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Observations from Records on Cattle Dipping for Tick Control during the 2000-2012 Period in Nandi County, Kenya

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Abstract: ***Most of the dairy cattle in Nandi County are found in smallholder farms, where ticks and tick-borne diseases pose challenges to their productivity and survival. Dipping of the cattle in chemical acaricides, on weekly basis, is used to manage the ticks. Examination of the County's tick control records for the period 2000 – 2012 revealed that 84.11% of the registered cattle were dipped in communally-owned and managed plunge dips, while 15.89% used privately-managed dips. Varying numbers of cattle were dipped annually (266,178.3±30,963), in either chlorfenvinphos, amitraz or synthetic pyrethroid acaricides. The dip-wash tests indicated that 56.36% of the samples were at the standard dipping concentrations while 38.81% were under-strength, and 4.83% over-strength. Anaplasmosis and East Coast Fever were prevalent tick-borne diseases, at 47.74% and 47.08%, respectively. Babesiosis and heart water remained low. In conclusion, the plunge dips were prominent tick control facilities, but their use was not consistent with the recommended operating procedures, leading to persistence of tick-borne diseases.***

Keywords: Ticks, acaricide, dips, tick-borne diseases

1. Introduction

The dairy cattle sector in Kenya contributes as much as 91.8% of the total milk production (Lanyasunya *et al.*, 2006; Onono, 2012). Benke et al (2011) estimated that cattle milk in 2009 was worth Kenya shillings 197.018 billion.

Most of the cattle are mainly raised under open grazing systems on natural pastures in smallholder farms, where ticks pose challenges to production (Omore *et al*, 1999; Wesonga *et al*, 2010). The one-host tick *Boophilus decoloratus*, and the three-host *Rhipicephalus appendiculatus*, amongst others, are common parasites to the cattle and other hosts as sheep, goats and donkeys in the farms. The ticks are associated with sporadic outbreaks of diseases of cattle, and other constraints as predisposition to secondary infections through bite-wounds, interference on feeding through irritations and tick-worry, anaemia from blood loss and reduction on qualities of hides and skins, amongst others (Wangila, 2016).

Weekly application of either, chlorfenvinphos, amitraz or different brands of synthetic pyrethroids acaricides, through plunge dips is widely used to control the ticks (Njagi, 2013; Mugambi *et al*, 2012).

Plunge dipping services in Kenya were previously offered as Government services to dairy farmer before a divested through restructuring of service delivery in 1991. The divestment saw conversion of the dips either to communally-managed facilities through user-committees, or private enterprises under individual farmers. This, however, led to collapse of some of the dips, which prompted Government intervention to communally-managed facilities through a brief assistance with free issue of acaricides in 1998 (Rono, 2002; Ngigi, 2005).

2. Materials and Methods

Study area

Nandi County is bound by the Equator to the south, latitude 0.034 º N, longitudes 34.045º E and 35.025º E. and covers an area of 2,884 sq. km. It has a cool wet climate with temperatures ranging from 15°C to 25°C., and a bimodal rainfall precipitation that ranges from 1200 mm – 2000 mm annually (Nandi County website). According to the Kenya Population and Household Census (2009), the cattle population stood at 309,039 heads, of which the majority were dairy breeds.

Mode of study

Data on the functional status of dips, cattle dipping trend, tick-borne disease incidences and quality of dip-wash were collected from the County tick control annual reports for the period 2000 – 2012.

3. Results

The majority of the dips (84.11%) were under communal management while 15.89% were privately-managed. The mean number of functioning communally-managed dips in the period was 286, while the non-functional was 45. The average number of functional privately- managed dips was 48 and the non-functioning was 15 (Table 1).

Table 1: Summary statistics of dips

Dips	Annual Mean	Std. Dev.	Percentage
Communally-managed functioning	286	20.73644	72.76%
Communally-managed non-functioning	44.61538	16.20462	11.35%
Privately-managed functioning	47.53846	13.46363	12.09%
Privately-managed non-functioning	14.92308	7.857709	3.8%
Total			100%

The number of functional communal dips (CDF) remained fairly constant in the period, until 2008 when it rose to peak level in 2011 (Figure 1). The rise in CDF coincided with a decline in the functional private dips (PDF), and subsequent rise in non-functional private dips (PDNF).

