BACKGROUND STUDY ON

CONTAGIOUS BOVINE PLEUROPNEUMONIA

(CBPP)

IN UGANDA

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ACRONYMS

CBPP	Contagious Bovine Pleuropneumonia
CFT	Compliment Fixation Test
DVOs	District Veterinary Officers
ECF	East Cost Fever
MAAIF	Ministry of Ariculture Animal Industry and Fisheries
OAU	Organisation of African Unity
OIE	Office des International of Epizootics
PACE	Pan African Control of Epizootics
PARC	Pan African Rinderpest Campaign
PMA	Plan to Modernise Agriculture
USA	United States of America

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EXECUTIVE SUMMARY

Contagious Bovine Pleuro-pneumonia (CBPP) is an infectious disease of the lungs in cattle caused by a bacterium through inhalation of infected droplets from infected animals. Symptoms include loss of appetite, severe cough and, if unchecked, outbreaks can result in mortality rate of over 50%. CBPP is a major cattle plague in Africa and therefore a major threat to cattle health and production. Direct losses result from mortality, reduced milk yield, and vaccination costs; indirect costs are due to loss of weight and working ability, delayed marketing, reduced fertility, losses due to quarantine and reduced cattle trade.

The disease causes heavy losses of livestock of cattle in endemic parts of Uganda which are mainly found in the north-eastern and north-western parts. A cost-benefit analysis of control programmes is necessary before launching campaigns to control the disease. It is against this background that this study under the Pan African programme for the control of Epizootics (PACE) was recommended to get baseline information on CBPP and lay strategies for its effective control.

This study aims at getting baseline information to assess economic impacts of CBPP, identify strategies in place and design optimal and sustainable control strategies in Uganda. The specific objectives of the study are: The specific objectives are, to:

- Describe the historical status of CBPP and extent of its spread to date
- Describe the various production systems in Uganda affected by CBPP and provide its epidemiological parameters.
- Assess the accuracy of the data collected
- Provide epidemiological parameters from national abattoirs
- Describe the cost recovery measures that have been used for CBPP, costs and sources of vaccines, costs and revenues collected since 1990.
- Give estimates of area cattle populations, and vaccinations and production systems
- Give an account of the different control methods used so far, problems encountered and achievements attained.
- Design optimal and sustainable control strategies

The focus of this study was the collection and analysis of data available from central level

national abattoirs. The findings show that CBPP remains a major cattle disease in Uganda and a serious obstacle to development. The findings also show that several control strategies are applied against CBPP, including test and slaughter, mass vaccinations, chemotherapy and control of cattle movements.

The test and slaughter method relies on sero-surveys to diagnose CBPP using complement fixation test (CFT). Cattle that are found to have the disease are slaughtered. Results show that since 1997, the number of seropositive cattle has been on the decrease. Positive herds are mainly detected among cattle from Mbarara and Ntungamo Districts. Mass vaccinations have been a major strategy in the control of CBPP in Uganda since the early 1980's. As a result of annual vaccinations, the disease has now been suppressed in most of the districts except in the North Western and North Eastern endemic districts. In chemotherapy, animals and positive reactors resulting from CFT are treated with Tylosin. However, Tylosin is very expensive and not affordable by most farmers. Control of livestock is one of the most effective methods of controlling and preventing the spread of CBPP especially when combined with the test and slaughter policy. Under this method, livestock markets remain closed in affected areas and efforts are made to obtain cattle directly from the farmers to slaughter places.

CBPP can rapidly spread in epidemic proportions across the country unless it is checked. There is need thus put in place sustainable control strategies to control and/or eradicate the disease. Based on the above findings, this study recommends the following measures:

a) Formulation of an effective on policy CBPP control
b) Improved resource allocation for CBPP control programmes
c) Establishment of epidemiological investigations and surveillance systems
d) Establishment of CBPP information systems
e) Training of service providers
f) Farmers sensitisation and training
g) Intensive disease surveillance and vaccination
h) Training of community based local vaccinators
i) Establishment of a monitoring and evaluation system of CBPP activities

Due to the transboundary nature of CBPP, the proposed control measures need to be commensurate with those of neighbouring countries under a regional collaborative

INTRODUCTION

1.1 General Background

The responsibility for livestock disease control in Uganda is the Ministry of Agriculture Animal Industry and Fisheries (MAAIF). Under the MAAIF, there is a Directorate of Animal Resources with a Department of Animal Health and Entomology that is responsible for livestock disease control. Government reform to modernise agriculture has resulted in the formulation of an overall framework for agricultural development under the Plan to Modernise Agriculture (PMA). Within the PMA, disease control is considered a priority. Contagious Bovine Pleuropneumonia (CBPP) is a key strategy under disease control.

1.2 Background information on CBPP

Contagious Bovine Pleuro-pneumonia (CBPP) is an infectious disease of the lungs in cattle caused by a bacterium, *Mycoplasma mycoides* var.*mycoides*. It is occasionally found in water buffaloes and yak (Blood and Henderson, 1979; Merck Veterinary Manual 1998). Symptoms include, loss of appetite, severe cough and if unchecked, outbreaks can result in mortality rate of over 50%. The disease is spread by inhalation of infected droplets from animals with the disease. Thus the infection is spread faster in places where animals are gathered together e.g. markets, housing transit, etc. Unapparent careers are a major source of infection and can carry the infection up to over two years. The organism can only survive a few hours outside the host.

CBPP is a major cattle plague in Africa and therefore a major threat to cattle health and production. Mlengeya (1995) states that direct losses results from mortality, reduced milk yield, vaccination campaign costs, disease surveillance and research programmes; while indirect costs are due to loss of weight and working ability, delayed marketing, reduced fertility, losses due to quarantine and reduced cattle trade. CBPP is of major economic importance. Outbreaks between 1990-95 in Tanzania resulted in deaths of 14,000 cattle valued at a cost above one million dollars (Mlengeya, 1995).

According to Blood and Henderson (1979), the disease was eradicated from USA in 1992, South Africa in1916 and Australia 1972. It is still found in other places such as India, China, South East Asia, Southern and Eastern Europe. The disease could have spread from Eastern and Western Africa through trade route and it is now endemic in much of the sub-Saharan Africa and its incidence is increasing (Egwu et al, 1996). Since 1994, its epidemiological situation in Africa has become alarming following the spread of the disease into areas of Southern and Eastern Africa that had been previously free from the disease, (www.dis.strath.ac.uk, 6/8/2001). Most serious

smuggling of livestock at the end of Namibia war of independence) and in Tanzania in 1995, countries which had not previously experienced the disease for 56 years and 50 years respectively. Some outbreaks also occurred in Zambia's borders, (www.dis.strath.ac.uk; www.fao.ag/aaga/agah/empres/news3.htm 6/8/2001).

Through rapid control measures such as restriction of cattle movement, erection of fences and slaughter of infected herds, Botswana has controlled the disease and was declared provisionally free from CBPP in January 1997 (www.fas.org/ahead/disease/cbpp 21/8/2001). However, CBPP is still endemic throughout most of semiarid and Sub Sahara Africa especially the wide belt from West Africa to Somalia, (Blood and Henderson, 1979). It is mainly enzootic (sporadic) in West Africa and South East Africa, thus placing South Africa under direct threat. Seasonal cattle movements by pastoralists resulted in CBPP spread from Kenya in 1990 where the disease had been endemic for some time to Tanzania (Egwu, 1996; www.fas.org/ahead/disease/cbpp, 21/8/2001). Due to draught, failure to report outbreaks of the disease, and continued unrestricted movement of livestock, CBPP spread further South in 1995 to most central and East Africa (OIE, 1995). It is further reported that the disease causes greater losses in cattle in Africa than any other disease (OIE, 1995). CBPP is therefore one of the priority diseases identified in the Pan African Control of Epizootics (PACE) and a major focus of activity for the programme.

1.2 Strategies to eradicate CBPP

A number of strategies for CBPP control and eradication exist in affected countries and regions. These include test and slaughter, mass vaccinations, chemotherapy and control of cattle movement.

(a) Test and Slaughter system

This method, also called "stamping out" is used when the disease is already present in the area. The complement Fixation Test (CFT) is used to identify infected animals in conjunction with clinical examination. All positive and suspicious reactors, and clinical cases are thereafter destroyed or transported under close control to abattoirs. Animals are kept under quarantine till slaughter. The slaughter system has been greatly used in developed countries like Great Britain and USA, (Egwu, 1996) where government compensates farmers. In Africa, Botswana has successfully used this strategy to eradicate the disease in 1995/1996 at a great cost, (www.fas.org/ahead/disease/cbpp 21/8/2001). About 300,000 heads of cattle were destroyed and buried and farmers compensated. In Botswana, to prevent re-infection, the stamping out method was complemented by fencing off farms and effective and efficient control of cattle movement.

While the strategy is one of the best in disease eradication, it has a number of disadvantages. It is

restock herds, (Egwu 1996). Most governments in Africa and other developing countries especially those with a pastoral economy cannot afford to compensate the farmers (Masika, 1996 and Egwu, 1996). Test and slaughter strategy is impractical where fencing is poor and collection of every animal cannot be guaranteed especially among the Nomads. In addition, most laboratories are not well developed to carry out the tests in the field. This is coupled with limited skilled personnel to do the tests. The method also psychologically affects the farmers as they watch their animals being killed and buried or burnt.

The success of this method relies on early detection of the disease and the ability of the authorities to detect the outbreaks effectively and to maintain the vaccinations for at least three years. Another problem is that cattle in incubative stages of the disease may give a negative reaction to the test (Blood and Henderson, 1979). Re-testing cannot be performed until two months later due to the serological reactions after the vaccination. This time lag might lead to further spread of the disease.

(b) Mass vaccinations:

Mass vaccination involves vaccinating all cattle in a given area at risk. It is widely used in endemic areas. According to Egwu et al (1996), two freeze dried live vaccines; TISR, KH3J and T144 are being used for immunizing against CBPP. Immunized cattle suffer mild infection and if given as a tail tip injection, the tail becomes inflamed and, in 40% of cases drop off. Therefore farmers are often reluctant to vaccinate against CBPP and prefer to treat their cattle with antibiotics. In addition, it is reported that TISR has failed to control recent outbreaks. Vaccine efficiency trials for both vaccines in Kenya and Cote d' Ivoire indicate that levels of protection achieved were not as high as expected, with only 50% developing immunity. Both vaccines provide insufficient immunity lasting less than one year and have to be repeated every year. More worryingly, breakdowns can occur in vaccinated herds (Egwu et al 1996). The method, if used over a period of 5 years can be used to eradicate the disease by reducing the prevalence of infection to significant levels. Ideally the infection can be finally eliminated by a test and slaughter policy.

