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Types and Classification of Acaricides used and Challenges faced by Livestock Farmers in Kajiado West Sub County, Kajiado, Kenya

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ABSTRACT

In Kenya tick borne diseases and tick control is mainly by use of acaricides through dipping or hand spraying. Intensive acaricides use has led to concern over resistance and residue problems prompting authors to discuss new pest management strategies. The study aimed at evaluating pastoralists farmers on the types, classification and various challenges experienced upon acaricides use to eradicate ectoparasites in livestock during the months of May (wet) and November (dry) in 2018. Parasites are responsible for economic losses either directly or indirectly to livestock through discomfort and damage, resulting to drop in quality and quantity of dairy products. A cross-sectional design that combined quality and quantitative methods where a structured questionnaire, face to face interviews and focus group discussions were used for data collection from 138 farmers in Loita, Ngurumani and Olkkeramatian locations who were willing to participated. Description statistic was carried for frequencies, percentages, variance and data subjected to confidence limits to T-test at 95 %. Results revealed that farmers used nine acaricides under different trade names for their livestock with which three active ingredients (a.i) commonly use were cypermethrin (76%), amitraz (72 %), and deltamethrin (46%). These acaricides were WHO class III (33.3 %) and WHO class II (67.7 %) respectively were used. The acaricides controlled major pests and diseases in livestock, such as lumpy skin disease, tick fever, anthrax, bovine anaplasmosis, East Coast fever, foot and mouth disease and black quarter. These diseases are caused by ticks, tsetse flies, fleas, Biting flies, Mite Manges and lice. The farmers' main livelihood was livestock that are sold to raise cash for food, school fees and other family obligation. The challenges faced by the farmers were climate change / variability led to loss of livestock due to inadequate pasture and water. This led to food insecurity, drought was the major problem leading to loss of livestock due to

malnutrition, caused inadequacy in pasture for livestock and water for human and livestock use, poor infrastructural establishment especially poor road networks and transport impediments to the nearby commercial centres where they purchase the acaricides with most of them purchased during market days. Tick borne diseases were the major constraints and difficulties in the control of the tick vectors due to exposure to same acaricides and shortage of water. Farmers were found to coexist with wildlife inhabiting the Ewaso Nyiro River banks. These coexistence of livestock and wildlife increased human-wildlife conflicts, there is need for collaboration to minimize risks by lowering negative attitudes pastoralists possess towards wildlife. Most acaricides, Cypermethrin and alpha-Cypermethrin, WHO class II pesticides may be replaced with WHO class III and IV. Integrated pesticide management (IPM) require proper pesticides use and management among the farmers to follow manufacturer's recommendation to prevent risks to human health and environmental pollution.

Keywords : Acaricides, disposal, Farmers, livestock, Kajiado County

I. INTRODUCTION

Tick control on livestock in Kenya is mainly by use of chemical acaricides which are regulated by the pesticides control products board of Kenya [1] and are continuously evaluated by the veterinary department to ensure effective tick control [2]. The high levels of illiteracy among livestock farmers and inadequate capacity in enforcement of regulatory laws by relevant regulatory agencies [3] has significantly led to poor usage of acaricides in underdeveloped nations [4]. Pesticides have been discovered to cause human health complications [5]. atmospheric pollution, water pollution in both the ground and surface [6]. The pH. of water can affect stability of pesticides. Under basic conditions the pesticide ends up degrading and hence become ineffective such as organophosphates and carbamates ending up with lower active ingredient concentration thus poor performance. pH is as well moderated by buffering solutions in the acaricides formulation [7].

A report of climate risk profile Kajiado County highlights livestock rearing and crop farming as the main economic activities [8]. A study carried out by the pest management plan for Kenya arid and semi-arid lands reported the need for farmers training and awareness creation on specific pest control products restricted to areas registered for with exceptions from expert and legal advice [9]. It further indicates that alternate use of pesticides products does not imply use of different ingredients rather than pest exposure to same pesticide [9]. A guide to health and hygiene published in 1979 concerning agriculture by international labour organization gives the intention to protection of agricultural workers from accidents and diseases plus extensive consideration of pesticides physiology and toxicology. More emphasis is laid on safe handling and use to avoid negative consequences, a copy which is used as a training aid in international labour organization (ILO) projects [10]

A study carried out in Kajiado central and Loitoktok areas indicate hand sprays and chemotherapy as main methods of vector control [11]. Although the farmers

in rural endemic areas of Uganda apply the acaricides on animals, very few have information on acaricide formulation hence some use a mixture of amitraz and pyrethroids to enhance efficacy [12]. Lack of veterinary extension services have as well been observed to propagate the concern [11]. According to Food and Agricultural Organization (FAO) pesticide disposal series, there is provision for guidance and form of advice concerning smaller volumes of unwanted, unusable pesticides found on farms. The responsibility is better placed on governments, extension services and pesticides suppliers as much as users are advised on dos and don'ts. Similarly, the guidelines emphasize a stoppage to the current practice of burying or burning empty pesticide containers [13]

The objective of this study was to assess acaricides types, classification and challenges faced by livestock farmers in Kajiado West Sub-County, Kajiado County, Kenya.

