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Full Length Research Paper

Farmer perceptions of classical swine fever outbreak in communal pig production systems of South Africa

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After the outbreak of classical swine fever (CSF) in the Eastern Cape Province of South Africa, policy makers are expected to make decisions on the restocking of pigs. The objective of this study was to investigate farmers' perceptions of CSF outbreak in coastal and inland communal production systems because of their differences in harbouring pathogens. Data were collected from 288 farmers in two CSF affected areas (one on the coast, one inland) and one unaffected coastal area. The majority of farmers in affected inland (73%) and coastal (89%) areas kept local pigs and non-descript crosses with imported pigs on backyard production system. Significantly, more pigs were culled in the affected coastal area than inland area. In both areas, the culling of pigs affected pork availability and income generation. Household heads that were residing on the farms that are educated, mature and located inland were less likely to experience disease challenges. To facilitate restocking and conservation of local pig genetic resources, farmers requested the government and stakeholders to assist with loans, breeding stock, proper housing structures and improved extension services. Farmers in both coastal and inland areas perceived CSF as destructive to pigs, thereby jeopardising their source of livelihoods.

Key words: Pig genetic resources, conservation, disease outbreaks, pig culling, restocking.

INTRODUCTION

Utilisation of local pig genotypes in communal areas has the potential to increase food security, reduce poverty and improve livelihoods of the resource-poor farmers (Halimani et al., 2010; Madzimure et al., 2012). Despite their importance, local pigs are threatened by sporadic disease outbreaks such as classical swine fever (CSF) (World Organisation for Animal Health, 2005). The outbreak of CSF in South Africa led to the culling of more than 335 000 pigs (more than two thirds of the pig population in the Eastern Cape Province) and a loss of about 95% in production (South African Press Association (SAPA), 2005). The loss of pig biodiversity affects the ability of future breeding programmes to respond to changing climate and consumer needs (Halimani et al., 2010). Culling also left few breeding males and females, thereby increasing the chances of related animals to mate each other. An obvious consequence is inbreeding. It is, therefore, important to understand the origins and impact of diseases in communal production systems, and tap on the indigenous knowledge on how to minimise their devastating effects. Any intervention to reduce the impact of diseases assists in the conservation of pig genetic resources.

The government of South Africa should consider initiating a national restocking programme in the affected areas. There is risk of disease outbreak if farmers are left to restock using some of the pigs that were hid during the culling exercise. Future outbreaks of contagious diseases such as CSF (Ruggli et al., 1996; Liu et al., 2009; Podgórska and Stadejek, 2010) should be avoided since it has a huge financial implication on the national economy

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Figure 1. Map showing study sites in the Eastern Cape Province of South Africa.

economy as the government struggles to control the disease (Edwards et al., 2000; Leifer et al., 2005; Rowlands et al., 2008). For example, the South African government paid more than R200 million to compensate the more than 83 000 affected farmers (National African Farmers Union (NAFU), 2007). The disease slowed down the development of the pig industry, reduced trade at the national and international levels and resulted in job losses (SAPA, 2005). The country lost potential revenue since it was banned from exporting pork up until it reached a CSF-free status.

The outbreak of CSF first occurred in the Western Cape Province before being detected in the Eastern Cape Province in 2005 (Penrith et al., 2011) where it was concentrated mainly around the informal free-roaming pig farming areas (NAFU, 2007). The disease spread over large distances when human intervention such as illegal swill feeding facilitated its movement (Edwards et al., 2000). Most of the pigs that were culled were from areas located along the coast, perhaps because of the pattern of spread of the disease which emanated from a coastal town of Centane (Department of Agriculture, 2006). The sampling of households for our study was, therefore, designed to represent the coastal and inland areas of the Eastern Cape. Coastal areas are known to harbour many diseases because of the hot humid conditions when compared to inland areas (Rowlands et al., 2008; Jutla et al., 2010; Ortiz-Pelaez et al., 2010).

Restocking of commercial pigs is generally easy to implement, as imported pigs are widely available from renowned pig breeders. Sourcing of local pigs after culling is, however, extremely difficult because there are no breeders. Local pig genotypes are ideal for the resource-poor communal farmers because they require low maintenance costs due to their foraging ability. Designing restocking programmes for pigs without establishing the perceptions of the communal farmers is likely to cause passive resistance and prohibit co-operation by the communities. The objectives of this study were to investigate farmers' perceptions of CSF outbreak in coastal and inland communal areas and to reveal differences in the way farmers were affected by and dealt with the outbreak across areas and production systems.

MATERIALS AND METHODS

Study sites

The study was conducted in communal production systems of Elundini (inland), Ntabankulu (coastal) and Ngqushwa (coastal) municipalities in the Eastern Cape Province of South Africa (Figure 1). The sites were chosen after the CSF outbreak and policy makers needed data to restock pigs in the Eastern Cape Province. The sites were selected with participation of State Veterinary Services, University of Fort Hare, councillors, farmer represent-tatives and government officials. In the whole of the Eastern Cape Province, Ntabankulu was the only municipality where pigs were not culled because the pigs tested negative against CSF. In addition, farmers in Ngqushwa Municipality are generally less poor and market-oriented when compared to the subsistence-oriented farmers in Elundini and Ntabankulu Municipalities. Elundini Municipality is situated 28° 25′ E; 30° 26′ S with an elevation of about 1600 m above sea level. The mean annual rainfall ranges from 800 to 1200 mm. The area has average minimum day temperature of 13°C and maximum temperature of 22°C. Ngqushwa Municipality is situated at 27° 7′ E and 33° 12′ S. The

temperature ranges from -2 to 42°C with an average of about 18°C. The area receives an annual rainfall of about 450 to 900 mm with most of it occurring in summer. The area has deep loamy soils with vegetation greatly covered by the *Acacia karroo.*