According to Masiga et al (1996) while mass vaccination is practiced to reduce the spread of the disease there are limitations to its application.

- Re-introduction of the disease as a result of poor cattle movement control systems.
- The expense involved in the mass vaccination followed by a test and slaughter policy. This may not control the disease especially if done by individual countries. There is need for concerted efforts from effected countries at risk of the disease, to identify and/ or put in

- Reactions like arthritis, myocarditis and vulvular endocarditis 3-4 weeks after and these need a follow up with antibiotic treatment making it more expensive for the farmers.
- Calves less than six months are not vaccinated yet they may get infected and spread the disease (Blood & Henderson, 1979)
- More often vaccines are commonly injected at the tip of the tail. In some cases, severe reactions occur resulting in severe lesions and sloughing off the tail and extensive cellulitis and necrosis at the hind quarters (or any part of the animal). This necessitates antibiotic treatment, and/or may result in death of the animal (Blood and Henderson, 1979)
- The reactors after vaccination are treated with a mycroplasmocidal drug like tylosin. This interferes with the development of immunity and such animals need to be re-vaccinated and resulting into increased expenditures for the farmers/government.
- Vaccines from M.mycoides grown in broth culture produce less severe reactions but correspondingly brief immunity of about 6-10 months and requires animal re-vaccination. The T I strain (+ve) broth-culture commonly used in nomadic cattle herds of Africa (Blood and Henderson 1979) have a long-term immunity of at least 2 years. Despite the severe reactions, virulent vaccines are still in use and are generally preferred provided tylosin is available to control the undesirable reactions.
- All vaccines against CBPP are susceptible to light and should be kept in a dark place. Thus the "shelf" life is shortened especially in tropical countries.

(c) Chemotherapy:

Endemic CBPP is not significantly different from losses caused by diseases such as East Cost Fever (ECF) and Trypanosomiasis. Masiga et al (1996) report that CBPP annual mortality is estimated at about 10%. Treating cattle with Tylosin and Sulphonamides can reduce the effects of the disease and the severe reactions after vaccination. According to Blood and Henderson (1979), the recommended dose rate of tylosin is 10mg/kg Body Weight (Bw) every (twelve) 12 hours for 6 injections (intramuscularly) and spiramycin at 10-15mg/kg Bw depending on the severity of the disease and/or reactions to vaccines. The recommended treatment is expensive for individual farmers who end up using other cheaper treatments like oxytetracycline and penicillins (though with some curative effect they are not very effective and are not drugs of choice). Use of antibiotics is discouraged. Ter Laak (1992) suggested that treatment might not eliminate the causal agent especially where lesions are sequestrated. It is suspected that use of antibiotics reduce clinical signs while creating chronic carriers that spread the disease to healthy animals (Mlengeya 1995) and the animals' immunity is reduced by the antibiotic treatment.

(d) Control of cattle movement:

Control of cattle movement is used together with other methods to prevent entry of CBPP into a free area. Quarantine is put in place but only the following categories of cattle (vaccinated or not) can be permitted to enter a free area: -

- Cattle that have not been in an infected area or in contact with infected animals for at least 6 months (Blood and Henderson 1979).
- Cattle that have given negative reactions to the Compliment Fixation Test (CFT) on two occasions within the preceding two months and have not been in contact with infected animals during this period.

Effective control of cattle movement, calls for concerted efforts of affected countries especially those sharing borders.

2 OBJECTIVES OF THE STUDY

2.1 Background to the study in Uganda

CBPP is endemic in some parts of Uganda. Like in most African countries, it has caused heavy losses to farmers and the country at large. Several strategies have been used to control the disease but it still remains endemic and sporadic cases still occur. The disease causes immense economic losses. A cost-benefit analysis of control programmes is necessary before launching campaigns to control the disease. It is against this background that the Pan African programme for the Control of Epizootics (PACE) has sought to carry out a study in Uganda to get baseline information on CBPP in Uganda and lay strategies for its effective control.

2.2 Goal

This study aims at getting baseline information to assess economic impacts of CBPP, identify strategies in place and design optimal and sustainable control strategies in Uganda.

2.3 Specific objectives

- To describe the historical status of CBPP and extent of its spread to date
- To describe the various production systems in Uganda affected by CBPP and provide its epidemiological parameters such as outbreaks, incidence rates, mortality and morbidity rates over the last ten years in the high risk, low risk, epidemic and endemic areas.
- To assess the accuracy of the data collected
- To provide epidemiological parameters from national abattoirs
- To describe the cost recovery measures that have been used for CBPP, costs and sources of vaccines, costs and revenues collected since 1990

- To give estimates of cattle population and vaccinations against CBPP in areas and production systems
- To give an account of the different control methods used so far, problems encountered and achievements attained.
- To design optimal and sustainable control strategies.

3. METHODOLOGY AND SCOPE OF THE STUDY

3.1 Literature review

The consultant reviewed literature and documents such as publications, project reports, annual reports at National and District levels to get information on epidemiological parameters such as number of outbreaks, incidence rates, mortality and morbidity rates, vaccinations, costs, sources of vaccines, types and revenue collected on the cost recovery basis.

3.2 Consultations

The consultant conducted informal interviews and group discussions with selected officials, extension workers, District Veterinary Officers, farmers, Ministry of Agriculture officials who have worked with the Pan African Rinderpest Campaign (PARC) and the PACE coordinator to find out their understanding of the disease (history, incidences, etc.) as well as finding out the control strategies.

3.3 Data Analysis

The information obtained was analysed to determine disease trends (historical background, incidences, etc.) using narrative description.

4 FINDINGS

4.1 Historical status and incidence of CBPP in Uganda

CBPP remains a major cattle disease in Uganda and a serious obstacle to cattle development in the country. Between 1947 and 1979 CBPP outbreaks were effectively limited to Karamoja District (Egwu et al 1996), and, it is believed that CBPP spread from Sudan and Kenya to Karamoja through cattle raids. The disease did not spread to the rest of the country due to effective livestock movement control measures at the time. Prior to 1979, no cattle would leave Karomoja to the rest of the country for breeding. They would only leave Karamoja for slaughter in Mbale, Soroti, Mukono and Kampala, before departure for slaughter, they would be quarantined at a holding ground on the border between Karamoja and Soroti. All animals would be bled and tested using

the CFT; those that tested negative would be left to move to the abattoirs in the South up to Kampala, using the train; positive ones were slaughtered within Karamoja.

After the 1979 war, and the subsequent civil war of 1980-86, cattle movements from Karamoja were not effectively controlled (MAAIF, 1996. The quarantine at the Karamoja-Sudan border was not enforced. As a result, cattle moved to the rest of the country by lorries through Tirinyi or by train. Thus, during the early 80's, CBPP outbreaks were reported in Soroti, Lira, Kitgum, Mbale, Mukono, Kampala and Jinja.

After the civil strife of 1980-1986, the Banyankole who had settled in Soroti moved to Luwero through Tirinyi, Kamuli and Mukono, spreading the disease as they moved. Animals would also be bought for breeding from the East to the rest of the country, while farmers would also shift to different areas as war intensified in their places, (Rwamushwa, personal communication, August 2001; Mwaka, personal communication, August 2001). This led to serious outbreaks in Mukono and Tororo in 1982-83 and by 1987 the disease had spread to Luwero, Kumi, Pallisa, Iganga and Kamuli, and in 1988, CBPP was reported in North Western Region and Iganga in 1988 (Magirigi, personal communication, August 2001; Iganga report 1995).

CBPP spread to the South and Southwest where the disease had never occurred. In September 1990, the disease was reported in Masaka and Rakai districts, and subsequently to Ankole Ranching Scheme in Mbarara District (Egwu et al, 1996; MAAIF, 1996). This CBPP spread was hastened by the cattle movement from Luwero up to Rwanda by Banyarwanda who returned to their country after the war, and by some Banyankole pastoralists who moved from Luwero to resettle in Sanga Mbarara during the restructuring of the ranches.

Recent outbreaks of CBPP have occurred in Namayuge and Mugongo parishes in Bale county Kayunga district (Mugabi, July 2001) and in Kikatsi subcounty Nyabushozi county Mbarara District (Barigye July 2001 and . Following CBPP history, incidences and its spread in Uganda, no district can be considered CBPP free.

4.2 Livestock Production Systems in Uganda

4.2.1 Pastoral

This system is practiced in Karamoja (Moroto, Kotido and Nakapiripiti Districts), and in some parts of Mbarara District. In Karamoja, nomadism is predominant. Cattle owners move their stock in search of water and pature. Such uncontrolled stock movements increase the spread of CBPP, and thus nomadism is an important means of transmitting infection from herd to herd. In some

activity. Cattle are confined to fenced farms and this reduces risks of disease transmission between herds

4.2.2 Agropsatoral

The system is practiced in all districts of Uganda mainly in Central, Western and Eastern except Karamoja. Both crop and livestock farming co-exist. Under livestock, different sub-systems are practised, namely: fenced farms, zero-grazing and communal grazing.

4.3 CBPP Control methods in Uganda, Problems encountered and Achievements

Since early 1980s, the major control strategy has been mass vaccinations in affected districts and those at risk. Other strategies include post-mortem inspection, serosurveillance and control of livestock movements.

4.3.1 Control Strategies

(i) Mass vaccinations

Mass vaccination campaigns have been a major strategy in the control of CBPP in Uganda since the early 1980's. PARC in collaboration with Government supported the vaccinations against Rinderpest and CBPP in 1990-1992 under the first phase of PARC TCP/UGA/2251 (MAAIF, 1996). In 1995, FAO supported the second PARC project (TCP/UGA/4454(E)) to continue with the vaccinations and to establish an efficient movement control system within the country and at the borders as well as strengthening disease surveillance (MAAIF, 1996).

