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Knowledge of Biosecurity among Livestock Farmers along Border Villages of South Africa and Botswana

O.I. Oladele, A.E. Kolawole and M.A. Antwi
Deaprtment of Agricultural Economics and Extension, North West University, Mafikeng Campus, Mmabatho, 2735, South Africa

Corresponding Author: O.I. Oladele, Deaprtment of Agricultural Economics and Extension, North West University, Mafikeng Campus, Mmabatho, 2735, South Africa

ABSTRACT

This study examines livestock farmers' knowledge of biosecurity along border villages of South Africa and Botswana. This is based on the fact that due to trans-boundary livestock activities between these countries farmers along the border villages are predisposed to inter-boundary disease transmission, which can be prevented by adequate biosecurity management practices. The population of study is all livestock producers in border villages along North West province, a mix of purposive and random sampling were used to select 199 respondents from which data were collected and analyzed with descriptive statistics and multiple regression analysis. The results show that 63% of the livestock farmers fall within the age 61 years and above. It is also revealed that 83.4% of the farmers are male, 66.8% of the farmers are married; most of the farmers are literate 61.8% of the respondents have less than five dependents, 94% of the farmers have livestock based farming system, 68.3% reported that they have no contact with extension agent, 96.0% have no access to market farmers personal and farm characteristics were significantly related to the farmers knowledge of livestock biosecurity practices. The F value of 3.74 shows a strong relationship between the independent variable and farmers' knowledge livestock biosecurity practices. The significant determinant at 5% sig. level are farm size (t = 3.343); extension contacts (t = -2.427); labour sources (t = -3.046), income (t = 2.113) while household size t = -1.729 and sources of land t = 1.867 are significant 10% sig. level.

Key words: Knowledge, biosecurity, incidence, prevalence livestock farmers, border villages

INTRODUCTION

Major limitations to livestock production in sub Saharan countries include are diseases, poor feeding, substandard management practices and unwholesome breeding policies (Lughano and Kambarage, 1996). Inadvertently, poor nutrition, poor breeding and poor management practices among other factors are also precursors to outbreak of animal diseases. Smolinski *et al.* (2003) also reported that the emergence of new livestock diseases can be due to world trade, animal translocation, ecological disruptions, climate change, pathogen adaptation and agricultural husbandry changes. This therefore implies that the occurrence and spread of animal diseases can be as a result of intrinsic weaknesses in management practices and extrinsic factors along the livestock production value chain and the environment. Lughano and Kambarage (1996) reported that diseases such as contagious caprine pleuropneumonia, contagious ecthyma, goat and sheep pox, foot rot, tyrapanosomiasis, helminthosis and ectoparasitic infestations are common diseases in

an extensive system of livestock production. FAO (2002) asserted that endemic production limiting diseases experienced among poor livestock farmers are not just because of the cost, absence and unsuitability of animal of animal health services but also as a result of poor production inputs, Communal grazing is characterized by poor management of cattle and low productivity. Shirley *et al.* (2010) argued that while intensification of animal production has proved a panacea to meeting the increasing demand for livestock products for the ever increasing world population, intensive system facilitates the easy transmission of diseases causing pathogens, therefore establishing an association between diseases incidence and prevalence with the systems of livestock production. Climatic factors also contributed immensely to the spread and transmission of many infectious diseases. Wobeser (2002) reported that a consequential increase in frequency of heat stress, drought and flooding events due to climate change can translate into increase in the existing vector borne diseases and macro-parasites, emergence of new diseases and transmission models. Furthermore drought motivated extensive migration of pastoral herds in search of water and grazing land facilitates the spread of vectors borne diseases due to contact between animals (FAO, 2002). However, whatever may be the cause of livestock diseases outbreak, the re-occurring decimals of its effect is summarized in the physical, economic, social, health and psychological devastating impacts it have not only on immediate stakeholders in the livestock industry but on the larger population as well. Belay *et al.* (2012) reported a loss amounting to 150 million USD due to poor productive and reproductive performance and death of animals in Ethiopia. FAO (2009) reported the direct effects on animal diseases to include poor feeding, poor digestion and metabolic rate, increase in cases of diseases and deaths, reduction in the rate of production, loss of body weight and abysmal drop in milk production. Shirley *et al.* (2010) submitted that contagious animal diseases impact negatively on food production in a number of ways, domestically it tells on the efficacy of meat production, death of host animals and barriers to international trade. Added to this is the increase in cost of production incurred to feed animals and pay for labour due to low rate of turnover in sales as a result trade barriers to prevent the prevalence of diseases. In addition to these are flight of capital, reduced consumption, loss in equity, loss productivity and sub optimal utilization of productive capacity (McConnell, 2006). There is also the animal-human disease interface in livestock production by which animal diseases infect human being with grave consequences of serious illness and deaths. Apart from this human health challenges due to zoonotic diseases is the further impoverishment of poor livestock farmers' income status due to the burden of paying for diseases control. Heffernan and Mistrueli (2000) reported that in Kenya farmers spent a large proportion of their income to treat endemic diseases. Sometimes necessary control measures such as culling may greatly affect the entire production sector, resulting into a devastating economic setback for the poor small holder livestock farmers' households for whom livestock is a major asset and safety net. In the same vein economic impact of diseases and the cost of control measures are high and becoming higher. The budgetary outlays which include cost for inspection, monitoring, prevention and response are sometimes prohibitive and commensurate to the cost of the size of the agricultural sector being protected (FAO, 2004).

