

Prospects of Dairy Intensification and Commercialization in Eastern Province of Rwanda

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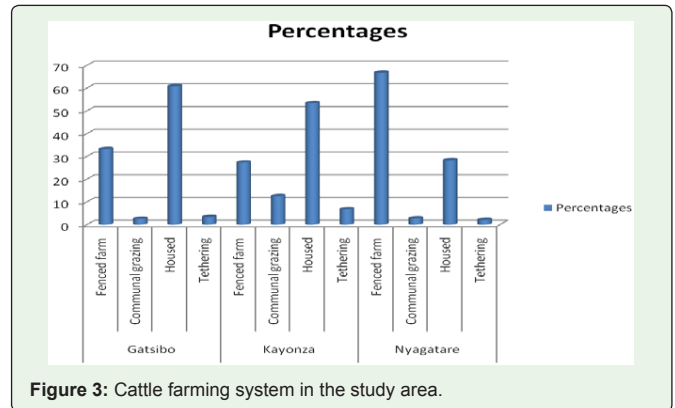
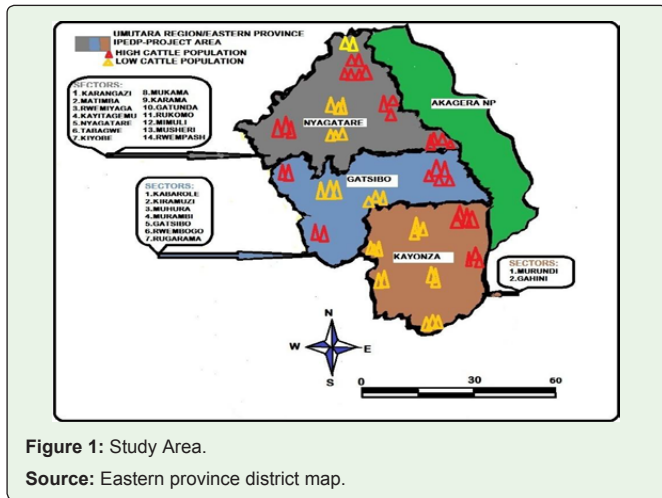
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Abstract

As part of its efforts to propel the country in to a middle-income economy through improvement of several programs, the Government of Rwanda (GoR) has put in place incentives for dairy intensification. However, despite these initiatives there has been limited follow up on their impacts on the production systems thereby making the planning of further interventions very difficult. A Study was to establish the status of dairying, identify challenges and recommend improvements. Pre-tested questionnaires were administered to 2,089 farmers, selected farmers by multi-stage sampling procedure on sectors and cells levels. Sample size was established basing on the procedure of Krejcie and Morgan 1970, analyzed in SPSS 16. The majority of households had five to seven members. Natural breeding predominated with 57% compared to Artificial Insemination (AI) at 25%. Zero grazing was predominant in Gatsibo at 60%, fenced farms predominated in Nyagatare at 65%. Communal grazing has greatly declined with exception of Kayonza at 10%. Crop residues and salt were the predominant modes of supplementary feeding at 42%. Nyagatare District showed advance in supplementary feeding at 21% than Gatsibo 18%, Kayonza District with 5%. Rice bran was still minimally used despite being abundant in the area. Industrial dairy meals were not used. Farmers reported shortage of water, East coast fever; followed trypanosomiasis were mainly reported in Nyagatare and Gatsibo Districts. There is a need for training farmers in dairy nutrition, scaling up AI services, water sources and control of vector born diseases and strengthening dairy cooperatives for efficient milk production and marketing.