In 1996 a new CBPP control strategy of vaccinating cattle once per annum was put in place. However, in areas where outbreaks were reported, vaccination was to be carried out at intervals of 0, 3, & 9 months (MAAIF, 1996). In 1997, FAO supported another programme which aimed at vaccinations and surveillance. After vaccinations, all animals are ear notched and certificates issued. Cattle without ear notches and certificates are not permitted to move to other areas. Table I shows the types and sources of vaccines used in Uganda since 1994.

As a result of annual CBPP vaccination campaigns, the disease has now been suppressed in most of the districts in the country except in the North Western and North Eastern endemic districts.

Table 1: CBPP Vaccines Used in Uganda

Date	CBPP Vaccine Manufacturer	Quantity (doses)	Type of Vaccine
24.09.94	Botswana Vaccine Institute	600,000	Not specified
16.12.94	Botswana Vaccine Institute	400,000	Not specified
27.07.95	Botswana Vaccine Institute(FAO)	400,000	Not specified
19.08.95	Botswana Vaccine Institute	591,200	Not specified
29.01.97	Botswana Vaccine Institute	200,000	Not specified
13.05.97	Kevevapi	309,300	Not specified
18.07.97	Kevevapi	265,450	Not specified
23.07.97	Botswana	500,000	Not specified
25.08.97	Kevevapi	76,000	Not specified
05.09.97	Botswana	1,000,000	T144
08.09.97	South Africa	230,000	Not specified
29.09.97	Kevevapi	107,900	Not specified
04.11.97	South Africa	970,000	Not specified
14.11.97	Ethiopia (FAO)	1,000,000	PERIBOV T144
12.10.99	Kevevapi	100,000	Not specified
23.05.2000	Botswana	230,400	Not specified
29.05.2000	Botswana	219,600	Not specified
14.07.2000	Botswana	230,000	Not specified
17.07.2000	Botswana	219,600	Not specified
	TOTAL	**7,649,050**	

T_1 – SR Vaccine was used from 1991 to 1993

Source: Ministry of Agriculture Animal Industry and Fisheries (2000)

(ii) Disease surveillance

Post-mortem inspection

Surveillance by post-mortem inspection is used to detect CBPP outbreaks and this has largely been by way of post-mortem inspection at abattoirs in different districts. The source of the affected cattle is traced backwards to the district of origin and control strategies timely executed. To improve surveillance at abattoirs, emphasis has been placed on training meat inspectors to increase their capacity in CBPP recognition skills. Surveillance is useful in accessing the disease situation country wide. However, it suffers from delays in submitting district reports to MAAIF.

Surveillance

Sero-surveys are used for CBPP diagnosis using CFT. Results show that since 1997, the number of seropositive cattle has been on the decrease. Positive herds are mainly detected among cattle from Mbarara and Ntungamo Districts. The Central Laboratory at Entebbe is equipped with diagnostic equipment, reagents and a standby generator provided under the PARC Project. The laboratory technicians were trained on enzyme immunoassays and their role in CBPP diagnosis.

The main problems facing CFT use include: high costs of the equipment, difficulty in handling animals, and resistance of some tribes such as the Karamojong against taking blood samples from their animals. In additon, high costs limit the number of animals tested.

(iii) Chemotherapy

Infected animals and positive reactors resulting from CFT are treated with Tylosin. However, Tylosin is very expensive and not affordable by most farmers who then turn to cheaper antibiotics like oxtetracycline. This is likely to hamper eradication efforts as such treatment creates a carrier state among the animals *(It was not possible to get detailed information on antibiotic treatments during the study).*

(iv) Control of livestock movement

This is one of the most effective methods of controlling and preventing the spread of CBPP especially when combined with the test and slaughter policy. Under this method, livestock markets remain closed in affected areas and efforts are made to obtain cattle directly from the farmers to slaughter places. Effective stock movement requires that cattle for slaughter are moved on trucks and are accompanied by permits signed by the district veterinary officer. Interstate movement is effected with permits from the Commissioner of Veterinary Services in consultation with veterinary authorities of countries of destination. Movement of breeding stock is limited unless animals are confirmed negative through tests.

Although animal movements should be preceded by tests, it is not often possible to carry out the tests due to lack of laboratories in the districts. In addition, continued civil strife and drought limit the effectiveness of this method as it becomes difficult to control animal movements. The main impediments to the use of this method are:

- Theft of animals, as stolen animals are moved without permission from authorities
- Indisciplined soldiers also disregard movement laws/quarantines
- People fleeing from war zones sell their cattle and this changes the normal pattern of livestock movement.
- Quite often, farmers fleeing civil unrest take their cattle with them to endemic areas and return them after the war and this may introduce disease to their areas. Experience has shown that at the first hint of an outbreak, farmers sell their cattle to traders who transport them without testing or quarantine thus spreading the disease further.

(iv) Cost recovery measures

Cost recovery was has been instituted in Uganda as an effective strategy to make the CBPP campaign sustainable. The cost sharing system of CBPP vaccination campaigns was first introduced in Uganda in 1992. A fee of U.Shs. 100/= per head of cattle vaccinated against CBPP was instituted during the Pan African Rinderpest Campaign (PARC). With this arrangement District Veterinary Officers are responsible for collecting vaccination fees from farmers. The funds collected are managed as a revolving fund for operational costs for vaccination campaigns.

In 1999, the fee was raised to 300/= (three hundred shillings), but its enforcement of 300/= cost recovery per head has not yielded good results. Most farmers are not willing to pay for routine vaccinations unless there is an outbreak (Mayega, 2001. This has led to low response to vaccination campaigns. For example, a report from Masaka District shows that a significant potion of CBPP vaccine received in 2000 were not used, and it was subsequently returned to the MAAIF after expiry. The low response to vaccination has left many districts with vaccines that are not used.

Another problem affecting cost recovery is failure by district authorities to remit funds. This could be a result of poor sensitisation and organisation of farmers by the District Veterinary Officers (DVOs). Currently, districts that do not remit these funds do not get more vaccines. This however creates a problem as the vaccines stay unused . Table 2 shows accountability for vaccines received by some districts. The money indicated as 'funds not recovered' includes vaccines which are wasted due to non use or other spoilage.

Table 2: Accountability of Vaccines procured and used in Masaka, Kumi and Mukono Districts

District	Year received	Vaccine Doses received	Value of vaccine	Funds recovered	Funds not recovered
Masaka	1997	50,000	5,000,000	4,120,000	880,000
	1998	20,000	2,000,000	1,306,000	694,000
	1999	50,000	5,000,000	2,500,000	2,500,000
Kumi*	1997-1999	115,000	11,500,000	8,035,398	3,378,885
Mukono	1992	25,000	2,500,000	1,639,906	860,094
	1993	48,000	4,800,000	2,765,000	2,035,000
	1994	25,000	2,500,000	-	2,500,000
	1995	22,000	2,200,000	700,000	1,500,000
	1996	35,000	3,500,000	1,856,500	1,643,500
	1997	50,000	5,000,000	1,360,000	3,640,000
	1998	32,000	3,200,000	-	3,200,000
	1999	-	-	255,000	

Source: Directorate of Animal Resources, MAAIF (2000)

4.3.2 Setbacks to the CBPP Control Programme

Negative reactions such as sloughing off the tail discourage farmers from presenting their cattle for vaccinations. Vaccination tail reactions affect about 1-2% of the cattle vaccinated. The reactors and infected cattle are treated with a mycoplasmocidal drugs like tylosin. This however interferes with the development of immunity and such animals need to be re-vaccinated, thereby resulting into increased expenditures by the farmers. A number of veterinarians interviewed during this study attribute low build up of immunity among vaccinated cattle due to improper vaccine storage, poor handling and inadequate dosage.

According to Eladu (1999), insecurity in Kotido due to cattle raids and clashes between the security forces and the warriors has greatly hindered the progress of CBPP vaccination.

Occasionally, the vaccination programme get disrupted by outbreaks of other notifiable diseases such as Foot and Mouth Disease. Farmers tend to respond to such outbreaks and temporarily put off the CBPP vaccination. In addition, due to limited field staff, it is not possible to carry out vaccination campaigns in each subcounty within one month. Staff has to move in teams from one sub county to another, thus vaccination campaigns take much longer time than expected.

Decentralisation has also compromised communication between districts and the MAAIF headquarters since most district staff feel they are mainly answerable to their districts. This has resulted in poor reporting of disease situations to MAAIF Headquarters. It is also felt that late release of funds is as a major set back for the success of CBPP control.

4.4. Accuracy of data collected

The accuracy of data on CBPP in is influenced by a number of factors, namely:

i. Lack of a responsive Management Information System (MIS) characterised by:

- Poor record keeping at field level, district level and MAAIF headquarters
- Infrequent reporting due to staff attitude, discontinuity of communication between districts and the Ministry Headquarters and logistical constraints.
- Under-reporting due to (i) fear of reprimand by the supervisors who may take it that disease outbreaks are due to the laxity of field staff, (ii) fear of loss of revenue by both the local governments and individual staff, for fear that quarantines may be imposed, (iii) fear by extension staff to remit revenues in proportion to the number of animals reportedly vaccinated under the cost recovery scheme, and (iv) cultural barriers by farmers.
- Late reporting by farmers and/or extension workers
- Poor accessibility to all livestock due to cultural barriers and security reasons

ii. Inadequate Capacity to diagnose CBPP arising from technical incompetency. In this case, field veterinarians are poorly equipped to diagnose disease incidences and mortality/morbidity.

The above problems weigh heavily on the data provided in this report and this must be borne in mind in the interpretation of the findings, conclusions and recommendations.

5. PROPOSED STRATEGIES TO CONTROL CBPP IN UGANDA

5.1 Introduction

Significant progress has been made towards CBPP control and /or eradication in Uganda. As a result, the disease has been suppressed in most parts of the country, but it is still endemic in North Western and North Eastern districts of Karamoja, Lira, etc. If not contained CBPP can rapidly spread in epidemic proportions and cause further critical shortfalls in production of milk, meat and other cattle products. There is need therefore to put in place sustainable control strategies to control and/or eradicate the disease. The main control measures that are feasible in Uganda are:

5.2 Formulation of an effective policy on CBPP control

Currently, Government policy is to continue with CBPP vaccinations throughout the country under the cost recovery system (in theory till CBPP is controlled). This could take longer because of poor immunogenicity of current vaccines and due to inadequate resources. Afterwards abattoir surveillance by post-mortem inspection and surveillance will be the main means of CBPP control.