There are instances where huge investments in animal diseases control do not pay off, because measures taken to combat such diseases proved ineffective (FAO, 2002). The huge cost associated with the control of animal diseases and the multidimensional losses due to the ineffectiveness of some of these control measures would have been avoided if there have been tangible investments in production inputs and adoption of more profitable risk management strategies that will forestall diseases outbreak (Swallow, 2000). FAO (2011) opined that sustained control of contagious disease

can be achieved by reducing the risks of disease transmission in the livestock population, in addition to quick disease detection, containment and response. Therefore a proactive approach to forestall the spread of animal disease through adequate preventive measures, or putting in place of a prompt curative measure for a noticed disease is a workable option in animal health and livestock production system with a weak financial base and whose stakeholders are small holder livestock farmers. These measures taken to keep diseases out of populations, herds or group of animals, formulated into a standard set of management practices and procedures is referred to as biosecurity. These routine practices include isolation of new animals brought to the farm, isolation of sick animals, regulation of the movement of people, animals and equipment and procedures for cleaning and disinfecting facilities and preventing the infiltration of wildlife. Biosecurity actions can be carried out by either of this ways, it can be total elimination of the disease agent out of the farm, called bio-exclusion or nipping in the bud the spread of already noticed disease in a unit referred to as bio-containment (FAO, WB and WOAH, 2007). The tone of farm-level biosecurity is determined by the producer or herd owner whose knowledge level of the biosecurity practices remain an influencing factor among other things in its effective practice.

The objective of this study is to examine Farmers' knowledge of biosecurity and to ascertain the incidence and prevalence of animal diseases along border villages between South Africa and Bostwana.

MATERIALS AND METHODS

The study was carried out in selected villages of the North West Province. South Africa has land boundaries: Total of 4,862 km and has land boundaries with countries such as: Botswana 1,840 km, Lesotho 909 km, Mozambique 491 km, Namibia 967 km, Swaziland 430 km, Zimbabwe 225 km. Land boundaries is the total and individual length for each of the contiguous border countries, when available, official lengths published by national statistical agencies. The selection of the study area was due to the high volume of trans-boundary activities particularly with respect to animals. The Northern Cape shares boundary with Namibia. Communities were purposively selected based on the concentration of livestock practices, while farmers were randomly selected from each community. The population of study is all livestock producers in border villages along Northern Cape provinces, a mix of purposive and random sampling were used to select 140 respondents for the study. Data were collected through the use of questionnaires, on farmers personal and farm characteristics and incidence and prevalence of livestock diseases. Descriptive statistics were used to analyze farmers personal and farm characteristics.