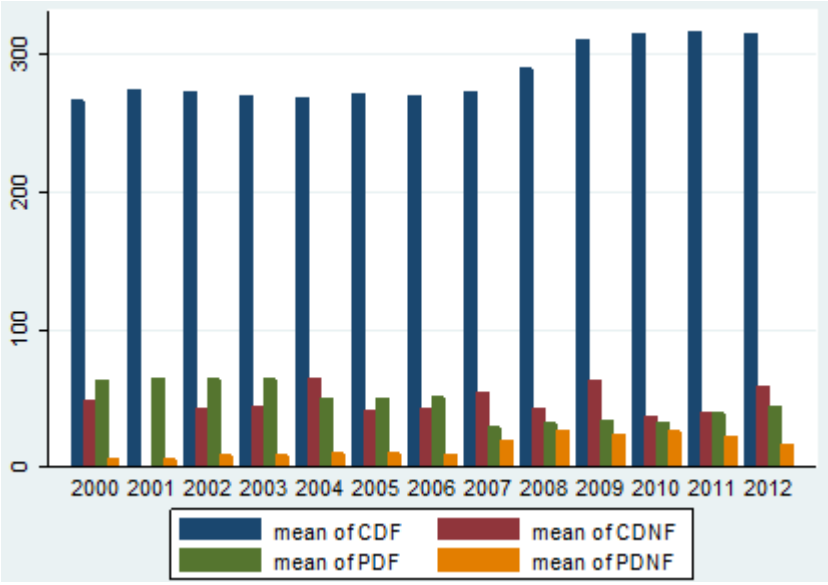

Figure 1: Trends in numbers of functional dip

The mean number of cattle registered for dipping were 266,178.3 ± 30,963.01. Their dipping was irregular over the years, until 2009 when the total annual dipping improved to reach peak levels in 2012 (Table 2).

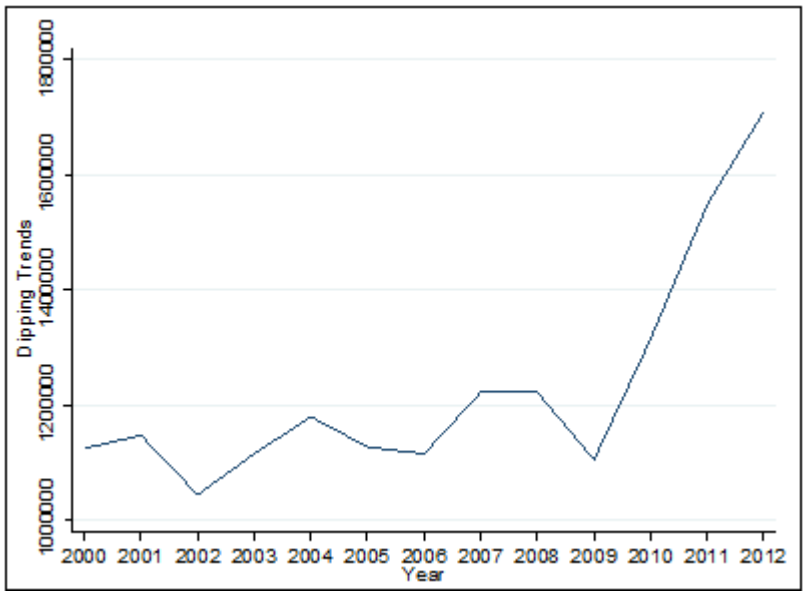

Figure 2: Cattle dipping trends

An average of 3,212.85 tick-borne disease incidences were reported annually, giving a total of 41,767 cases in the period. Anaplasmosis and East Coast Fever topped the list with annual means of 1,533 (47.74%) and 1,512 (47.08%) cases, respectively. The incidence of babesiosis and heartwater remained low, with the annual means of 146 (4.55%), and 20 (0.63%) cases, respectively (Table 3).