Introduction

Rwanda is one of the five countries forming the East African Community. It geographically has a hilly land-scape of 1500m above sea level with exception of the Eastern Province which forms the “Umutara Region” covering the Districts of Nyagatare, Gatsibo and part of Kayonza. Before the 1994 Tutsi Genocide which devastated the Rwandan economy and human capacity, Umutara Region was divided into pastoral grass land and a wild life conservation area [1]. Rwanda, like other Developing countries is generally characterized by food insecurity, low household incomes and high prevalence of animal diseases. Rwanda faces a deficit of animal products and therefore must increase its animal production in quantity, quality and efficiency (EDPRS 1). The national vision 2020 [2,3] and other recent policies (EDPRS1&2) are to guide the government during this endeavor. One of the key pillars of vision 2020 is the transformation of Agriculture from subsistence to a productive, high value, market-oriented agriculture that has an impact on other economic activities [2]. The government has acknowledged animal production as an important pillar for achieving food security and increasing household income in the country [4,5]. Almost 90% of Rwandan active population is engaged in some form of agriculture for their livelihood [6]. Rwanda’s traditional agricultural system is characterized by small and fragmented land holdings, cultivation on hill slopes and wetlands, as well terraced land among others [7-9]. There is need for each alienage to develop the animal production systems in such a way that they can competitively contribute to both food security and poverty alleviation, especially in the smallholder sector, without leading to environmental degradation [10]. The development of agricultural sector through increased productivity with more commercial activities which generate better revenues is now one of the major objectives under the national strategy for poverty reduction. It is for this reason that the Government of Rwanda started the policy of land re-distribution and intensification of livestock production through One Cow per Poor Family (Girinka Munyarwanda) and sends a Cow [11]. The government put in place incentives for dairy intensification such as valley dams, Water Tanks, Artificial Insemination (AI) services, Milk Correction Centres, Dairy Plants, Exotic Bulls, farmer training and micro-finance institutions [7,12]. There has been limited follow up on the impact of all these incentives and interventions on the production systems there by making the planning of further interventions very difficult. The purpose of this study was to establish the current status and identify the challenges of dairy cattle production in Eastern Province of Rwanda (Nyagatare, Gatsibo and parts of Kayonza Districts) (Figure 1).



by Agajie et al., [15] who indicated that having many wives is one of the wealth indicators and commonly practiced types of marriage in the Central Rift Valley of Ethiopia (Figure 2).

Methodology

The study was done in ten months in the period of 2016-2017 covering a total of 2,089 households that were selected by multi-stage sampling procedure bearing in mind the differences in production systems within sectors and cells of a District. The overall sample size at any stage was established basing on the procedure of Krejce [13]. The corresponding numbers of pre-tested questionnaires were availed to the relevant sector veterinary personnel who had been previously trained on procedure of questionnaires administration. The data were collected, cleaned, sorted and entered into excel spread sheets and analyzed in SPSS (Statistical Package for Social Science), 2006, SPSS Version 16, and presented as tables and figures.

Rearing systems

Rearing in houses (zero grazing) is predominant in Gatsibo and Kayanza, where as fenced farms predominate in Nyagatare. It is not able that communal grazing has greatly declined with exception of Kayanza (Figure 3).

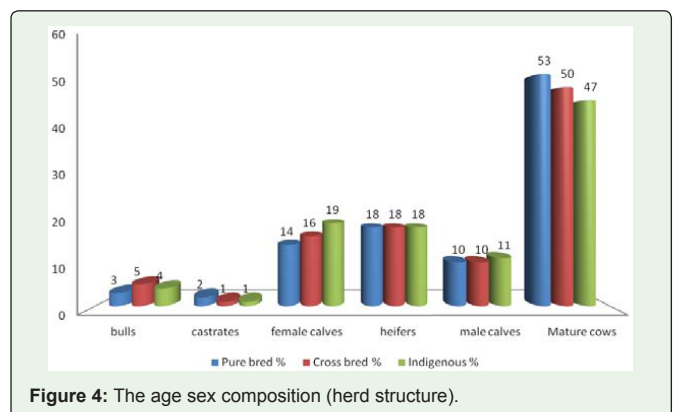
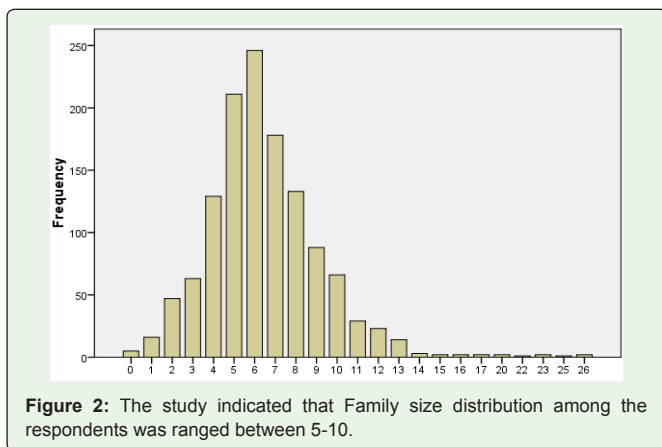
Results