The results of these study can be used by both the national and Kajiado County governments for policy formulation and by future researchers as baseline information within the sub county.

II. METHODS AND MATERIAL

2.1. Study area

Kajiado County was formed after implementation of the 2010 Constitution of Kenya and has a catchment area of 21,900.9 Km2, consisting of five sub-counties; Kajiado Central, Isinya, Kajiado North, Loitoktok and Kajiado West [14]. It neighbors five other Counties; Kiambu, Machakos, Narok, Taita Taveta and Makueni Counties [14]. The county is mainly water stressed and inhabitants travel for long distances in search of the commodity due to the vastness and long dry spell in the county as reported by County government of Kajiado [14]. The County is administered from the five sub-counties. Kajiado West Sub-County was chosen for this study (Figure 1), due to its vastness and one of the regions where experience active participation in pastoralism as a major economic activity and to compare what it holds [15]. It lies between latitude 10°0' and 30° 0'to the South and longitude 36° 5' and 37° 5' to the East of the Equator [16] with a sub county population of 182,849 people [17]. The study area lies within the Agro ecological zone (AEZ) [18]. Table 1 shows the description of the sampling sites.

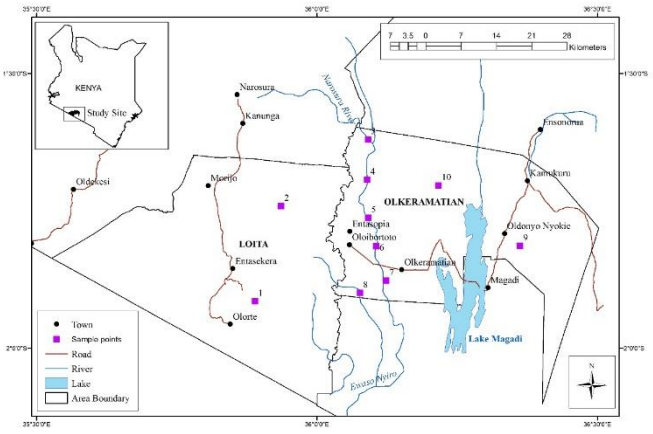


Figure 1. Map of Kajiado West Sub County Showing the Sampling Sites

Table 1 : Description of the Sampling Sites in Kajiado West Sub County

Site	Given name	Longitude	Latitude	Altitude (m)	Human activities around the sampling location
1	Empaleki 1	$35^0$53'24" E	1^0 54'34'S	689	Cattle rearing, subsistence farming of maize, beans, lemons and tomatoes
2	Empaleki 2	35^0 56'9.6" E	$1^0$44'531.2" S	699	Cattle rearing, subsistence farming of maize, beans, greens, kales and cabbages
3	Oldoraja	$36^0$5'27.6''E	1^0 37' 12" S	703	Cattle rearing, subsistence farming of maize, beans, vegetables, Sukuma wiki and peas
4	Esaginy 1	36^0 5'24" E	$1^0$41'34.8" S	711	Cattle rearing, subsistence farming of beans, maize, and pawpaw
5	Esaginy 2	36^0 5' 27.6" E	$1^0$45'46.8" S	702	Cattle rearing, Subsistence farming of maize, beans and pawpaw.
6	Esaginy 3	36^0 6'21.6" E	$1^0$48' 54" S	706	Cattle rearing, Subsistence farming of maize, beans, pawpaw and mangoes.
7	Oldonyonyokie 1	36^0 7' 22.8" E	$1^0$52'37.2" S	701	Cattle rearing, Chicken rearing
8	Oldonyonyokie 2	$36^0$4'37.2" E	$1^0$54'0" S	703	Cattle rearing, Chicken rearing
9	Kamkuru 1	$36^0$13'1.2" E	$1^0$42'14.4" S	698	Cattle rearing.
10	Kamkuru 2	$36^0$21'43.2" E	$1^0$48'30.4" S	699	Cattle rearing.