RESULTS AND DISCUSSIONS

Table 1 revealed that 31.7% of the livestock farmers fall within the age 61 years and above. It is also revealed in Table 1 that 28.6% of them fall within the age range of 51-60, while 18.1% of the farmers fall within the age range of 30-40 years. Those farmers whose ages are less than 30 years are just 6.5%. The age distribution of the respondent revealed older people predominance in the management of communal livestock in the study area. This may be due to the rural urban drift of youths due to the unattractiveness of agriculture as practiced by our farmers, they preferred the white collar job which they believed have a lot of prospects. The initial capital outlay to set up livestock production particularly ruminants is a bit high, considering the structures to be put in place; it would have been easier if the parents are into animal husbandry from which they can be given their own herd or get it inherited at death of parents. The rigors involved in a nomadic

Table 1: Personal characteristics of livestock farmers

Variable	Frequency	Percentage
Age		
<30	13	6.5
30-40	30	15.1
41-50	36	18.1
51-60	57	28.6
≥61	63	31.7
Gender		
Male	166	83.4
Female	33	16.6
Marital statns		
Single	57	28.6
Married	133	66.8
Widow	09	4.5
Religion		
Christianity	195	98.0
Bahai	1	0.5
Other	3	1.5
Edncational level		
Primary	90	45.2
Secondary	38	19.1
High School	36	18.1
College	6	3.0
University	4	2.0
Others	25	12.6
No. of dependents		
<5	123	61.8
5-10	70	35.2
≥11	6	3.0

pastoral life may also look disgusting to the youths. Skills borne out of experiences are necessary ingredients in communal livestock management. This is mostly gotten in this kind of systems through a sort of apprenticeship and mentoring that required not only patience but diligence and resourcefulness which are visibly missing virtues in our youths today. It is also shown from the table that 83.4% of the farmers are male while the female livestock farmers are just 16.6%. This is a clear expression that livestock farming is a male dominated activity in the area of study. This may not be far from the fact that most of the activities in the livestock production particularly the communal livestock husbandry are strenuous and energy demanding, coupled with this are a sort of intricate wild seldom characteristics of domesticated animals which require some level of courage which are rarely exhibited by the womenfolk. It is shown in the table that 66.8% of the farmers are married; 28.6% are single while 4.5% are widow. The bulk of married men involved in the keeping of hvestock underscored the possibility of a probable source of livelihood for almost all members of the family, the man getting income from the sale of animals while the women make their income from the sales of processed animal prducts like milk and cheese, the children too are gainfully engaged in marketing these products. This apart from been an economic diversification that will increase farmers income level is a fertile training ground for the children who are early introduced to livelihood options that can be a way of life for the rest of their lives. It will therefore be a viable job alternative for some of these children who by design or defaults couldn't take up other livelihood

options. IFAD (2003) reported that women are typically responsible for milking ewes, processing and selling milk products, providing feed or fodder and water, caring for newborn lambs/kids and sick animals. Young girls are also involved in the grazing of goats and sheep while male tasks include herding. So as members of the family by this design, carry out these livelihood options they are one way or the other providing the needed labour force for the farm. This is supported by the findings of, Mabe *et al.* (2010) which reported that many of the female farmers are married and that through marriage farmers gain access to family labour; 4.5% of the respondents were widows; there is a major possibility that the animals kept by these widows must have been inherited from their late husbands. And since these women were not totally aliens to livestock husbandry activities they must have continued with the support of their children in raising these animals. This buttressed the fact that livestock apart from being an asset act as a sort of a social safety nets for smallholders livestock farmers. About 29% were single, this implies that new blood are also injected into animal production, the fact that they took up livestock production at this particular period of their lives indicated that they may likely continue and take up livestock farming as a source of livelihood. Table 1 also shows that 45.2% of the farmers have primary school education, 19.1% have secondary school education, 18.1% attended high school and 3.0% of the respondents went to college and those who have university education had a share of 3.0%. This reveals that almost all the farmers have some sort of literacy. However, the distribution of the respondents according to their level of education revealed that almost half the people interviewed have just primary school education, while about one fifth of them have secondary education, the implication of this is that most of the people that find themselves in farming by default may be as a result of not being able to cope in school and now as drop outs find agriculture as the only easiest option to make a living, since that is almost a culture in the area of study. Moreover, the smaller percentage of highly literate respondent in livestock production shows that the elite still see agriculture as the place for the misfortune and the never do well. However, the fact that the bulk of the farmers are literate provided a platform for easy training in this area and a possibility of receptiveness to change. This is predicated on the fact that their literacy will enhance easy their easy understanding and adoption of improved livestock technology as packaged by extension that 61.8% of the respondents have less than five dependants, 35.2% have between five and ten respondents and 3.0% have above eleven respondents. The implication of this is that may be most of the households interviewed of respondents interviewed are only made up of the father, the mother and the children and these family members are enough to provide the needed labour on the farm, apart from this a higher number of dependants will mean a higher level of subsistence which will bear negatively on the lean source of income from livestock production. It may also be that farmers with large number of dependent have larger herd size which requires other helping hands and since they are dependents, the cost of their subsistence bore by the household head may be relatively cheaper than hiring labour. Furthermore, these crop of dependents may be more reliable as they may be members of extended family. Apart from this these dependents will be more experienced than hired labour since they have a steady continuous working as long as they remain with the household. Their loyalty to their benefactor may be better than those hired labour, another implication for improved livestock production.