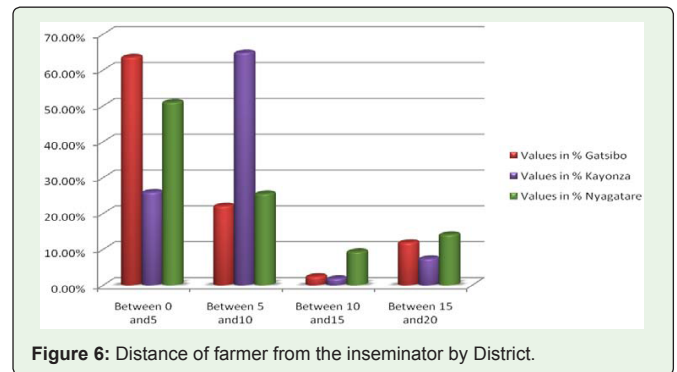
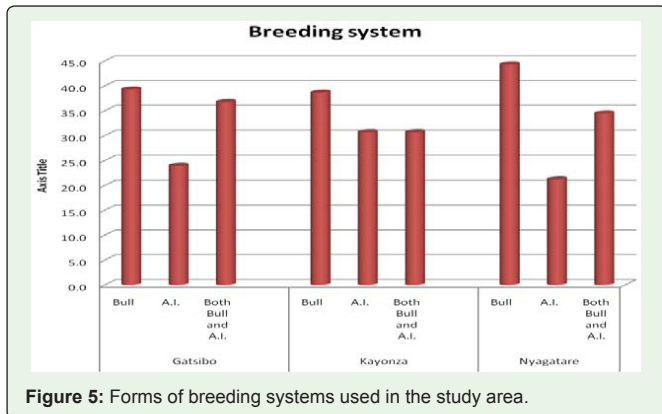
Family size

The majority of households had a family size of six to eight people per family and there were many families with more than seven family members. Large family-size suggests easy availability of family labor but also high demands for personal needs, subsistence. The reported family size was higher than Sub-Saharan average of 5.6 [14] but below Rwandan national average of 7.4 [3] which may be attributed to polygamous practices and traditional belief that, many children are for safety (family protection), inheritances and wealth as also reported

Herd structure

The age sex composition (herd structure) of cattle population there is a balance between the indigenous Ankole cattle and the various grades of cross breeding. The herd structure shows great potential for herd growth given the high proportion of mature cows. It could also be indicative of importation of mature dairy cows to build the national dairy herd through projects such as One Dairy Cow per Family (GirinkaInka). Indigenous (local) Ankole cattle were the predominant livestock kept in all Sectors, followed by cross-breeds with European cross breeds. Pure-bred dairy cattle were still in the study area. In terms of standard livestock units, all the cattle breeds constituted 90.6%, followed by goats (7.9%) and sheep (1.5%). There was no difference in average sheep flocks per Sector 1.18 ±3.0 similar findings was reported by Mazimpaka et al., and Miah [11,16]. However, the average goat flock size was significantly different (t=1.4, P < 0.05) among the Sectors. With regard to multite-species composition of farm flocks, the keeping of small stock with cattle is still a historical culture of Rwanda society (Figure 4).





Breeding systems

Although Artificial Insemination (AI) has been in Rwanda for decades, it is yet to be adopted by dairy farmers as this study revealed that natural breeding is still predominant in Eastern Province. Natural breeding with bulls still remains the predominant mode of breeding, although artificial insemination is on the increase in all the Districts of the study area. The study results showed that artificial inseminators were spatially attached to dairy farmers as most of them were less than 10 Kms away from the farms. Where Gatsibo and Nyagatare A.I services were mainly in the distance range of one (1) to five (5) kilometers from the farm, whereas in Kayonza the A.I services were in the distance range of 5 to 10 Kms Purchases and social exchanges still greatly contribute to herd growth. A high percent of sells show adoption of cattle production as a business and also possibly genetic culling of poor performing cattle for improvement. Crop residues and salt are the predominant modes of supplementary feeding. Nyagatare District more advances in supplementary feeding than Gatsibo and Kayonza shown in table 1. An over whelming majority of farmers in all districts do not perform supplementary feedings. Rice bran still very minimally used despite being abundant in the area [17,18]. There is no use of industrial dairy meals, seed cakes and pellets (Figures 5 & 6).

