of preference e in FGD. In West Kabras farmer trainer (rank 1) was the most preferred extensional strategy, followed by demonstration (rank 2), dissemination facilitators (rank 3), personal knowledge (rank 4) and least media (rank 5) while in Butali-chegulo participants preferred demonstration (rank 1), followed by farmer trainer, dissemination facilitators, personal knowledge and the least preferred a rank 5 media. Spearman rank order correlation measure was done to evaluate the association between the extensional strategies in the two FGDs.

Spearman rank order correlation formula

$$r(R) = 1 - [6 \sum d_i^2] / [n (n^2 - 1)]$$

Where,

n= number of data points of the two variables

di= difference in ranks

The Spearman Coefficient, ρ , can take a value between +1 to -1

Spearman's rank correlation coefficient (ρ) determines the strength of extension strategies in table 6.7 in terms of dissemination of technologies. From the data gathered in this study spearman's rank correlation coefficient was 0.8 and since the ρ is close to +1 the results confirm a close association (strong correlation) between extension strategies in West Kabras and Butali-Chegulo. Table 6.5 shows the absolute magnitudes of the observed Spearman correlation coefficient. This results are similar to Abdullah (2021) and Bozayeh et al. (2017) where the extensional strategies available in Iran counties had a strong correlation (7.49) with Tv program (media) ranked last. Media remain undervalued suggesting need to use in a complementary and contextual manner. Pearson rank correlation reinforces the validity of the findings and help guide coherent territorial planning of extension activities.

Table 7: Extensional strategies rank in Malava Sub County

Extension source	West Kabras (n= 17)	Butali-Chegulo (n =15)		
	rank	Rank	d	d-square
Farmer trainer	1	2	1	1
Demonstration	2	1	1	1
Dissemination facilitator	3	3	0	0
Personal knowledge	4	3	1	1
Media	5	5	1	1
TOTAL				4

NB: rank 1 is the most preferred, preference decreases to rank 5

**Media (Tv, radio programs and newspapers)

CONCLUSIONS

In conclusion despite huge availability of SCTs in Malava Sub-County their utilization as dairy feed remains underutilized due to limited access to extensional strategies to improve on knowledge and adoption of conservation technologies. Extensional strategy varied significantly based on the demographic characteristic of the respondents in the FGDs ranging from age, gender and level of

education. Demonstration and farmer trainer approaches were the most favoured. There was a positive correlation between extensional approaches in the two administrative wards signifying that demographic characteristics are critical in promoting inclusion and accessibility to the right extensional methods to improve dairy productivity and feed conservation among smallholder dairy farmers

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