This study further recommends that the cost recovery strategy be reviewed in order to integrate the concerns of the peasant farmers, including the reduction of the cost of vaccination per animal, and overall policy changes should be within the framework of the Poverty Eradication Action Plan and Plan for Modernisation of Agriculture which aim at increasing the incomes of the rural poor.

5.3 Improved resource allocation for CBPP control programmes

The findings show that inadequate allocation of funds to local governments impedes smooth implementation of CBPP control programmes. The government should put in

place a contingency fund for emergency in case of disease outbreaks. In line with decentralisation, the districts should also contribute to the contingency fund.

5.4 Establishment of epidemiological investigations and surveillance systems

To eradicate CBPP, a quick response system in animal health is a very crucial. This includes establishment of structures and management systems that lead to early detection of the disease, prediction of the likely spread, targeted control and elimination of the disease. CBPP surveillance is the key to early detection and thus an early warning to a change in the health status of the cattle population.

Generally, reports from MAAIF show that CBPP incidences have decreased. The disease however remains endemic in Northern Uganda districts and it is sporadic in some districts in central and Southwest Uganda.

Surveillance needs to be intensified and prompt reports made so that the disease can be detected early and timely action taken. This necessitates that laboratories are well equipped and more technicians/veterinarians trained in laboratory diagnosis, and early warning systems. Regional laboratories should be rehabilitated in order to speed up the process of serosurveillance. This will enable forecasting disease outbreaks and carrying out timely control actions.

5.5 Establishment of CBPP information systems

It has been noted that one of the major issues in CBPP control is lack of information and /or poor information management. The system for reporting and dissemination of information to stakeholders on CBPP is not well established. MAAIF needs to improve information flow and reporting by establishing an information system at different levels from farmers level to ministerial level that will enable easy collection and dissemination and /or access by the different stakeholders. In addition a multimedia approach to disseminating information about CBPP should be developed, including the use of FM radios, posters, films, CBPP booklets, etc.

5.6 Training of service providers

Comprehensive training should be conducted to develop capacity in emergency preparedness among field veterinary staff, MAAIF staff, laboratory technicians and farmers. Pertinent issues to be addressed include:

- Epidemiology of CBPP
- Disease surveillance and diagnosis
- Early warning systems and early reactions to CBPP control
- Animal health information systems
- Vaccine handling
- Participatory planning methodologies
- Management of CBPP control and /or eradication programmes
- Use of antibiotics

5.7 Farmers sensitisation and training

The study has shown that due to continued vaccinations, CBPP has been suppressed in most parts of the country. However, the situation has been aggravated by the cost sharing system and post-vaccination reactions that have made farmers less enthusiastic about vaccinations. In view of this, continuous farmers sensitisation should be conducted on the economic importance of CBPP and its early detection. Farmers should also be involved in planning control strategies at district and subcounty levels to increase their ownership of CBPP control programme.

Strong livestock farmers groups should be formed in line with the National Agriculture Advisory Services (NAADS) to enable farmers demand advisory services in the control of CBPP and major epizootics like Foot and Mouth Disease, Lumpy Skin Disease and Rabies. Under the NAADS programme, farmers will be able to access private veterinary extension services.

It has also been noted that funds allocated for disease control (including CBPP) at district level are inadequate. There is a need for sensitisation of the District Local Councils (DLCs), Chief Administrative officers (CAOs), District Finance Officers (DFOs) and the

District Technical Planning Committees (DTPCs) since they can influence allocation of funds to CBPP activities at the district and sub county level.

5.8 Intensive disease surveillance and vaccination

In order to reduce expenditures on vaccination campaigns, routine vaccinations should only be conducted in endemic and high risk areas of Moroto, Kotido, Nakapiririt, Moyo, Yumbe, Adjumani, Gulu, Kitgum, Pader and Arua as well as districts that are at risk from bordering countries of Tanzania, Rwanda (Rakai, Mbarara, Ntungamo, Kabale, and Kisoro). Routine mass vaccinations should be ceased and instead emphasis placed on intensive disease surveillance and heightening response to outbreaks.

5.9 Training of community based local vaccinators

CBPP control in nomadic communities requires special attention. Nomadic communities should identify and recommend people to be trained as animal health workers. Ideally, such personnel should be part of community, move with cattle owners and therefore provide continuous basic animal health services.

5.10 Establishment of a Monitoring and Evaluation System of CBPP activities

Currently, CBPP activities are being monitored through passive reporting. The serosurveillance section of MAAIF should be supported by MAAIF Planning Department in order to develop an effective monitoring and evaluation system that is responsive to the needs of farmers and local governments. This will include, among others, training of staff in participatory planning, process monitoring and evaluation.

6. CONCLUSION

CBPP is a transboundary disease of significant economic, trade and food security importance that can easily spread to neighbouring countries and reach epidemic proportions. Affected countries need to work together as a team to enhance emergency preparedness, and well-coordinated national and regional eradication programmes. Uganda, Sudan, Kenya, Tanzania and Rwanda should strengthen strategies for regional CBPP control, building on the experiences gained under PARC and other regional programmes such as trypanosomiasis control.

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ANNEX 1: Status of CBPP in epidemic areas of Uganda												
Year	Livestock Production System	District	Cattle Population		Outbreaks	Deaths	Case Fatality Rate	Mortality Rate	Morbidity	Prevalence	No. Vaccinated	Vaccination Coverage (%)
			Animals at High Risk	Infected Animals	-							
1990	Agro-pastoral	Apach	51895	NA	NA	NA	NA	NA	NA	NA	50468	97.25021678
	Agro-pastoral	Arua	113524	NA	NA	NA	NA	NA	NA	NA	60826	53.57985977
	Agro-pastoral	Bundibugyo	62804	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	115786	NA	NA	NA	NA	NA	NA	NA	102755	88.74561691
	Agro-pastoral	Gulu	12395	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Hoima	23304	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Iganga	154020	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	17433	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kabale	51392	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kabarole	172004	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kalangala	1365	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	15938	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kamuli	146862	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kapchorwa	36103	NA	NA	NA	NA	NA	NA	NA	23000	63.70661718
	Agro-pastoral	Kasese	51655	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kibale	14106	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kiboga	42184	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kisoro	10369	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kitgum	5634	NA	NA	NA	NA	NA	NA	NA	6918	122.7902023
	Agro-pastoral	Kumi	18778	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Lira	11268	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Luwero	105988	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Masaka	305692	1	NA	NA	NA	NA	0.0003271	0.0003271	NA	NA
	Agro-pastoral	Masindi	40452	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mbale	106350	3	NA	NA	NA	NA	0.0028209	0.0028209	97000	91.20827457
	Agro-pastoral	Mbarara	768403	3	NA	NA	NA	NA	0.0003904	0.0003904	NA	NA
	Agro-pastoral	Mpigi	140969	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mubende	277584	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mukono	129765	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Nebbi	68417	NA	NA	NA	NA	NA	NA	NA	25987	37.98324978
	Agro-pastoral	Ntungamo	129109	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Pallisa	19720	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Agro-pastoral	Rakai	195614	1	NA	NA	NA	NA	0.0005112	0.0005112	NA	NA
	Agro-pastoral	Rukungiri	66229	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Soroti	22537	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Tororo	297266	NA	NA	NA	NA	NA	NA	NA	120000	40.367886
1991	Agro-pastoral	Apach	53589	NA	NA	NA	NA	NA	NA	NA	30922	57.70214036
	Agro-pastoral	Arua	117374	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bundibugyo	64937	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	120036	NA	NA	NA	NA	NA	NA	NA	102755	85.60348562
	Agro-pastoral	Gulu	12815	66	NA	NA	NA	NA	0.5150215	0.5150215	310	2.419040187
	Agro-pastoral	Hoima	24135	NA	NA	NA	NA	NA	NA	NA	8587	35.5790346
	Agro-pastoral	Iganga	159280	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	18054	NA	NA	NA	NA	NA	NA	NA	47233	261.6206935
	Agro-pastoral	Kabale	53227	NA	NA	NA	NA	NA	NA	NA	130000	244.2369474
	Agro-pastoral	Kabarole	178075	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kalangala	1418	NA	NA	NA	NA	NA	NA	NA	19514	1376.163611
	Agro-pastoral	Kampala	16978	NA	NA	NA	NA	NA	NA	NA	101630	598.5981859
	Agro-pastoral	Kamuli	151965	NA	NA	NA	NA	NA	NA	NA	16725	11.00582371
	Agro-pastoral	Kapchorwa	37332	NA	NA	NA	NA	NA	NA	NA	25000	66.96667738
	Agro-pastoral	Kasese	53417	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kibale	15498	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kiboga	43630	NA	NA	NA	NA	NA	NA	NA	35229	80.7449003
	Agro-pastoral	Kisoro	10538	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kitgum	5825	8	NA	NA	NA	NA	0.1373391	0.1373391	NA	NA
	Agro-pastoral	Kumi	19462	53	NA	NA	NA	NA	0.2723256	0.2723256	5703	29.30325763
	Agro-pastoral	Lira	11650	NA	NA	NA	NA	NA	NA	NA	3902	33.49356223
	Agro-pastoral	Luwero	109593	NA	NA	NA	NA	NA	NA	NA	187205	170.8183917
	Agro-pastoral	Masaka	316338	NA	NA	NA	NA	NA	NA	NA	265000	83.77115617
	Agro-pastoral	Masindi	41869	NA	NA	NA	NA	NA	NA	NA	18507	44.20215434
	Agro-pastoral	Mbale	110148	1	NA	NA	NA	NA	0.0009079	0.0009079	NA	NA
	Agro-pastoral	Mbarara	795236	39	NA	NA	NA	NA	0.0049042	0.0049042	933800	117.4242615
	Agro-pastoral	Mpigi	145877	201	NA	NA	NA	NA	0.1377873	0.1377873	75841	51.98968994
	Agro-pastoral	Mubende	287107	NA	NA	NA	NA	NA	NA	NA	111215	38.73642928
	Agro-pastoral	Mukono	134349	NA	NA	NA	NA	NA	NA	NA	137477	102.3282644
	Agro-pastoral	Nebbi	70736	25	NA	NA	NA	NA	0.0353427	0.0353427	24859	35.14334992
	Agro-pastoral	Ntungamo	133553	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Pallisa	20387	NA	NA	NA	NA	NA	NA	NA	26824	131.5740423
	Agro-pastoral	Rakai	202402	NA	NA	NA	NA	NA	NA	NA	174843	86.38402783
	Agro-pastoral	Rukungiri	68573	NA	NA	NA	NA	NA	NA	NA	48979	71.42607149
	Agro-pastoral	Soroti	23300	NA	NA	NA	NA	NA	NA	NA	12649	54.28755365
	Agro-pastoral	Tororo	307366	NA	NA	NA	NA	NA	NA	NA	NA	NA