2.2. **Sample collection**

A reconnaissance trip was conducted a month prior to sample collection in company of local veterinary officer (Mr. Mulwa) during months of May (wet season) and in November (dry season) in 2018. The Global positioning system (GIS) of sampling locations (Map 410) was used to obtain the coordinates. A cross-sectional that combined quality and quantitative methods where a structured questionnaire, face to face interviews and focus group discussions with 46 farmers from Loita and 58 at Olkkeramatian and 34 in Ngurumani locations participated. During the study period there were 138 livestock farmers keeping livestock in their farms and participated in the

interviews. There were ten farmers who agreed to participate in second part of this study that has not been included, thus their homesteads were used for homemade acaricides spray investigations.

2.4. Data analysis

Data analysis was by using Microsoft excel and Statistical Package for Social Scientists (SPSS version 20). The data was then presented in form of tables and graphs.

III. RESULTS AND DISCUSSION

3.1. Farmers interviewed per location

The focus group discussions show the numbers of the participants per location (Table 2). Oldoraja and Oldonyonyokie in Olkkeramatian location had highest number participants at 42%.

Table 2: Number of farmers interviewed per site

Site name	Numbers of farmers interviewed
Loita (Empaleki 1 and Empaleki 2)	46
Olkkeramatian (Oldoraja and Oldonyonyokie)	58
Ngurumani (Esaginy 1, 2 and 3)	34

The survey revealed that 100 % of the farmers who participated were livestock keepers (Table 1) and control ectoparasites using acaricides by use of hand sprays through use of manual knapsack sprayers. The finding confirms with earlier study by Mugambi who confirmed use of both hand spray and chemotherapy to control ticks [11]. All the acaricides used by the farmers in the sub county were found to be registered by the Pest control products board of Kenya [1].

The sampling sites (Table 1) labelled Empaleki 1 and 2 plus Oldoraja are where subsistence farming in addition to cattle keeping has great potential while sites 7, 8, 9 and 10 are Oldonyonyokie 1 and 2, Kamkuru 1 and Kamkuru 2 where cattle rearing is experienced with water scarcity taking prevalence (Figure 1). Farmers in Oldonyonyokie were found to rear chicken in addition to cattle rearing. In the rest of the regions beyond Lake Magadi (Sites 3-6) in Olkkeramatian location, there was an additional pest attack the tsetse fly besides ticks affecting cattle. 60 % of the farmers were found to spray their animals for both ticks and tsetse flies. This report was in agreements with a study in Serere County Soroti district Uganda where agro-pastoral communities live and had tick borne diseases caused by both vectors affecting livestock production [19].

The study revealed that 47 % of the cattle farmers had primary, 32 % informal, 18 % secondary while only 3 % had tertiary level of education (Table 3). Among the female respondents only one had attended school up to primary standard four while the rest had informal education because parents preferred boys to girls' education.

Table 3: Academic qualification of the farmers

Academic qualification	number of respondents	Percentage (%)
Primary	65	47
secondary	25	18
Tertiary	4	3
Informal	44	32
Total	138	100

Table 4, showed that 68 % of the farmers had advanced training and 32 % with basic training on pesticides management and safe use, an indication there is a need for further training to hence their knowledge on pesticides managements. It was observed that all the farmers interviewed had received either basic or advanced training thus had received training on pesticides management and safe use.

Table 4: Training of farmers on pesticides management and safe use

Farmers	Number	Percentage (%)
Basic Training	44	32
Advanced Training	94	68
Untrained	0	0
Total	138	100

3.3. Acaricides rate of application and WHO classification

The reconnaissance tour in Kajiado West Sub-County showed a shift from dipping system in the dilapidated dip vat to homemade spraying (Figure 2) occasioned by higher costs of dip vat maintenance and acaricides replacement by the farmers

Figure 2 : Cattles in the cattle shade heading for manual knapsack hand spray

Table 5 : Acaricides used, application rates and WHO Toxicity Classifications

Acaricide	Active Ingredient	Quantity recommended by manufacturer per 20L	Percentage (%) households Use	WHO Toxicity classification
Triatix	12.5 % Amitraz	40 mls	37	III
Dominator	100 EC: 100 g/L alpha-Cypermethrin	10 mls	12	II
Sypertix	10 EC: alpha-Cypermethrin	10 mls	12	II
Tixfix	12.5 % Amitraz	40 mls	50	III
Norotraz	12.5 % Amitraz	40 mls	50	III
Decis	25g/ Deltamethrin	20- 40 mls	8	III
Delete	50 g/ Deltamethrin	20 mls	46	III
Bye-Bye	12.5 % Amitraz	40 mls	72	III
Ectopor	20 g/Cypermethrin	10 mls	76	II