Record keeping

Majority of the farmers (93%) do not keep records while only 19 (7%) do keep records. No significant difference among the sectors ($p > 0.014$) but differently reported by Thornton [19]. Among the reasons of not keeping records (60%) mentioned lack of awareness (ignorance) same result was reported by Mpairwe et al., and Dixon et al., [20,21]. Water resources in the study area with regard to water sources, the majority of surveyed farms (89.7%) had no water near

or within their farms. Most farmers trekked their cows to the nearest public valley dam (59.2%), rivers (21.1%) (Muvuba and Akagera) and only 6% of respondents had access to piped water, while 2.6% of the farmers had water reservoirs in form of polythene sheeting and water tanks. It is noteworthy that the public water sources were often far from the farms as 41.9% of respondents reported a distance of 3-5km similar result was reported by Lumu and Peden et al., [22,23]. Evolution levels of cattle production system in Nyagatare District. The results of scores on ten management variables were determined in the current study on a scale of 0-100. The results revealed that the combined management practices of cattle farms in the study area were still at a medium level according to the score ranges where the scoring showed three main blocks, most farmers were in block area of scores of a range of 41-70 (54.9%) followed by a block of farmers scoring a range 0-40 (42.0%) leaving only 3.1% above 70 scores. More evolutionary signs were much seen in the Sectors of Rukomo with 53.03% scores followed by Nyagatare 49.76% scores with Karangazi scoring the lowest 29.33% (Figure 7).

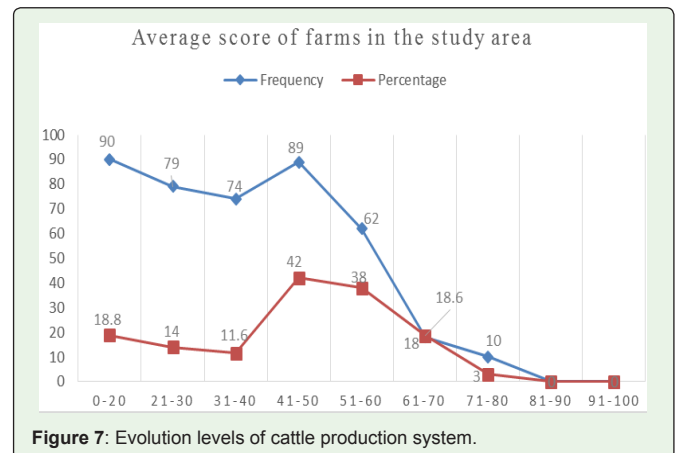


Table 1: Cattle Herd growth and off take by district for Umutara region.

District		Curves born	herd of bought	Herd of cattle Cattle Socially exchanged*	Annual Total	Current	Sold
Gatsibo	Total	477	467	461	944	1447	456
	Percentage	33	32	32			32
Kayonza	Total	171	169	168	340	532	172
	Percentage	32	32	32			32
Nyagatare	Total	567	563	566	1130	1707	564

Table 2: Various grades of indigenous-exotic and crosses.

Animals a	Locals	Crosses	Exotics
Calves	21.5 +.56	22.0 + .43	26.0 + .40
Heifers	3.4 + .07	3.4 +.07	7.0 ± .05
Cows	4.6 + .07	6.2 ± .09	11.2 + .10
Bulls	3.4 +.15	4.6 ± .03	8.4 ±.08
Steers	6.9 + .44	2.9 + .04	8.3 ± .03
Overall	8.5 +.12	10.9 + .11	14.0 + .19

Cattle mortality rates

Calves reportedly had higher mortality rates than all other age sex groups. However, the mortality of all breeds was significantly higher (t=14.06) in the exotics than in the local (9.7 ± .05). Similar results were presented by Mazimpaka and Usman et al., [11,24]. Calves in exotics had higher significant difference (t=3.2, p>.05) mortality than the local breeds and the calf mortality of crosses were intermediate. The main causes of mortality were reported to be diseases (68.6%), followed by lack of feeds 28.5%. In a study on dairy farms in four agro- ecological zones of Ethiopia, Mpairwe and Karimuribo et al., [20,25] observed that about 33% of the respondents indicated that diseases were the major cause of calf mortality in cattle, while up to 6% of the causes of mortality in calves were unclear to the farmers.

Given that diseases are a major constraint to the improvement of the livestock industry in the tropics as they decrease production and increase morbidity and mortality. Mazimpaka and Swai, special efforts should be put on disease diagnosis treatment and management to enable efficient cattle herd growth and production in Rwanda [11,18].

Weighted mean mortality rates (± s.e.)

Crop residues and salt are the predominant modes of supplementary feeding. Nyagatare District is more advanced in supplementary feeding than Gatsibo and Kayonza Districts. An overwhelming majority of farmers in all Districts do not perform supplementary feedings. Rice bran still very minimally used despite being abundant in the area [11,17]. There is no use of industrial

Table 3: Type of additional feed stuffs by each district in Umutara region.