Table 3: Mean numbers of tick-borne diseases

Diseases	Mean	Std. Dev.	Total	%
ECF	1512.615	176.8095	19664	47.08%
Ana	1533.769	233.3564	19939	47.74%
Bab	146.3077	33.99114	1902	4.55%
Hw	20.15385	7.914608	262	0.63%
Total	**3212.85**		**41767**	**100%**

Key: ECF = East Coast Fever, Ana = Anaplasmosis, Bab = Babesiosis, Hw = Heartwater

The cases of anaplasmosis and ECF fluctuated over the years, compared with those of babesiosis and heartwater, which maintained a relatively constant trend (Figure 3).

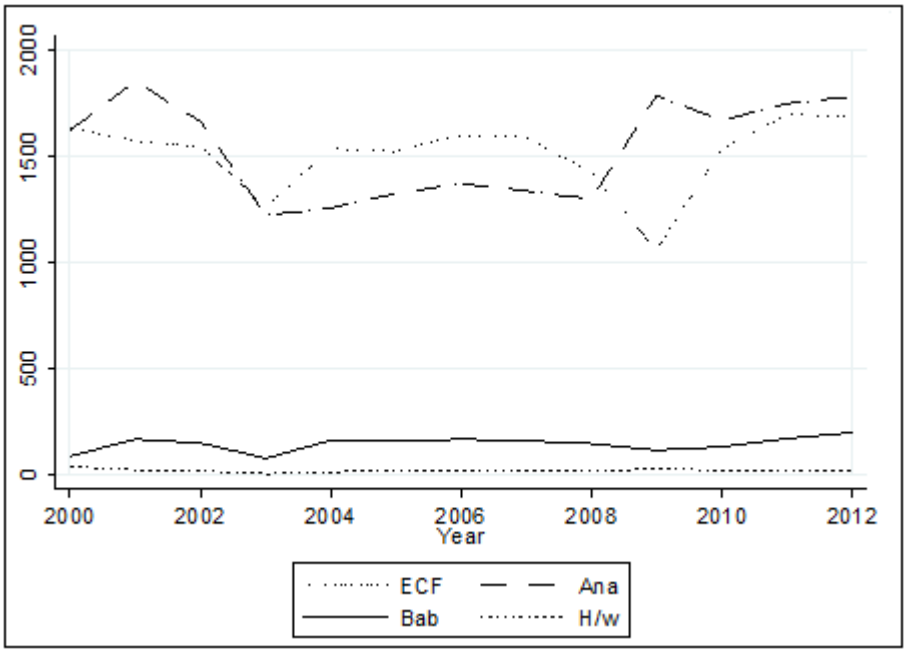

Figure 3: Trend of tick-borne diseases

Just over half of the dip-wash (56.36%) samples from the functioning dips were at the recommended dipping concentrations, while 38.81% were below the standard, and 4.83% above it (Table 4.3).

Table 4.3: Summary of concentrations of dip-wash samples

Dip-wash Concentration	No. of samples	Mean	Std. Dev.	Percentage
Over-concentrated	638	49.07692	36.42907	4.83%
Normal	7444	572.6154	114.2859	56.36%
Under-concentrated	5126	394.3077	154.3855	38.81%
Total	**13208**			**100%**

The qualities of the dip-wash concentrations fluctuated throughout the period (Figure 4.4).