1992	Agro-pastoral	Apach	54446	NA	NA	NA	NA	NA	NA	NA	8627	15.84505749
	Agro-pastoral	Arua	119263	183	NA	NA	NA	NA	0.1534424	0.1534424	2574	2.158255285
	Agro-pastoral	Bundibugyo	65990	NA	NA	NA	NA	NA	NA	NA	24542	37.19048341
	Agro-pastoral	Bushenyi	122544	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Gulu	13020	31	NA	NA	NA	NA	0.2380952	0.2380952	852	6.543778802
	Agro-pastoral	Hoima	24595	NA	NA	NA	NA	NA	NA	NA	20931	85.10266314
	Agro-pastoral	Iganga	161910	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	18399	NA	NA	NA	NA	NA	NA	NA	4837	26.28947225
	Agro-pastoral	Kabale	54249	NA	NA	NA	NA	NA	NA	NA	894	1.647956644
	Agro-pastoral	Kabarole	181367	NA	NA	NA	NA	NA	NA	NA	66300	36.555713
	Agro-pastoral	Kalangala	1452	NA	NA	NA	NA	NA	NA	NA	2048	141.046832
	Agro-pastoral	Kampala	17527	335	NA	NA	NA	NA	1.9113368	1.9113368	5304	30.26188167
	Agro-pastoral	Kamuli	154630	NA	NA	NA	NA	NA	NA	NA	1965	1.270775399
	Agro-pastoral	Kapchorwa	37940	NA	NA	NA	NA	NA	NA	NA	7270	19.16183448
	Agro-pastoral	Kasese	54300	NA	NA	NA	NA	NA	NA	NA	32109	59.13259669
	Agro-pastoral	Kibale	15794	NA	NA	NA	NA	NA	NA	NA	5973	37.81815879
	Agro-pastoral	Kiboga	44357	NA	NA	NA	NA	NA	NA	NA	30584	68.94965845
	Agro-pastoral	Kisoro	10904	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kitgum	5918	2	NA	NA	NA	NA	0.0337952	0.0337952	2367	39.99662048
	Agro-pastoral	Kumi	19860	47	NA	NA	NA	NA	0.2366566	0.2366566	5703	28.71601208
	Agro-pastoral	Lira	11836	NA	NA	NA	NA	NA	NA	NA	6767	57.17303143
	Agro-pastoral	Luwero	111376	NA	NA	NA	NA	NA	NA	NA	128031	114.95385
	Agro-pastoral	Masaka	321927	3	NA	NA	NA	NA	0.0009319	0.0009319	85155	26.45164898
	Agro-pastoral	Masindi	42620	NA	NA	NA	NA	NA	NA	NA	19434	45.59831065
	Agro-pastoral	Mbale	112263	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mbarara	809416	20	NA	NA	NA	NA	0.0024709	0.0024709	623000	76.969074
	Agro-pastoral	Mpigi	148450	109	NA	NA	NA	NA	0.0734254	0.0734254	52622	35.44762546
	Agro-pastoral	Mubende	291923	5	NA	NA	NA	NA	0.0017128	0.0017128	39517	13.53678881
	Agro-pastoral	Mukono	136836	NA	NA	NA	NA	NA	NA	NA	46980	34.33307024
	Agro-pastoral	Nebbi	71871	100	NA	NA	NA	NA	0.1391382	0.1391382	13986	19.45986559
	Agro-pastoral	Ntungamo	1355819	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Pallisa	20713	NA	NA	NA	NA	NA	NA	NA	26824	129.5032105
	Agro-pastoral	Rakai	205934	NA	NA	NA	NA	NA	NA	NA	103193	50.1097439
	Agro-pastoral	Rukungiri	69854	NA	NA	NA	NA	NA	NA	NA	21128	30.24594154
	Agro-pastoral	Soroti	23672	NA	NA	NA	NA	NA	NA	NA	11304	47.75261913
	Agro-pastoral	Tororo	312347	NA	NA	NA	NA	NA	NA	NA	NA	NA
1993	Agro-pastoral	Apach	50888	NA	NA	NA	NA	NA	NA	NA	8267	16.24548027
	Agro-pastoral	Arua	158385	NA	NA	NA	NA	NA	NA	NA	17880	11.28894782
	Agro-pastoral	Bundibugyo	79280	NA	NA	NA	NA	NA	NA	NA	47000	59.28355197
	Agro-pastoral	Bushenyi	142239	NA	NA	NA	NA	NA	NA	NA	107964	75.90323329

	Agro-pastoral	Gulu	15498	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Hoima	90469	NA	NA	NA	NA	NA	NA	NA	9901	10.94408029
	Agro-pastoral	Iganga	162760	NA	NA	NA	NA	NA	NA	NA	31548	19.38314082
	Agro-pastoral	Jinja	19344	31	NA	NA	NA	NA	0.1602564	0.1602564	NA	NA
	Agro-pastoral	Kabale	84242	NA	NA	NA	NA	NA	NA	NA	3413	4.051423281
	Agro-pastoral	Kabarole	146118	NA	NA	NA	NA	NA	NA	NA	111499	76.30750489
	Agro-pastoral	Kalangala	17438	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	20194	252	NA	NA	NA	NA	1.2478954	1.2478954	5228	25.88887788
	Agro-pastoral	Kamuli	256451	NA	NA	NA	NA	NA	NA	NA	52588	20.50606159
	Agro-pastoral	Kapchorwa	42899	NA	NA	NA	NA	NA	NA	NA	6160	14.35930907
	Agro-pastoral	Kasese	35296	8	NA	NA	NA	NA	0.0226655	0.0226655	18915	53.58964189
	Agro-pastoral	Kibale	35554	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kiboga	24510	2	NA	NA	NA	NA	0.0081599	0.0081599	62517	255.0673195
	Agro-pastoral	Kisoro	9383	NA	NA	NA	NA	NA	NA	NA	6588	70.21208569
	Agro-pastoral	Kitgum	12960	3	NA	NA	NA	NA	0.0231481	0.0231481	2171	16.75154321
	Agro-pastoral	Kumi	15824	42	NA	NA	NA	NA	0.2654196	0.2654196	4126	26.07431749
	Agro-pastoral	Lira	29785	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Luwero	102395	NA	NA	NA	NA	NA	NA	NA	96343	94.08955515
	Agro-pastoral	Masaka	286847	372	NA	NA	NA	NA	0.1296859	0.1296859	130266	45.41305992
	Agro-pastoral	Masindi	58474	10	NA	NA	NA	NA	0.0171016	0.0171016	7780	13.30505866
	Agro-pastoral	Mbale	218087	NA	NA	NA	NA	NA	NA	NA	9178	4.208412239
	Agro-pastoral	Mbarara	676881	15	NA	NA	NA	NA	0.002216	0.002216	465844	68.82214156
	Agro-pastoral	Mpigi	183655	NA	NA	NA	NA	NA	NA	NA	84123	45.80490594
	Agro-pastoral	Mubende	155760	15	NA	NA	NA	NA	0.0096302	0.0096302	11793	7.571263482
	Agro-pastoral	Mukono	97772	85	NA	NA	NA	NA	0.086937	0.086937	53240	54.45321769
	Agro-pastoral	Nebbi	119826	10	NA	NA	NA	NA	0.0083454	0.0083454	5241	4.373842071
	Agro-pastoral	Ntungamo	157315	NA	NA	NA	NA	NA	NA	NA	17655	11.22270604
	Agro-pastoral	Pallisa	119068	NA	NA	NA	NA	NA	NA	NA	121165	101.7611785
	Agro-pastoral	Rakai	283926	NA	NA	NA	NA	NA	NA	NA	160000	56.35271162
	Agro-pastoral	Rukungiri	90682	NA	NA	NA	NA	NA	NA	NA	5599	6.17432346
	Agro-pastoral	Soroti	21942	NA	NA	NA	NA	NA	NA	NA	4354	19.84322304
	Agro-pastoral	Tororo	162690	NA	NA	NA	NA	NA	NA	NA	30611	18.81553875
1994	Agro-pastoral	Apach	48181	49	NA	NA	NA	NA	0.1016998	0.1016998	51000	105.8508541
	Agro-pastoral	Arua	150033	141	NA	NA	NA	NA	0.0939793	0.0939793	5531	3.686522298
	Agro-pastoral	Bundibugyo	75054	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	141455	NA	NA	NA	NA	NA	NA	NA	70789	50.04347672
	Agro-pastoral	Gulu	14672	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Hoima	176343	NA	NA	NA	NA	NA	NA	NA	17094	9.693608479
	Agro-pastoral	Iganga	126978	NA	NA	NA	NA	NA	NA	NA	13170	10.37187544
	Agro-pastoral	Jinja	18484	6	NA	NA	NA	NA	0.0324605	0.0324605	14913	80.68058862