District	Crop residues	Values (%)	Crop residues Usage	Rice bran	Values (%)	Rice bran Usage	Sunflowers cake	Values (%)	Sunflowers cake Usage
Gatsibo	Permanently	28%	42%	Permanently	3.02%	6%	Permanently	2%	4%
	Occasionally	14%		Occasionally	3.45%		Occasionally	2%	
	Never	58%	Never	93.53%	Never	96%			
	Total	100%	Total	100%	Total	100%			
Kayonza	Permanently	9%	12%	Permanently	0.00%	0%	Permanently	0%	0%
	Occasionally	3%		Occasionally	0.00%		Occasionally	0%	
	Never	88%	Never	100%	Never	100%			
	Total	100%	Total	100%	Total	100%			
Nyagatare	Permanently	34%	36%	Permanently	7.00%	8%	Permanently	0%	1%
	Occasionally	3%		Occasionally	1.08%		Occasionally	1%	
	Never	64%	Never	91.92%	Never	99%			
	Total	100%	Total	100%	Total	100%			

dairy meals, seedcakes and pellets. Similar results were reported by Katongole and McDermott [26] (Tables 2-4).

Levels of supplementation in the study area

Most farmers (58.5%) grazed their animals on pastures with minimal supplementation as only (6.4%) of farmers practiced supplement feeding using crop residues. Among the few that practice supplementary feeding the most (51.5%) were from Nyagatare district followed by Gatsibo district (31.5%). Planted grazing pastures were being used as (41.9%) reported to graze both natural and planted pastures including pasture trees. Napier grass (*Pennisetum purpureum*) was the main planted forage reported (93.2%) for supplementary feeding of grazed animals but also the main feedstuff for zero grazed animals, followed by *Chloris gayana* (5.1%) and *Brachiara*. Leguminous forages such as *Calliandra*, *Lucaena leucocephala*, *Desmodium* species, *Lablab* and *Mucuna* were also reported by few farmers (13%) predominantly in Gatsibo and Kayonza district. Maize and rice brans were reported to be the main feedstuffs used in supplementary feeding especially for lactating cows in all three districts. However crop residues of maize, beans and rice and purchased hay were reported to be used in dry season supplementary feeding (56.1%). There was statistically significant difference (XP2<0.05) among the districts (Tables 5).

Disease challenges

Most farmers (92%) practice mixed farming with maize and beans being the main crops as similarly reported by (Mbuza, Dixon and Brunori et al., [21,27,28]. East-coast fever was pertinently reported in Nyagatare and Gatsibo Districts followed by Trypanosomiasis (73.4%) and Helminthiasis. There was statistical significant difference in diseases occurrence in all Districts (p<0.05) similar report by Waiswa and Karimuribo [25,29] (Figure 8).

Farmers’ challenges and constraints

Cattle diseases were reported (93.6%) to be the main challenge faced mostly in Sectors of Kayonza 96.9% and Gatsibo 93.4%. Followed by lack of water much in Nyagatare (89.7%), and it was statistically significant different p< 0.002 among various Districts. Shortage of feeds especially during dry season was also a big constraint (78.6%) together with lack of breeding facilities (75.2%).

Table 4: Feed stuffs continues.

District	Hay	Values (%)	Hay Usage	Salt	Values (%)	Salt Usage	General usage of additional feeding
Gatsibo	Permanently	1%	5%	Permanently	16%	34%	18%
	Occasionally	4%		Occasionally	18%		
	Never	95%	Never	66%			
	Total	100%	Total	100%			
Kayonza	Permanently	0%	1%	Permanently	10%	10%	5%
	Occasionally	1%		Occasionally	1%		
	Never	99%	Never	90%			
	Total	100%	Total	100%			
Nyagatare	Permanently	2%	5%	Permanently	47%	52%	21%
	Occasionally	3%		Occasionally	5%		
	Never	95%	Never	48%			
	Total	100%	Total	100%			

Lack of information (67.5%), extension workers and lack of land were also statistically significant $p > 0.003$. The other constraints included: lack of capital, housing, price fluctuation and theft this was similar to report by Knowler [30].