Table 2 reveals that 39.7% of the farmers have less than ten years of farming experience, 42.7% have between ten to twenty years of experience and 10.1% have between twenty one to thirty years of experience. Five percent of the farmers falls between thirty one years and forty years, 2.5% falls within the age of forty one years and above. The respondents' years of farming

Table 2: Farm characteristics of livestock farmers

Variable	Frequency	Percentage
Years farming experience		
<10	79	39.7
10-20	85	42.7
21-30	20	10.1
31-40	10	5.0
≥41	5	2.5
Source of land		
Personal	166	83.4
Rented	2	1.0
Allocated	30	15.1
Others	1	0.5
Farming system		
Livestock based	187	94.0
Crop based	2	1.0
Mixed	10	5.0
Farm size		
<50 ha	165	82.9
51-2000 ha	4	2.0
≥2000 ha	30	15.1
Contact with extension agent		
Yes	63	31.7
No	136	68.3
Freqnency of contact with extension agent		
Regularly	118	59.3
Occasionally	56	28.1
Rarely	25	12.6
Source of extension messages		
Government	195	99.3
Non- governmental organization	2	1.0
Parastatals	2	1.0
Labour sources		
Self	168	84.4
Family	19	9.5
Hired	12	6.0
Access to market		
Yes	8	4.0
No	191	96.0
Access to credit		
Yes	1	0.5
No	198	99.5

experience revealed that majority of the farmers have above ten years of farming experience. It is an indication that most of the farmers are well experienced in livestock farming. The fact that a sizeable percentage of the farmers have less than ten years of experience is an indication that the number of livestock farmers in this area is not static, there is this possibility that new people kept on joining livestock production in the area of study. This years of experience also counts in good management practices which evolves over many years of livestock farming, particularly as it affects distinct identification and record keeping of diseases that affect their animals. It is also shown in Table 2 that, 83.4% of the farmer own the land they use for keeping livestock, 1% rented their land.

It is also revealed that 15.1% of the farmers have the land they use for livestock keeping allocated to them; Land is an important factor of production in agriculture. Therefore, this land ownership pattern is healthy for livestock production because it makes room for improved livestock production, which allows livestock farmers explored innovations without being fettered. It will also not be gainsaid if it is concluded that the sizeable percentage of the livestock farmers who had their land allocated to them may be beneficiary of the land reform programme in South Africa, which made land available to black emerging farmers.