Source [20, 21]

Table 5 show the nine acaricides under different names used for pests and diseases control in the livestock, Ectopor (Cypermethrin), with WHO type II classification was the most commonly used by 76 % of the farmers, followed by Bye-Bye (Amitraz) at 72 %, Tixfix and Norotraz both at 50 % and Delete (Deltamethrin) at 46 %. All the acaricides used are registered by the Pest Control Products Board [1]. Generally, from the nine pesticides that are in use in the sub-county, 33.33 % are toxic (WHO II) while 66.67 % are less toxic (WHO III) pesticides [20,21]. The rate of acaricides application ranged 10 ml-40 ml by the manufacturers (Table 5), farmers should comply with these specifications to ensure correct concentrations are sprayed on their livestock.

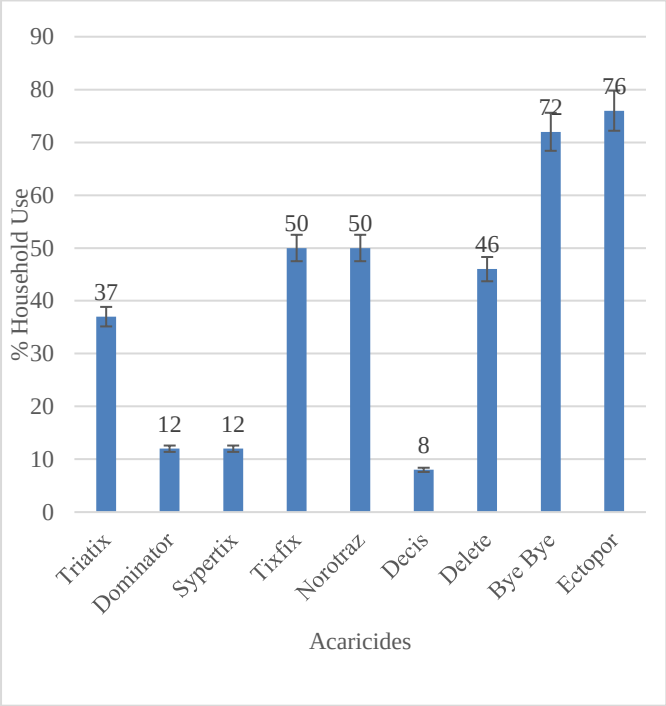


Figure 3. Percentage acaricides used per household

Figure 3, show the number of acaricides used per household, Amitraz, a WHO type III classified acaricide under four different trade names, Bye-Bye, Tixfix, Norotraz and Triatix [20] was the most preferred acaricide compared to synthetic pyrethroids by the farmers. The farmers were too familiar with local names of different livestock diseases (Table 6). Some reported the use of antibiotics such as tetracycline in control of livestock diseases. Hand spraying was reported to be cost effective by means of knapsack sprayers individually owned by farmers. The spraying is mainly done by men who are family heads and only by delegation that elder sons or females can be allowed to undertake the task (Figure 2). The tick was recorded to be predominant in the area of Loita while additional pest tsetse flies was recorded in areas of Ngurumani and Olkkeramatian respectively. There was observed coexistence of wildlife in the region which depend on Ewaso Nyiro River for watering. This interaction widens the vector spreading and conflict between human and wildlife animals [22].

Table 6. Local and scientific names of diseases affecting livestock

Local disease name	Disease Name	Scientific name	(%) Disease affects cattle
Entorobo	Trypanosomiasis	Trypanosoma Congolense	42
Lipis	East coast Fever	Theileriosis	48
Oloirobi	Foot and Mouth Disease	Aphthae epizooticae (Gingiva)	61
Ollomoroos	Goat Pox	Variola caprina	38
Entemelua	Anthrax	Bacillus anthracis	52
Olmilo	Heart water	Ehrlichia ruminanium	12
Enpuruu	Black quarter	Gangraena emphysematosa (Blackleg)	16
Olkipey	Contasiu bouvine pleuro pneumonia	Contagious bovine pleuropneumonia (CBPP)	24
Ngerebo	Lumpy skin disease (LSD) cattle	Capri poxvirus	33
Echuka	Helminthiasis	Helminthiasis	12
Onkikana	Anaplasmosis	Bovine anaplasmosis	14
Oloodua	Rinderpest	Rinderpest (Cattle plague)	32