The above challenges need immediate attention so as to enhance cattle production and the evolution process. Cattle production systems in Kayonza are still largely extensive or semi- intensive with low levels of intensification. Out-grazing on natural grasslands, on small pieces of fenced land predominates. Good dairy practices such as record keeping, supplementary feeding, calf housing, pasture improvement, Artificial Insemination and animal identification were still rudimentary. Similar results were reported by Nabahungu & Visser [31]. As a consequence growth and production parameters were still very low, where Age at First Calving (AFC) ranges from $40.1 \pm .31$ for indigenous cattle to $29.1 \pm .50$ months for exotics while calving rate is $42.3 \pm .45$ for local cattle and 65.7 ± 3.0 for exotics and average daily milk yield ranges from $2.4 \pm .08$ in local cattle to $09.42 \pm .36$ for exotic cattle, this result was similar to that of Tesfaye and Manzi [32,33].

Eastern part of Rwanda

The cattle disease situation is also still problematic as East cost fever; trypanosomiasis and helminthiasis still prevail at high levels, leading to high mortality rates. Same result was reported in Nyagatare District eastern part of Rwanda by Mazimpaka and Muhanguzi [11,34] in Western Uganda. Lack of water, feed shortage during dry season,

Table 5: Percentage feeding levels of supplements in the study area.

Item	Percentage
Feed stuffs and feeds used**	
Sorely on pastures	58.5
Supplements	6.4
Both (natural pasture and supplement)	41.9
Main food crops	
Maize	92.5
Beans, banana or soya beans residues	7.5

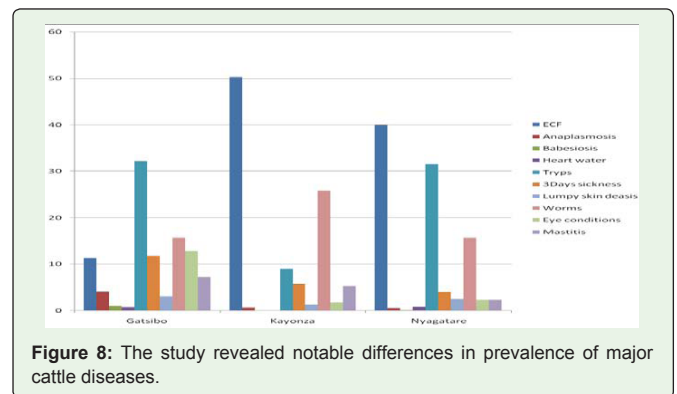


Figure 8: The study revealed notable differences in prevalence of major cattle diseases.

inadequate breeding facilities including veterinary services, lack of information and extension workers, small pieces of land, meager investment capital, ineffective cattle premises, price fluctuation and lastly stock theft are the prevailing challenge to improved cattle production in all three Districts.

Farmers' suggestions

In this study, both veterinary and financial assistance were reported by 83% of respondents as the huge need to help them improving their cattle production. Seventeen (17%) of respondent were purely subsistence farmers indicating no need for technology and financial interventions.

Conclusion

Dairy production in the Eastern Province of Rwanda is still at a low level of intensification and commercialization. Family size in the region is still very high at more than five members which demands high income per family. The cattle population in the region affects a balance between the indigenous cattle and the various grades of cross breeding between indigenous and exotic dairy breeds (mainly Frisian). The herd structures show great potential for herd growth given the high proportion of mature cows. Bulls are still the main mode of breeding as only (25%) of the farmers were using artificial insemination. However artificial insemination was on the increase

in all the Districts. Zero grazing was predominant in Gatsibo (60%), whereas fenced farms predominated in Nyagatare (65%). It is notable that communal grazing has greatly declined with exception of Kayonza at (10%). Crop residues and salt were the pre-dominant modes of supplementary feeding (42%). Especially in Nyagatare District where (21%) of the farmers supplemented dairy cows followed by Gatsibo (18%) and Kayonza only (5%) rice brand was still very minimally used despite being abundant in the area. There was no use of industrial dairy meals, seed cakes and pellets. Most farmers reported shortage of water in all Districts. East coast fever followed by trypanosomiasis was particularly reported in Nyagatare and Gatsibo Districts.

Recommendation

Farmers: Farmers should adopt artificial insemination, improved pastures and introduce legumes in dairy nutrition, purchase diary meals and vita mineral blocks for effective supplementation. Agro-processing and crop residues (brains) seed cakes should be widely used to reduce cost supplementation. They should regularly deep their cattle to control vector borne diseases. They should form and strengthen diary cooperatives to facilitate the acquisition of farming inputs and milk marketing University of Rwanda: The University should develop short courses for training farmers and farm managers in areas of diary feeds and feeding AI diseases management and control and farm managing. Adaptive research is required in areas of cost effective feeding technologies.

The Government of Rwanda: The government should increase more water sources in all the districts of the region and train farmers in water resource management. The government should also further support research and extension activities in the diary sector.

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