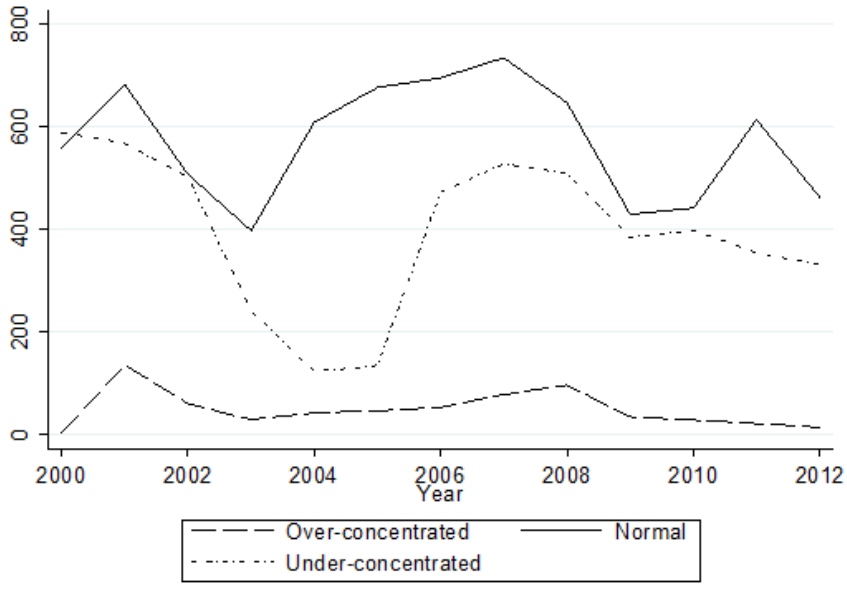

Figure 4.4: Trends on the quality of dip-wash

4. Discussion

The study made the first analysis on tick control records held the County. The communally-managed dips were noted as the main facilities used for topical application of acaricides, followed by the privately-managed dips. However, the dipping of 266,173 ± 30,963 heads of cattle compared to the County's 309,039 heads, as established by The Kenya Population and Housing Census (2009), suggested that plunge dips were not the only means for tick control. This observation was contrary to Kenya's policy on weekly dipping of all dairy cattle, as stipulated by the country's Legal Notices made through the Cattle Cleansing Act (1967).

The variation in the mean numbers of functional dips in the period may be due to the inadequate capacity of stakeholders to take up services that were rapidly divested by Government during re-structuring of service delivery, as observed by Rono (2002). The fluctuating dipping trend observed before 2009 coincided with the implementation of the restructuring strategies, referred to as the Structural Adjustment Programmes (Strategy for Performance Improvement in the Public Service, 2001; Poverty Reduction Strategy, 2007). The periodic improvement in numbers of functional communal dips and dipping performance, especially in 2008 to 2012, may be attributed to salvage interventions through Government support, rehabilitation of dormant dips, conversion of private dips into public facilities, or extension services and uptake of liberalized services by professional personnel in private practice (Chema and Gathuma, 2004; Ngigi, 2005). If this holds true, then the observations support the finding by Drummond (1983) about four decades earlier, that farmers preferred communal dips for tick control.

The high prevalence of anaplasmosis (47.74%), a disease attributed to the tick *B. decoloratus,* and East Coast Fever (47.08%), which is attributed to *Rhipicephalus appendiculatus*, underscored the importance of the two vectors to dairy cattle. This finding challenges the prevailing policy emphasis through Legal Notices Nos. 549 (1968), 212 (2003) and 46 (2013) for the control of *R. appendiculatus*, with assumption that other ticks would be controlled concomitantly, in an ecosystem where both ticks are ubiquitous, as observed by Omore et al (1999) and Okuthe, *et al,* (2006). The emphasis on control of one parasite is contrary to finding by Thumbi *et al* (2014) that co-infections by parasites increased mortality risks on cattle. The low incidence of babesiosis and heartwater suggests that the majority of the *B. decoloratus* and *Amblyomma variegatum* ticks in the County harbored low levels of *Babesia bigemina* and *Cowdria ruminantium* pathogen, respectively.

Dipping of cattle was done in various qualities of acaricides, that ranged from low to higher concentrations than those recommended for use. This was an indiscriminate management of acaricides; a practice that can accelerate selection for resistant populations of ticks. This management style for dip-wash may have been associated with low capacity of stakeholders in technical skills, inadequate extension services and/or poor enforcement of prevailing policies.

The prolonged use of the acaricides, coupled with their incorrect use are contributory to the persistence of ticks, and hence tick-borne diseases on dipped cattle in the County.

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