	Agro-pastoral	Kabale	80274	NA	NA	NA	NA	NA	NA	NA	17698	22.04698906
	Agro-pastoral	Kabarole	140389	NA	NA	NA	NA	NA	NA	NA	60203	42.88298941
	Agro-pastoral	Kalangala	16543	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	19291	77	NA	NA	NA	NA	0.3991499	0.3991499	NA	NA
	Agro-pastoral	Kamuli	243071	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kapchorwa	40652	NA	NA	NA	NA	NA	NA	NA	29271	72.00383745
	Agro-pastoral	Kasese	33613	NA	NA	NA	NA	NA	NA	NA	13097	38.96409127
	Agro-pastoral	Kibale	33807	2	NA	NA	NA	NA	0.0059159	0.0059159	37000	109.4447895
	Agro-pastoral	Kiboga	23297	34	NA	NA	NA	NA	0.1459415	0.1459415	50326	216.0192299
	Agro-pastoral	Kisoro	8891	NA	NA	NA	NA	NA	NA	NA	360	4.049038353
	Agro-pastoral	Kitgum	12269	NA	NA	NA	NA	NA	NA	NA	1038	8.460347217
	Agro-pastoral	Kumi	14981	35	NA	NA	NA	NA	0.2336293	0.2336293	13766	91.88972699
	Agro-pastoral	Lira	28202	NA	NA	NA	NA	NA	NA	NA	13446	47.67746968
	Agro-pastoral	Luwero	97080	440	NA	NA	NA	NA	0.4532344	0.4532344	17381	17.90379069
	Agro-pastoral	Masaka	272005	312	NA	NA	NA	NA	0.1147038	0.1147038	17602	6.471204573
	Agro-pastoral	Masindi	55610	8	NA	NA	NA	NA	0.0143859	0.0143859	NA	NA
	Agro-pastoral	Mbale	207547	NA	NA	NA	NA	NA	NA	NA	32000	15.41819443
	Agro-pastoral	Mbarara	645377	6	NA	NA	NA	NA	0.0009297	0.0009297	120884	18.73075737
	Agro-pastoral	Mpigi	174269	12	NA	NA	NA	NA	0.0068859	0.0068859	65991	37.86732006
	Agro-pastoral	Mubende	148151	38	NA	NA	NA	NA	0.0256495	0.0256495	22411	15.1271338
	Agro-pastoral	Mukono	94762	NA	NA	NA	NA	NA	NA	NA	32469	34.26373441
	Agro-pastoral	Nebbi	113452	2550	NA	NA	NA	NA	2.2476466	2.2476466	10706	9.436589923
	Agro-pastoral	Ntungamo	149562	NA	NA	NA	NA	NA	NA	NA	26293	17.58000027
	Agro-pastoral	Pallisa	112722	NA	NA	NA	NA	NA	NA	NA	5000	4.435691347
	Agro-pastoral	Rakai	268826	NA	NA	NA	NA	NA	NA	NA	70555	26.24560124
	Agro-pastoral	Rukungiri	86415	NA	NA	NA	NA	NA	NA	NA	3252	3.763235549
	Agro-pastoral	Soroti	20772	11	NA	NA	NA	NA	0.0529559	0.0529559	17295	83.26112074
	Agro-pastoral	Tororo	154017	NA	NA	NA	NA	NA	NA	NA	17398	11.29615562
1995	Agro-pastoral	Apach	49628	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Arua	154561	121	NA	22	18.181818	0.0142339	0.0782862	0.0782862	NA	NA
	Agro-pastoral	Bundibugyo	77306	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	147607	NA	NA	NA	NA	NA	NA	NA	13652	9.248883861
	Agro-pastoral	Gulu	15112	2	NA	NA	NA	NA	0.0132345	0.0132345	NA	NA
	Agro-pastoral	Hoima	88649	NA	NA	NA	NA	NA	NA	NA	8579	9.677492132
	Agro-pastoral	Iganga	130879	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	19087	NA	NA	NA	NA	NA	NA	NA	14913	78.13171268
	Agro-pastoral	Kabale	82829	NA	NA	NA	NA	NA	NA	NA	34694	41.88629586
	Agro-pastoral	Kabarole	145180	778	NA	2	0.2570694	0.0013776	0.5358865	0.5358865	25318	17.43904119
	Agro-pastoral	Kalangala	17050	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	19918	36	NA	44	122.22222	0.2209057	0.180741	0.180741	1580	7.932523346

	Agro-pastoral	Kamuli	250447	362	NA	NA	NA	NA	0.1445416	0.1445416	562	0.224398775
	Agro-pastoral	Kapchorwa	41874	NA	NA	5	NA	0.0119406	NA	NA	6084	14.52930219
	Agro-pastoral	Kasese	34678	13	NA	9	69.230769	0.0259531	0.0374877	0.0374877	39126	112.8265759
	Agro-pastoral	Kibale	34863	NA	NA	15	NA	0.0430256	NA	NA	10152	29.1196971
	Agro-pastoral	Kiboga	24022	30	NA	15	50	0.0624428	0.1248855	0.1248855	62072	258.3964699
	Agro-pastoral	Kisoro	9109	NA	NA	NA	NA	NA	NA	NA	19165	210.3963113
	Agro-pastoral	Kitgum	12637	1	NA	NA	NA	NA	0.0079133	0.0079133	2113	16.72074068
	Agro-pastoral	Kumi	15430	NA	NA	6	NA	0.0388853	NA	NA	15673	101.5748542
	Agro-pastoral	Lira	29050	141	NA	NA	NA	NA	0.4853701	0.4853701	12223	42.0757315
	Agro-pastoral	Luwero	100033	315	NA	24	7.6190476	0.0239921	0.3148961	0.3148961	79194	79.1678746
	Agro-pastoral	Masaka	280290	350	NA	18	5.1428571	0.0064219	0.1248707	0.1248707	160490	57.25855364
	Agro-pastoral	Masindi	57349	22	NA	2	9.0909091	0.0034874	0.0383616	0.0383616	36451	63.55995745
	Agro-pastoral	Mbale	214078	9	NA	NA	NA	NA	0.0042041	0.0042041	7456	3.482842702
	Agro-pastoral	Mbarara	666022	51	NA	4	7.8431373	0.0006006	0.0076574	0.0076574	228593	34.32213951
	Agro-pastoral	Mpigi	179610	3	NA	5	166.66667	0.0027838	0.0016703	0.0016703	32945	18.3425199
	Agro-pastoral	Mubende	152791	NA	NA	NA	NA	NA	NA	NA	31334	20.50775242
	Agro-pastoral	Mukono	98223	3	NA	NA	NA	NA	0.0030543	0.0030543	45000	45.81411686
	Agro-pastoral	Nebbi	116229	974	NA	261	26.796715	0.2245567	0.8380008	0.8380008	12893	11.09275654
	Agro-pastoral	Ntungamo	154227	NA	NA	NA	NA	NA	NA	NA	49714	32.23430398
	Agro-pastoral	Pallisa	116103	52	NA	NA	NA	NA	0.0447878	0.0447878	15023	12.9393728
	Agro-pastoral	Rakai	276901	38	NA	2	5.2631579	0.0007223	0.0137233	0.0137233	106242	38.36822547
	Agro-pastoral	Rukungiri	89166	3	NA	NA	NA	NA	0.0033645	0.0033645	23717	26.59870354
	Agro-pastoral	Soroti	21395	15	NA	7	46.666667	0.0327179	0.0701098	0.0701098	39819	186.1135779
	Agro-pastoral	Tororo	156638	20	NA	NA	NA	NA	0.0127683	0.0127683	13870	8.854811732
1996	Agro-pastoral	Apach	51115	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Arua	159224	144	NA	NA	NA	NA	0.0904386	0.0904386	NA	NA
	Agro-pastoral	Bundibugyo	79625	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	154058	NA	NA	NA	NA	NA	NA	NA	12828	8.326734087
	Agro-pastoral	Gulu	15566	32	NA	NA	NA	NA	0.2055763	0.2055763	NA	NA
	Agro-pastoral	Hoima	91533	NA	NA	NA	NA	NA	NA	NA	18045	19.71420144
	Agro-pastoral	Iganga	134901	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	19711	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Kabale	85469	NA	NA	NA	NA	NA	NA	NA	45087	52.75245996
	Agro-pastoral	Kabarole	150148	NA	NA	NA	NA	NA	NA	NA	2668	1.776913445
	Agro-pastoral	Kalangala	17572	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	20568	32	NA	NA	NA	NA	0.1555815	0.1555815	705	3.427654609
	Agro-pastoral	Kamuli	258047	NA	NA	NA	NA	NA	NA	NA	976	0.378225672
	Agro-pastoral	Kapchorwa	43148	NA	NA	NA	NA	NA	NA	NA	150	0.347640679
	Agro-pastoral	Kasese	35777	37	NA	NA	NA	NA	0.1034184	0.1034184	860	2.403778964
	Agro-pastoral	Kibale	35952	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Agro-pastoral	Kiboga	24771	2	NA	NA	NA	NA	0.008074	0.008074	32623	131.6983569
	Agro-pastoral	Kisoro	9387	NA	NA	NA	NA	NA	NA	NA	4229	45.0516672
	Agro-pastoral	Kitgum	13016	4	NA	NA	NA	NA	0.0307314	0.0307314	1770	13.59864782
	Agro-pastoral	Kumi	15893	NA	NA	NA	NA	NA	NA	NA	13775	86.67337822
	Agro-pastoral	Lira	29922	64	NA	NA	NA	NA	0.2138894	0.2138894	NA	NA
	Agro-pastoral	Luwero	103077	NA	NA	NA	NA	NA	NA	NA	9205	8.930217216
	Agro-pastoral	Masaka	288832	NA	NA	NA	NA	NA	NA	NA	83860	29.03417904
	Agro-pastoral	Masindi	59145	NA	NA	NA	NA	NA	NA	NA	18084	30.57570378
	Agro-pastoral	Mbale	220822	2	NA	NA	NA	NA	0.0009057	0.0009057	5552	2.51424224
	Agro-pastoral	Mbarara	687365	NA	NA	NA	NA	NA	NA	NA	43630	6.347428222
	Agro-pastoral	Mpigi	185118	NA	NA	NA	NA	NA	NA	NA	15659	8.458928899
	Agro-pastoral	Mubende	157580	NA	NA	NA	NA	NA	NA	NA	21534	13.66543978
	Agro-pastoral	Mukono	101825	NA	NA	NA	NA	NA	NA	NA	32000	31.42646698
	Agro-pastoral	Nebbi	120368	NA	NA	NA	NA	NA	NA	NA	49	0.040708494
	Agro-pastoral	Ntungamo	159041	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Pallisa	119586	NA	NA	NA	NA	NA	NA	NA	7002	5.855200442
	Agro-pastoral	Rakai	285219	NA	NA	NA	NA	NA	NA	NA	27029	9.476577647
	Agro-pastoral	Rukungiri	92010	NA	NA	NA	NA	NA	NA	NA	3550	3.858276274
	Agro-pastoral	Soroti	22037	NA	NA	NA	NA	NA	NA	NA	53215	241.4802378
	Agro-pastoral	Tororo	163397	197	NA	NA	NA	NA	0.1205652	0.1205652	NA	NA
1997	Agro-pastoral	Apach	52653	NA	NA	NA	NA	NA	NA	NA	50000	94.96135073
	Agro-pastoral	Arua	164030	NA	NA	NA	NA	NA	NA	NA	9329	5.687374261
	Agro-pastoral	Bundibugyo	82014	NA	NA	NA	NA	NA	NA	NA	20000	24.38608043
	Agro-pastoral	Bushenyi	160823	NA	NA	NA	NA	NA	NA	NA	46187	28.71915087
	Agro-pastoral	Gulu	16033	NA	NA	NA	NA	NA	NA	NA	1501	9.361940997
	Agro-pastoral	Hoima	94046	0	NA	NA	NA	NA	0	0	15000	15.94964166
	Agro-pastoral	Iganga	139250	0	NA	NA	NA	NA	0	0	71847	51.5956912
	Agro-pastoral	Jinja	20356	0	NA	NA	NA	NA	0	0	18700	91.86480645
	Agro-pastoral	Kabale	88198	NA	NA	NA	NA	NA	NA	NA	18484	20.95739132
	Agro-pastoral	Kabarole	155303	NA	NA	NA	NA	NA	NA	NA	5993	3.85890807
	Agro-pastoral	Kalangala	18110	NA	NA	NA	NA	NA	NA	NA	4500	24.84815019
	Agro-pastoral	Kampala	21239	15	NA	NA	NA	NA	0.0706248	0.0706248	3794	17.86336457
	Agro-pastoral	Kamuli	265884	0	NA	NA	NA	NA	0	0	84338	31.71984775
	Agro-pastoral	Kapchorwa	44454	NA	NA	NA	NA	NA	NA	NA	15000	33.74274531
	Agro-pastoral	Kasese	36914	NA	NA	NA	NA	NA	NA	NA	18339	49.68033808
	Agro-pastoral	Kibale	37078	NA	NA	NA	NA	NA	NA	NA	8771	23.65553698
	Agro-pastoral	Kiboga	25543	NA	NA	NA	NA	NA	NA	NA	49800	194.9653525
	Agro-pastoral	Kisoro	9722	NA	NA	NA	NA	NA	NA	NA	6348	65.29520675
	Agro-pastoral	Kitgum	13406	NA	NA	NA	NA	NA	NA	NA	3144	23.45218559
	Agro-pastoral	Kumi	16370	NA	NA	NA	NA	NA	NA	NA	20013	122.2541234