Table 2 also shows that 94% of the farmers have livestock based farming system, 1% practiced crop based farming whereas 5% of the respondents practiced mixed farming system. It is clear from the foregoing that livestock farming is the culture in the area of study. The low percentage recorded by crop based and mixed farming among the respondents may be as a result of the climatically induced and the resultant vegetation facilitated comparative advantage livestock farming has over these farming systems because of the arid nature of the area and the vast area of Savanna which support livestock farming, especially ruminants. Sole crop production which recorded so low may not be a practice inherent in their traditional farming system however the crop-animal production integrated farming system if encouraged, would have been a symbiotic synergy that would have put animal and plant waste to their best uses. The poor soil will not only be rejuvenated by the application of dungs of animals which will serve as organic manure but put food on the tables of the farmers, provide feeds for animals from the vegetative remains of harvested plants and in the long run save the lean resources being spent on food by the poor farmers. It can also be a guarantee against failure in the animal enterprise. This was an important implication for the livestock extension workers. Table 2 also revealed that 15.1% of the respondents have farm size of about 2000 ha, 2.0% have between 51-2000 ha whereas 82.9% of the respondents have less than 50 ha. This small area of land owned by farmers is a true reflection of the land ownership pattern which is predominantly personally owned. Such personal lands are mostly inherited and must have suffered a sort of fragmentation over the years to make room for new family members who may want access to land. It may also be because of their small holdings of livestock which required less land areas because there is no need for large area of land to establish pasture since most the animals graze freely in natural grassland in these homesteads. The small proportion of farmers who have large area of farm land may have very large stock or operate on a large scale. These may also be farmers who benefited from allocation of land through the land reform programme, This programme does not just encourage black farmers as small holders but develop them into large scale commercial farmers. Table 2 also revealed that farmers provide 84.4% of the labour requirement on the farm, 9.5 and 6.0% labour were sourced from family members and hired labour, respectively. This predominantly provision of labour by the farmers themselves and the little support from the family typifies the features of the small scale livestock production, labour requirement is low and easily supplied by the farmer and his family members. It may also be because specialization is low or not existing in this system thereby minimizing the labour requirement as experienced in a specialized large scale animal production. Furthermore due to poor income of small holder livestock farmers payment of hired labour will be additional financial burden that may not be accommodated by the poor financial status, it may even mean a strategy to maximizing profit by these farmers since self and family labour are seen as free and have no financial implications attached to it. It is also shown in the table that 31.7% of the farmers indicated that they have contact with extension agents while 68.3% noted that they have no conact with extension agent. This may be as a result poor coverage of extension officer which may be due to paucity of extension officer or poor working

conditions particularly as it affects logistics, most of the time extension coverage is limited because of poor means of transportation, 59.3% of the farmers say that they have regular contact with extension agents, 28.1% said they occasionally meet with the extension agents while 12.6% of the farmers reported that they rarely meet with extension agents. The percentage of farmers that regularly meet with extension agents is encouraging. This may be because the few extension officers that are available visit farmers that are accessible, close to them or receptive to extension messages. It is seen that 89.3% of the farmers have access to market while 10.7% of the respondents do not have access to market. Also in Table 2, 99.3% of the respondent reported that Government extension agents are the source of their extension messages, while parastatals and Non-Governmental organization only provides 1% each of the extension messages. This development reveals that Non-Governmental agencies are not actively involved in livestock extension in the area of study. This may be as a result lack of awareness or necessary sensitization by the Government to bring in the Non-Governmental organization such a synergy tends to have a multiplier effect which will positively affect the farmers, lessen the burden of the work on governmental agencies and also improve the efficiency of the work. Table 2 shows that 0.5% of the farmers have access to credit while 99.5% of the respondents have no access to credit. This low percentage of farmers having access to credit may be as a result of stringent conditions attached to accessing credits by lending institutions which farmers find difficult to meet up with. Formation of cooperative societies seems to be lacking among these farmers and this would have been another viable options to other financial institutions in accessing credit in their own little way with bearable rules which tone will be set by them.

Diseases identified in the study area as revealed in Table 3 include lumpy skin, black quarter, Anthrax, Heartwater, Anthrax, Brucellosis, Footh and mouth Diseases, Newcastle, Avian influenza, Bovine Malignant, Anaplasmosis, Sheep scab, Rift Valley, Classical swine fever, CBPP and Trypanosomiasis Sheep scab, Blackquarter , Newcastle Disease, Rift Valley fever and Corridor. However, lumpy skin disease (52.3%), black quarter (44.7%), Heart Water (22.6%), Brucellosis (9.0%) and Foot and Mouth diseases (5.0%), were reported to be prevalent in the study area. However, lumpy skin is the most severe disease plaguing livestock in the area of study. This report