The different types of diseases affecting livestock in the sub county are shown in Table 6. Farmer's preferred using their local language to differentiate between the diseases. Foot and Mouth disease was found be more prevalent at 61 %, followed by anthrax at 52 %, East coast fever at 48 %, trypanosomiasis 42 %, Goat pox at 38 %, Lumpy skin disease (LSD) cattle at 33 %, Rinderpest 32 %, Contagious bovine pleuropneumonia (CBPP) at 24 %, Black quarter 16 %, anaplasmosis at 14 % and finally Helminthiasis and heart water both at 2 % respectively (Figure 4). Previous studies by Mugambi [11] within Loitoktok (agro pastoral) and Kajiado central (pastoral) showed a slight change in preference with East coast Fever, anaplasmosis, Babesiosis and Cowdriosis being the prevalent diseases. The use of questionnaires as a qualitative means of identifying most prevalent diseases in the sub county was based on the farmers perceptions [23].

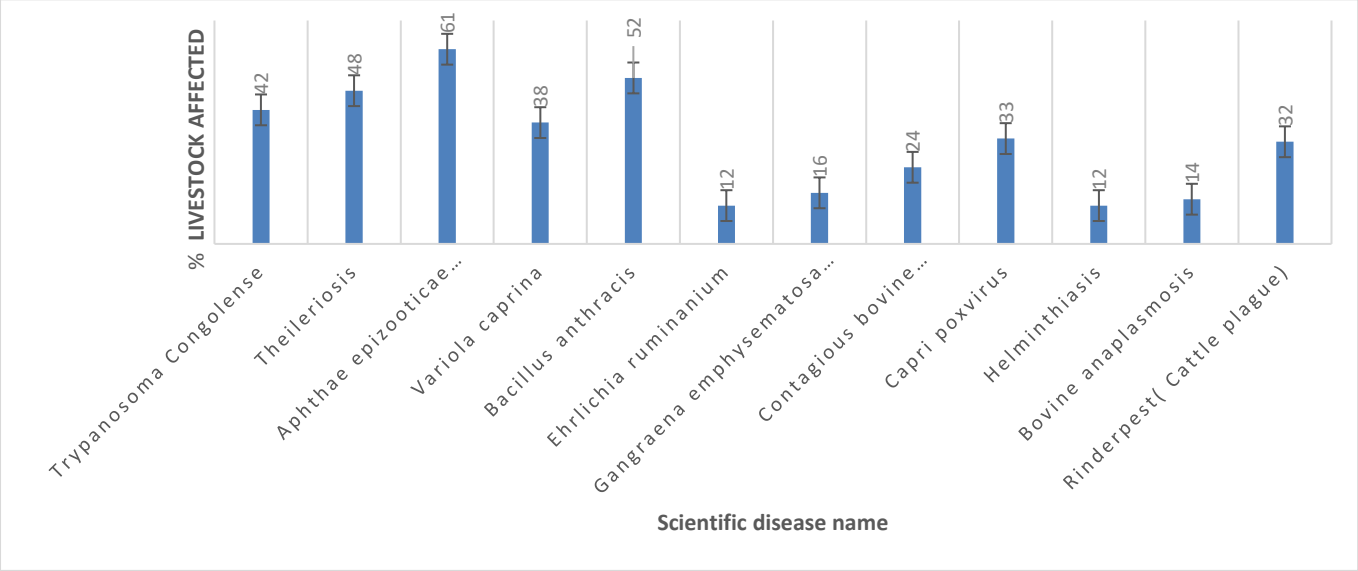


Figure 4. Showing the Scientific name of disease affecting livestock and their percentage

3.4. The methods of controlling ticks, flies and tick-borne diseases

In Controlling the diseases and pests, cattle farmers chose their preferred method of application of pesticides to control ticks, flies and tick- bone diseases on their animals. 82 % of farmers preferred spraying their cattle at home, 14 % indicated manual removal of ticks and other pests as their preferred method, 2 % used both manual removal and spraying while 5 % did not have any preferred method (Figure 5). The knapsack hand spray was the most preferred spray method than dipping in a dip vat system due to retrieval of the Kenya Government support during the structural adjustment programs (SAPs) promoted by lending agencies with target of reducing nations expenditures and departmental budgets [11].