	Agro-pastoral	Lira	30821	0	NA	NA	NA	NA	0	0	8016	26.00824113
	Agro-pastoral	Luwero	106214	0	NA	NA	NA	NA	0	0	21709	20.43892519
	Agro-pastoral	Masaka	297658	NA	NA	NA	NA	NA	NA	NA	63349	21.28247855
	Agro-pastoral	Masindi	60999	NA	NA	NA	NA	NA	NA	NA	20638	33.83334153
	Agro-pastoral	Mbale	227789	14	NA	NA	NA	NA	0.006146	0.006146	72397	31.78248291
	Agro-pastoral	Mbarara	709429	7	NA	NA	NA	NA	0.0009867	0.0009867	88759	12.51132953
	Agro-pastoral	Mpigi	190799	0	NA	NA	NA	NA	0	0	22000	11.53045876
	Agro-pastoral	Mubende	162527	NA	NA	NA	NA	NA	NA	NA	30198	18.58029743
	Agro-pastoral	Mukono	105573	0	NA	NA	NA	NA	0	0	18435	17.46185104
	Agro-pastoral	Nebbi	123983	NA	NA	NA	NA	NA	NA	NA	12908	10.41110475
	Agro-pastoral	Ntungamo	164012	6	NA	NA	NA	NA	0.0036583	0.0036583	40150	24.4799161
	Agro-pastoral	Pallisa	123174	NA	NA	NA	NA	NA	NA	NA	26000	21.10835079
	Agro-pastoral	Rakai	293784	NA	NA	NA	NA	NA	NA	NA	115500	39.31459848
	Agro-pastoral	Rukungiri	94949	NA	NA	NA	NA	NA	NA	NA	17844	18.7932469
	Agro-pastoral	Soroti	22698	0	NA	NA	NA	NA	0	0	30887	136.0780686
	Agro-pastoral	Tororo	168299	NA	NA	NA	NA	NA	NA	NA	46857	27.84152015
1998	Agro-pastoral	Apach	54234	NA	NA	NA	NA	NA	NA	NA	9000	16.59475606
	Agro-pastoral	Arua	168982	19	NA	NA	NA	NA	0.0112438	0.0112438	17521	10.36855996
	Agro-pastoral	Bundibugyo	84474	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	167921	NA	NA	NA	NA	NA	NA	NA	78838	46.94945838
	Agro-pastoral	Gulu	16514	NA	NA	NA	NA	NA	NA	NA	1457	8.822817004
	Agro-pastoral	Hoima	97214	NA	NA	NA	NA	NA	NA	NA	14055	14.45779414
	Agro-pastoral	Iganga	143330	NA	NA	NA	NA	NA	NA	NA	12313	8.590664899
	Agro-pastoral	Jinja	21025	0	NA	NA	NA	NA	0	0	2600	12.36623068
	Agro-pastoral	Kabale	91018	NA	NA	NA	NA	NA	NA	NA	25231	27.72089037
	Agro-pastoral	Kabarole	160650	NA	NA	NA	NA	NA	NA	NA	15772	9.817615935
	Agro-pastoral	Kalangala	18664	NA	NA	NA	NA	NA	NA	NA	2000	10.71581655
	Agro-pastoral	Kampala	21934	3	NA	NA	NA	NA	0.0136774	0.0136774	NA	NA
	Agro-pastoral	Kamuli	273961	NA	NA	NA	NA	NA	NA	NA	31607	11.53704359
	Agro-pastoral	Kapchorwa	45790	NA	NA	NA	NA	NA	NA	NA	28249	61.69250928
	Agro-pastoral	Kasese	38088	NA	NA	NA	NA	NA	NA	NA	2349	6.167296786
	Agro-pastoral	Kibale	38240	NA	NA	NA	NA	NA	NA	NA	2029	5.305962343
	Agro-pastoral	Kiboga	26341	NA	NA	NA	NA	NA	NA	NA	49233	186.9063437
	Agro-pastoral	Kisoro	10017	NA	NA	NA	NA	NA	NA	NA	6500	64.88968753
	Agro-pastoral	Kitgum	13809	NA	NA	NA	NA	NA	NA	NA	161	1.165906293
	Agro-pastoral	Kumi	16861	NA	NA	NA	NA	NA	NA	NA	22936	136.0298915
	Agro-pastoral	Lira	31747	NA	NA	NA	NA	NA	NA	NA	24295	76.52691593
	Agro-pastoral	Luwero	109451	NA	NA	NA	NA	NA	NA	NA	30698	28.04725402
	Agro-pastoral	Masaka	306716	0	NA	NA	NA	NA	0	0	87001	28.36532819
	Agro-pastoral	Masindi	62914	NA	NA	NA	NA	NA	NA	NA	25918	41.19591824

	Agro-pastoral	Mbale	234985	14	NA	NA	NA	NA	0.0059578	0.0059578	9178	3.90578122
	Agro-pastoral	Mbarara	732242	5	NA	NA	NA	NA	0.0006828	0.0006828	324967	44.37972692
	Agro-pastoral	Mpigi	196657	NA	NA	NA	NA	NA	NA	NA	39304	19.98606711
	Agro-pastoral	Mubende	167634	NA	NA	NA	NA	NA	NA	NA	23109	13.7853896
	Agro-pastoral	Mukono	109477	NA	NA	NA	NA	NA	NA	NA	108120	98.76047024
	Agro-pastoral	Nebbi	127707	NA	NA	NA	NA	NA	NA	NA	13209	10.3432075
	Agro-pastoral	Ntungamo	169145	NA	NA	NA	NA	NA	NA	NA	69248	40.94002187
	Agro-pastoral	Pallisa	126869	NA	NA	NA	NA	NA	NA	NA	8705	6.861408224
	Agro-pastoral	Rakai	302611	NA	NA	NA	NA	NA	NA	NA	15200	5.022950256
	Agro-pastoral	Rukungiri	97987	NA	NA	NA	NA	NA	NA	NA	28908	29.5018727
	Agro-pastoral	Soroti	23379	NA	NA	NA	NA	NA	NA	NA	13767	58.88617991
	Agro-pastoral	Tororo	173348	NA	NA	NA	NA	NA	NA	NA	14298	8.248148234
1999	Agro-pastoral	Apach	55863	0	NA	NA	NA	NA	0	0	2000	3.580187244
	Agro-pastoral	Arua	174083	NA	NA	NA	NA	NA	NA	NA	11678	6.708294319
	Agro-pastoral	Bundibugyo	87008	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	175366	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Gulu	17009	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Hoima	99932	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Iganga	147745	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	21716	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kabale	94533	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kabarole	166200	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Kalangala	19237	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	22654	12	NA	NA	NA	NA	0.0529708	0.0529708	NA	NA
	Agro-pastoral	Kamuli	282285	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kapchorwa	47185	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kasese	39301	NA	NA	NA	NA	NA	NA	NA	111	0.282435561
	Agro-pastoral	Kibale	39440	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kiboga	27165	NA	NA	NA	NA	NA	NA	NA	8335	30.68286398
	Agro-pastoral	Kisoro	10320	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kitgum	14223	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Kumi	17367	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Lira	32701	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Luwero	112785	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Masaka	316076	NA	NA	NA	NA	NA	NA	NA	47041	14.88281299
	Agro-pastoral	Masindi	64890	NA	NA	NA	NA	NA	NA	NA	11329	17.45877639
	Agro-pastoral	Mbale	242420	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mbarara	755831	NA	NA	NA	NA	NA	NA	NA	3257	0.430916435
	Agro-pastoral	Mpigi	202100	NA	NA	NA	NA	NA	NA	NA	11070	5.477486393
	Agro-pastoral	Mubende	172909	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Agro-pastoral	Mukono	113542	7	NA	NA	NA	NA	0.0061651	0.0061651	2780	2.448433179
	Agro-pastoral	Nebbi	131384	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Ntungamo	174443	NA	NA	NA	NA	NA	NA	NA	18580	10.65104361
	Agro-pastoral	Pallisa	130675	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Rakai	311701	NA	NA	NA	NA	NA	NA	NA	2661	0.853702747
	Agro-pastoral	Rukungiri	101128	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Soroti	24081	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Tororo	178548	NA	NA	NA	NA	NA	NA	NA	NA	NA
2000	Agro-pastoral	Apach	57541	NA	NA	NA	NA	NA	NA	NA	8267	14.3671469
	Agro-pastoral	Arua	179340	NA	NA	NA	NA	NA	NA	NA	17850	9.953161593
	Agro-pastoral	Bundibugyo	89619	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Bushenyi	183181	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Gulu	17519	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Hoima	103011	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Iganga	152299	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Jinja	22433	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Kabale	96948	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kabarole	171860	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kalangala	19827	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kampala	23399	32	NA	NA	NA	NA	0.136758	0.136758	NA	NA
	Agro-pastoral	Kamuli	290867	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kapchorwa	48614	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kasese	40554	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kibale	40679	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kiboga	28015	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kisoro	10631	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kitgum	14650	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Kumi	17688	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Lira	33684	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Luwero	116223	5	NA	NA	NA	NA	0.0043021	0.0043021	NA	NA
	Agro-pastoral	Masaka	325726	0	NA	NA	NA	NA	0	0	NA	NA
	Agro-pastoral	Masindi	66932	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mbale	250099	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mbarara	780215	12	NA	NA	NA	NA	0.001538	0.001538	NA	NA
	Agro-pastoral	Mpigi	208933	1	NA	NA	NA	NA	0.0004786	0.0004786	NA	NA
	Agro-pastoral	Mubende	178357	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Mukono	117775	11	NA	NA	NA	NA	0.0093398	0.0093398	NA	NA
	Agro-pastoral	Nebbi	135493	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Ntungamo	179914	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Pallisa	134595	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Agro-pastoral	Rakai	321066	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Rukungiri	104375	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Soroti	24803	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Agro-pastoral	Tororo	183905	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: CBPP reports from the Ministry of Agriculture Animal Industry and Fisheries , CBPP reports from the District local government