Table 3: Incidence and prevalence of animal diseases

Disease	Frequency	Percentage	Estimated cost of treatment/vaccination
Lumpy skin	104	52.3	29489.20
Blackquarter	89	44.7	12142.27
Heart water	45	22.6	2989.80
Anthrax	27	13.6	1776.60
Brncellosis	18	9.0	793.80
Foot and mouth disease	10	5.0	105.00
Newcastle disease	7	3.5	5.11
Avian influenza	5	2.5	13.30
Bovine malignant catarrh	4	2.0	0.00
Anaplasmosis	3	1.5	6.03
Sheep scab	3	1.5	3.18
Rift valley fever	02	1.0	10.60
Classical swine	2	1.0	3.02
Cattle rabies	1	0.5	1.11
Trypanosomiasis	1	0.5	0.00

Table 4: Multiple regression analysis of personal characteristics and knowledge of biosecurity

	Unstandardized coefficients		Standardized coefficients		
Parameters	B	Std. Error	Beta	T	Sig.
(Constant)	57.447	5.378		10.682	0.000
Sex	-0.043	1.791	-0.001	-0.024	0.981
Age	0.037	0.050	0.045	0.744	0.457
Marital status	0.228	1.048	0.013	0.218	0.828
Household size	-0.416	0.241	-0.090	-1.729	0.085
Sources of land	0.829	0.444	0.097	1.867	0.063
Farm size	0.001	0.000	0.193	3.343	0.01
Group membership	0.660	1.476	0.024	0.447	0.655
Extension contacts	-3.269	1.347	-0.130	-2.427	0.016
Labour sources	2.705	0.888	0.178	3.046	0.003
Income	4.676E-005	0.000	0.130	2.113	0.035
Extension contacts	-0.002	0.061	-0.001	-0.026	0.980
F	3.74				
R	0.205a				
R square	0.042				

of prevalence of Lumpy skin disease in the study area agreed with the findings of Belay *et al.* (2012) which reported high incidence of Lumpy skin disease among cattle in small scale livestock production system in Jimma.

Table 4 shows the multiple regression analysis of the relationship between farmers personal and farm characteristics and farmers knowledge of livestock biosecurity practices. The independent variables were significantly related to the farmers knowledge of livestock biosecurity practices. The F-value of 3.740 shows a strong relationship between the independent variable and farmers' knowledge livestock biosecurity practices. The significant determinant at 5% significant level are farm size (t = 0.01) income t = 2.113, extension contacts t = -2.427 and labour source t = 3.046 while source of land t = 1.867 and household size = -1.729 are significant at 10% significant level. This implies that farmers' farm size affects livestock farmers' knowledge of biosecurity practices. The larger the size of the farm the greater the level of investment and the level of income, therefore, farmers operating on a large economy of scale will put in necessary measures to forestall any outbreak of diseases which consequences can be devastating and a monumental loss. Farmers' contact with extension agents influence their access to information on improve practices in agriculture and in this stance will not only be aware but have a regular updates on tips on biosecurity practices which definitely will increase their knowledge. It then implies that the more the contact with extension agents, the better the knowledge of farmers on biosecurity. Skilled labour tend to have a better knowledge of biosecurity practices than their unskilled counterparts, their actions and inactions on the farm will not just be guided by the fear of consequences of not doing the required but by a sound knowledge of the implications of a wrong actions which is a mark of true professional. Improve income will enhanced farmers abihty to purchase necessary items and those of a better quality, measures needed to be put in place and precautions needed to be taken to upheld farm level biosecurity standard will not be compromised for lack of fund.

CONCLUSION

This study revealed that hvestock farmers along border villages of South Africa and Bostwana are mostly above 50 years of age, male, married; literate, have less than five dependents, have

livestock based farming system, have no contact with extension agent and access to market. Prominent diseases are Lumpy Skin, Brucellosis, Blackquarter, Anthrax, Heart water Sheep scab, foot and mouth Diseases, while other diseases are reported to be minimal. It therefore implies that there is need to educate livestock farmers to introduce preventive practices in order to limit the incidences and prevalence of these diseases. Training should be organized for all categories of livestock farmers particularly those operating on small scale to keep them abreast of livestock biosecurity practices. Extension agents should not only improve on their coverage but also make also make trainings on biosecurity practices part of their livestock extension packages. Government should recruit more and competent agricultural extension agents, especially livestock extension personnel.

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