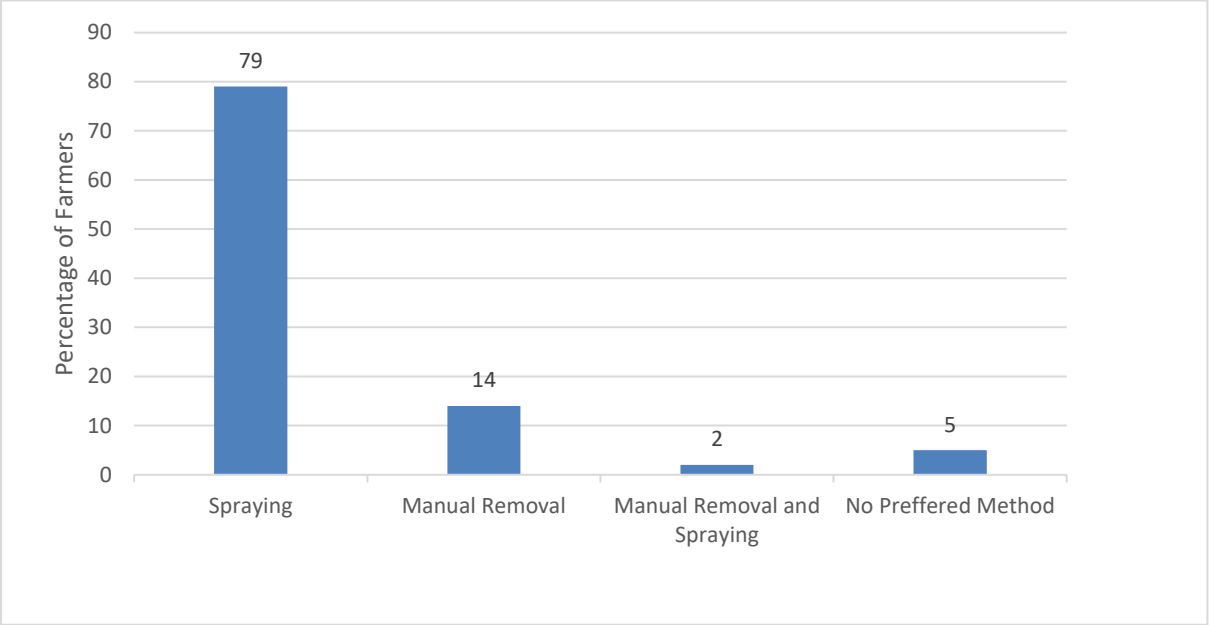
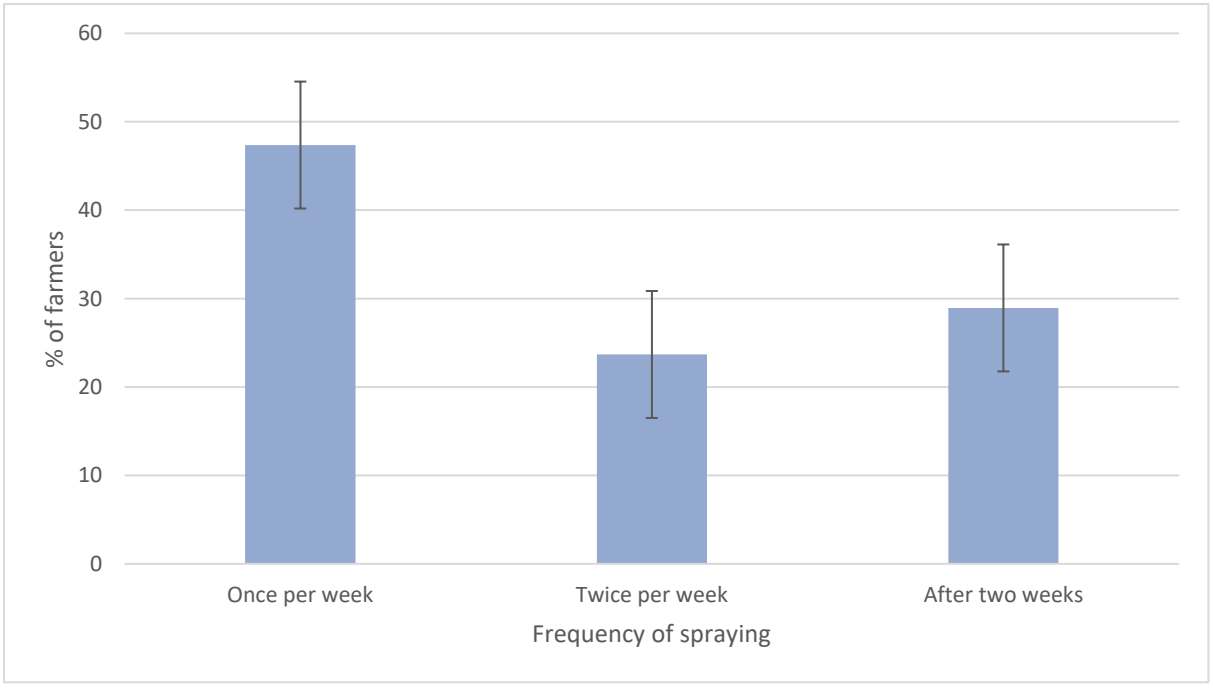


Figure 5. Mode of eradicating vectors from their animals

3.5. Frequency in livestock spraying

The farmers gave different durations when they use acaricides on their cattle. Most farmers (58%) preferred spraying their animals once a week, 32 % twice a week while 37 % after two weeks as shown in Figure 6.