Key:

NA- no data available

Notes: 1. Case fertility rate = $\frac{\text{No. of deaths}}{\text{No. of infected animals}}$

Mortality rate = $\frac{\text{No. of deaths}}{\text{Animals at high risk}}$

Morbidity = $\frac{\text{No. of infected}}{\text{Animals at high risk}}$

Vaccination coverage = $\frac{\text{No. vaccinated}}{\text{Animals at high risk}}$

X 2: CBPP status in endemic areas of Uganda

	Livestock Production System	District	Cattle Population		Outbreaks	Deaths	Case Fatality Rate	Mortality Rate	Morbidity	Prevalence	No. Vaccinated	Vaccination Coverage (%)
			Animals at High Risk	Infected Animals								
1990	Pastoral	Kotido	450735	NA	NA	NA	NA	NA	NA	NA	110000	24.4045836
	Pastoral	Moroto	6761003	65	NA	NA	NA	NA	0.0096139	0.0096139	56144	8.30406018
	Pastoral	Moyo	19115	NA	NA	NA	NA	NA	NA	NA	27330	142.97672
1991	Pastoral	Kotido	46993	NA	NA	NA	NA	NA	NA	NA	149525	318.185687
	Pastoral	Moroto	698989	95	NA	NA	NA	NA	0.0135911	0.0013591	108112	15.4669101
	Pastoral	Moyo	19763	NA	NA	NA	NA	NA	NA	NA	4836	24.4699691
1992	Pastoral	Kotido	473442	188	NA	NA	NA	NA	0.0397092	0.0397092	26663	5.63173525
	Pastoral	Moroto	710162	14	NA	NA	NA	NA	0.0019714	0.0019714	14100	1.98546247
	Pastoral	Moyo	29078	NA	NA	NA	NA	NA	NA	NA	8170	28.096843
1993	Pastoral	Kotido	457642	187	NA	NA	NA	NA	0.0408616	0.0408616	171321	37.4355938
	Pastoral	Moroto	723711	6	NA	NA	NA	NA	0.0008291	0.0008291	9815	1.35620434
	Pastoral	Moyo	32784	NA	NA	NA	NA	NA	NA	NA	NA	NA
1994	Pastoral	Kotido	433248	467	NA	NA	NA	NA	0.1077905	0.1077905	259000	59.781003
	Pastoral	Moroto	685134	248	NA	NA	NA	NA	0.0361973	0.0361973	8003	1.16809267
	Pastoral	Moyo	31036	37	NA	NA	NA	NA	0.1192164	0.1192164	11067	35.65859
1995	Pastoral	Kotido	446245	48	NA	NA	NA	NA	0.0107564	0.0107564	25000	5.60230367
	Pastoral	Moroto	705688	172	NA	76	44.18605	0.01077	0.0243734	0.0243734	45729	6.48005918
	Pastoral	Moyo	31967	126	NA	49	38.88889	0.153283	0.3941565	0.3941565	9642	30.1623549
1996	Pastoral	Kotido	459633	NA	NA	NA	NA	NA	NA	NA	62534	13.6052024
	Pastoral	Moroto	726859	15	NA	NA	NA	NA	0.0020637	0.0020637	2882	0.3965006
	Pastoral	Moyo	32926	NA	NA	NA	NA	NA	NA	NA	NA	NA
1997	Pastoral	Kotido	473422	NA	NA	NA	NA	NA	NA	NA	130000	27.4596449
	Pastoral	Moroto	748665	9	NA	NA	NA	NA	0.0012021	0.0012021	81519	10.8885817
	Pastoral	Moyo	33914	NA	NA	NA	NA	NA	NA	NA	6745	19.8885416
1998	Pastoral	Kotido	487624	NA	NA	NA	NA	NA	NA	NA	66527	#REF!
	Pastoral	Moroto	771125	5	NA	NA	NA	NA	0.0006484	0.0006484	58676	7.60914249
	Pastoral	Moyo	34932	NA	NA	NA	NA	NA	NA	NA	3396	9.7217451

1999	Pastoral	Kotido	502253	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pastoral	Moroto	794258	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pastoral	Moyo	35980	NA	NA	NA	NA	NA	NA	NA	1118	3.10728182
2000	Pastoral	Kotido	517321	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pastoral	Moroto	818086	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pastoral	Moyo	37059	NA	NA	NA	NA	NA	NA	NA	NA	NA

e: CBPP reports from the Ministry of Agriculture Animal Industry and Fisheries , CBPP reports from the District local government

o data available

K 3: Methods used for the control of CBPP in Uganda

ock tion n	District	Uncoordinated single or multiple vaccinations	Intensive bi/tri-annual vaccination	Movement control	Quarantine	Stamping out new cases	Screen new animals and treat positive ones	Treatment of sick animals	Combination of vaccination and movement control	Training and awareness workshops
astoral	Apac	NA	NA	X	X	NA	X	X	X	X
astoral	Arua	NA	NA	X	X	NA	X	X	X	X
astoral	Bundibugyo	NA	NA	X	X	NA	X	X	X	X
astoral	Bushenyi	NA	NA	X	X	NA	X	X	X	X
astoral	Gulu	NA	NA	X	X	NA	X	X	X	X
astoral	Hoima	NA	NA	X	X	NA	X	X	X	X
astoral	Iganga	NA	NA	X	X	NA	X	X	X	X
astoral	Jinja	NA	NA	X	X	NA	X	X	X	X
astoral	Kabale	NA	NA	X	X	NA	X	X	X	X
astoral	Kabarole	NA	NA	X	X	NA	X	X	X	X
astoral	Kalangala	NA	NA	X	X	NA	X	X	X	X
astoral	Kampala	NA	NA	X	X	NA	X	X	X	X
astoral	Kamuli	NA	NA	X	X	NA	X	X	X	X
astoral	Kapchorwa	NA	NA	X	X	NA	X	X	X	X
astoral	Kasese	NA	NA	X	X	NA	X	X	X	X
astoral	Kibale	NA	NA	X	X	NA	X	X	X	X
astoral	Kiboga	NA	NA	X	X	NA	X	X	X	X
astoral	Kisoro	NA	NA	X	X	NA	X	X	X	X
astoral	Kitgum	NA	NA	X	X	NA	X	X	X	X
al	Kotido	NA	NA	X	X	NA	X	X	X	X
astoral	Kumi	NA	NA	X	X	NA	X	X	X	X
astoral	Lira	NA	NA	X	X	NA	X	X	X	X
astoral	Luwero	NA	NA	X	X	NA	X	X	X	X
astoral	Masaka	NA	NA	X	X	NA	X	X	X	X
astoral	Masindi	NA	NA	X	X	NA	X	X	X	X
astoral	Mbale	NA	NA	X	X	NA	X	X	X	X
astoral	Mbarara	NA	NA	X	X	NA	X	X	X	X
al	Moroto	NA	NA	X	X	NA	X	X	X	X
al	Moyo	NA	NA	X	X	NA	X	X	X	X

astoral	Mpigi	NA	NA	X	X	NA	X	X	X	X
astoral	Mubende	NA	NA	X	X	NA	X	X	X	X
astoral	Mukono	NA	NA	X	X	NA	X	X	X	X
astoral	Nebbi	NA	NA	X	X	NA	X	X	X	X
astoral	Ntungamo	NA	NA	X	X	NA	X	X	X	X
astoral	Pallisa	NA	NA	X	X	NA	X	X	X	X
astoral	Rakai	NA	NA	X	X	NA	X	X	X	X
astoral	Rukungiri	NA	NA	X	X	NA	X	X	X	X
astoral	Soroti	NA	NA	X	X	NA	X	X	X	X
astoral	Tororo	NA	NA	X	X	NA	X	X	X	X

: CBPP reports from the Ministry of Agriculture Animal Industry and Fisheries , CBPP reports from the District local government

he method is not used in Uganda