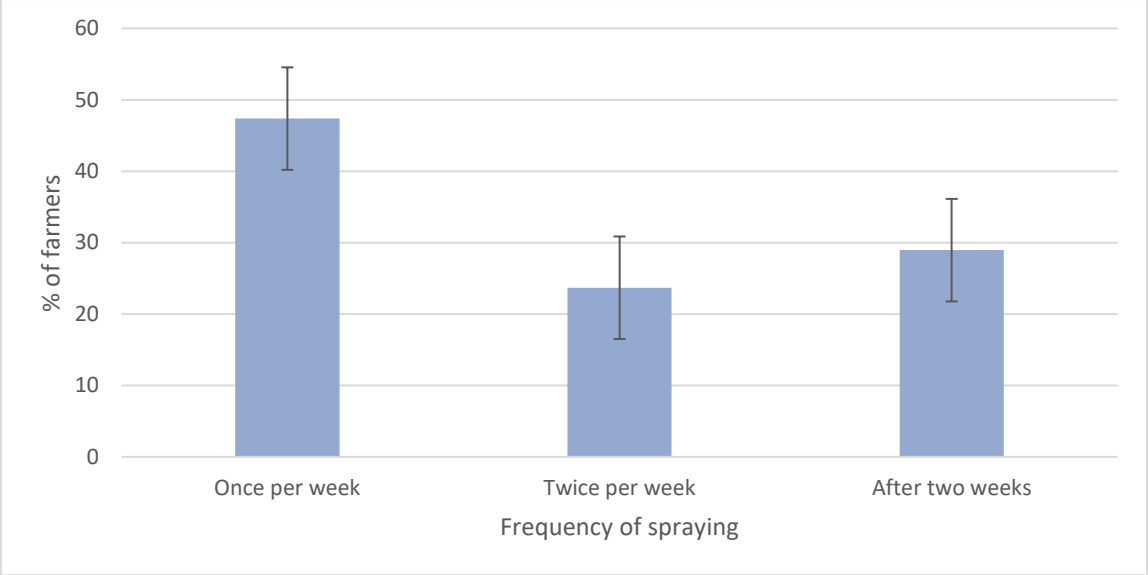


Figure 6. Farmers' livestock spraying frequency in Kajiado West Sub-County

Table 7. Disposal practices of unused acaricides and containers after use

Method of Disposal	Percentage (%)
Burning	43.
Dropping at pit Latrine	22
Burying	12
Use for other purposes	23

Table 7 show that 43 % of the farmers discard the container by burning, 22 % drop the bottles to open pits while 12 % dug them under ground as a mode of disposal while 23 % used the containers for other uses or retain them in warehouse for upcoming usage. The observed methods of disposal may have great potential to cause environmental (atmospheric, water and soil) pollution. Pesticides in the environment have been connected to numerous adverse health effects like disruption of hormones and impairment of nervous system in Human beings [24]

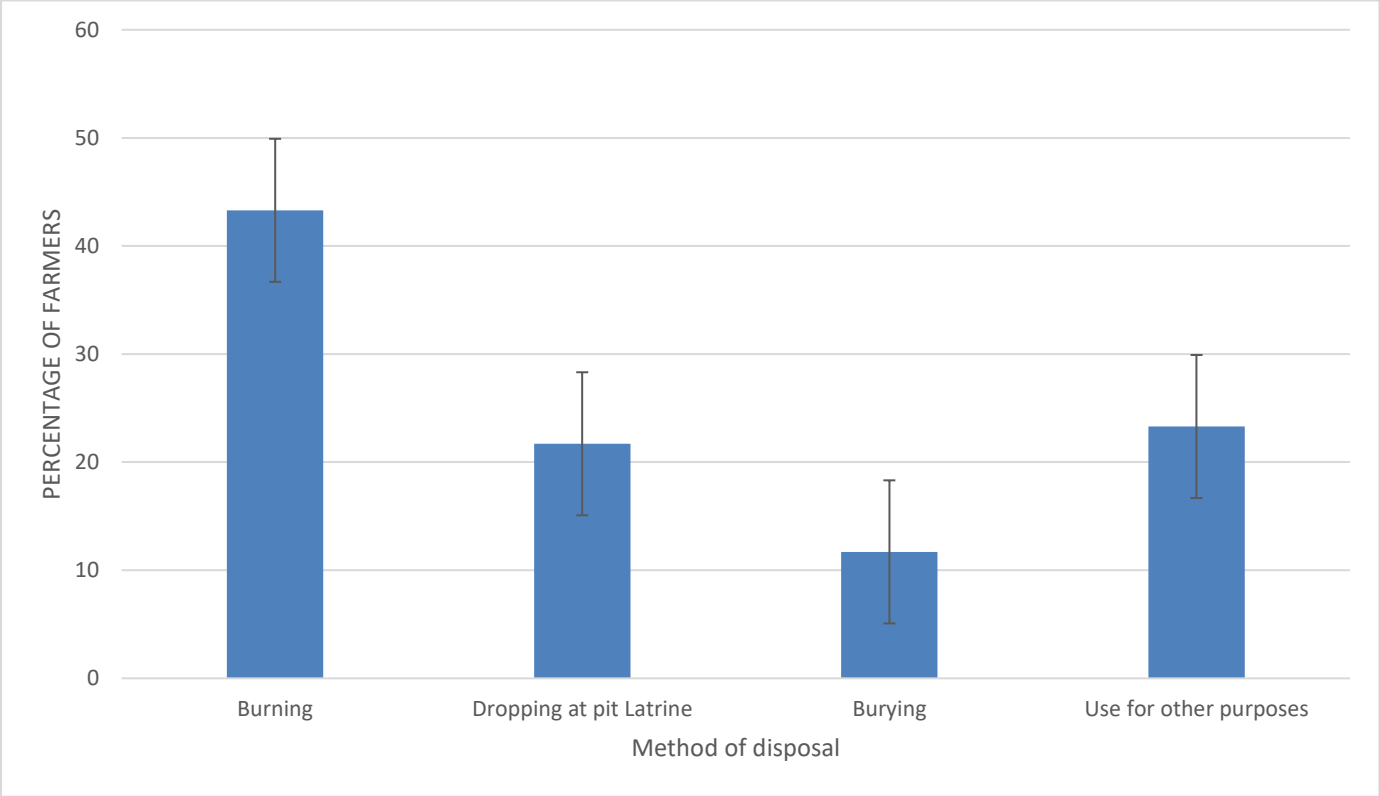


Figure 7. Disposal practices of expired acaricides and containers after use.

IV.CONCLUSION

The study observed that majority of Cattle farmers in Kajiado West Sub County were male and in the age bracket of 40 - 50 years, possessed different literacy levels with many having only informal education. The region was found to empress hand spraying rather than dipping system due to retrieval of government support during the structural adjustment programs (SAPs) promoted by lending agencies with target of reducing nations expenditures and departmental budgets [11]. The farmers reported much focus on tick control than focus on environmental pollution since this was their life line. The focus groups discussions revealed farmers had knowledge on most acaricides present in the market inspite of different commercial trade names that revealed nine (9) different commercial products registered by pest control products Board [1]. The major three acaricides used by the farmers were those with the following active ingredients (a.i) cypermethrin (76 %), amitraz (72 %), and deltamethrin (46 %). The acaricides were WHO class III (33.3 %) and WHO class II (67.7 %) classified respectively. Famers heavily relied on different types of acaricides to control major pest and diseases in the livestock, such as lumpy skin disease, tick fever, anthrax, bovine anaplasmosis, East Coast fever, foot and mouth disease and black quarter. These diseases are caused by ticks and other pests such as tsetse flies, fleas, Biting flies, Mite Manges and lice. Most acaricides, Cypermethrin and alpha-Cypermethrin, WHO class II pesticides may be replaced with WHO class III and IV. 12 % of the cattle farmers though trained on safe handling of acaricides there is need for refresher trainings up to the 26 % untrained farmers. It was also found that farmers spray their animals once or twice a week and very few for more than two weeks as found by [11]. Though many have undergone some training the disposal practices could cause environmental pollution [13]. There is need for awareness creation through public forums to mitigate against environmental pollution and concern for

human health through food chain [12,14]. The major challenges faced by the farmers were climate changes that has caused drought that results to loss of livestock and shortage of water, poor infrastructure leading to poor transport system especially to agro vet centres which are in Magadi town and Kiserian town accompanied by low incomes earning.

Disclosure Statement

The authors declared no conflict of interest

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