Ntabankulu Municipality is situated at 29° 16′ E and 31° 04′ S with an elevation of about 476 m above sea level. Ntabankulu receives mean annual rainfall of 620 mm with most rainfall occurring during mid-summer. The average daily temperature ranges from 17.8°C in June to 25°C in January. In all municipalities, pigs formed integral components of mixed crop-livestock farming systems by providing manure or cash for the purchase of inputs for crop production. Local pigs can also utilise resources that have few alternative uses, such as agricultural by-products. Crops commonly grown by farmers in these areas include maize, beans, potatoes and pumpkins.

Data collection

Data were collected from three municipalities using individual structured questionnaires, in-depth interviews with key informants and direct observations of pigs and production practices. Primary information about pig production was obtained from key informants. Extension officers, veterinary specialists, local leadership (political and customary) and the elderly (over 70 years of age) provided the secondary data. Secondary information was obtained from the Department of Agriculture. The study was conducted from August to December 2009. Communities with many pig owning households were identified with the assistance of the National Department of Agriculture. The households with pigs were identified with the assistance of the local leadership and the snowballing technique was used to select participants who were willing to participate in the project. The key informants were interviewed to establish the pig production trends, factors affecting production levels and traits of economic importance, as a first step in designing a structured questionnaire. The questionnaires were administered in the vernacular Xhosa language. Farmers' wealth status was categorized during interviews with key informants and was based on number of livestock species. Any household owning more than five heads of cattle or more than 20 heads of small stock (sheep, goats and pigs) was considered as less poor while the other category of less privileged people was considered as poor.

The number of households owning pigs that were interviewed in Elundini, Ngqushwa and Ntabankulu was 122, 102 and 64, respectively. Data were collected using structured questionnaires and included demographic data, pig rearing systems, number of culled per household, perceptions of farmers on the severity of CSF and how the government should have controlled it. Additional data included compensation price for different classes of pigs and whether farmers received it, farmers' perceptions on whether the compensatory price was satisfactory and suggested compensation price. Changes of pig prices with CSF outbreaks, government's effort in restocking and whether farmers were sending of dead pigs for post-mortem were also captured. Direct observations were made to verify pig genotypes. The perceptions of the people on the need to conserve the local pig genetic resources were captured using a structured questionnaire.

Statistical analyses

The Generalised Linear Models procedure of SAS (2006) was used to analyse the effects of farmers' socio-economic profiles, area of location (coastal and inland) and pig rearing systems (backyard and scavenging) on the number of pigs culled. Pair-wise comparisons of the least square means for culled pigs were performed using the PDIFF option. Information regarding demographic data, pig rearing system, pig breeds owned, farmer's perceptions on the incidences, impact and control of CSF was analysed using PROC FREQ of SAS (2006).

An ordinal logistic regression (PROC LOGISTIC) was used to estimate the probability of household experiencing CSF (SAS, 2006). The logit model fitted predictors such as area of location, pig rearing system, household size, pig housing, and head of household's demographic factors such as age, education level, employment status, marital status and place of residence (stays mainly at home or works and stays away from home). The logit model used was:

$$\ln [P/1-P] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_{3...} + \beta_t X_t + \varepsilon$$

where: P = the probability of a household experiencing CSF; [P/1−P] = odds ratio, which referred to the odds of household experiencing CSF; β_0 = intercept; $\beta_1 X_1 ... \beta_t X_t$ = regression coefficients of predictors; ε = random residual error

When computed for each predictor ($\beta_1 ... \beta_t$), the odds ratio was interpreted as the proportion of households experiencing CSF versus those that did not experience it.

RESULTS

Farmers' socio-economic profile

The socio-economic profiles of respondents in the Elundini, Ngqushwa and Ntabankulu Municipalities are shown in Table 1. The proportion of households headed by females in the three locations was equal. Mean household size across all municipalities was 5.2 ± 4.63 (mean ± standard error) members. Most of the interviewees in Elundini, Ngqushwa and Ntabankulu municipalities were unemployed and survived on subsistence farming or social grants. There were more respondents with basic education (grade 1 to 7) than secondary or tertiary education in the three municipalities. The majority of the interviewees in Elundini, Ngqushwa and Ntabankulu municipalities were Christians, while the remainder were African tradition worshippers. Most of the heads of households were resident on the farms in the three municipalities. In all three municipalities, most women over 60 years old were actively involved in pig rearing while men, boys and girls helped in the absence of women. Across all the municipalities, pigs were mostly owned by women. The majority of farmers were using backyard production system where the pigs were free roaming in the yard and the remainder were using the free range or scavenging production system (Table 1). About 86% of the farmers reported that the major field crop they grew was maize, largely for household consumption and as supplementary feed for livestock. The other minor crops grown for consumption, in order of importance, were beans, vegetables, potatoes and pumpkins.

Farmers' perceptions on classical swine fever outbreak

The impact of CSF and the perceptions of farmers about

Table 1. Socio-economic characteristics of respondents (percentage) in different locations.

Socio-economic characteristic	Elundini (Inland) n = 122	Ngqushwa (Coastal) n = 102	Ntabankulu (Coastal) n = 64
Male headed households	52	47	55
Married respondents	67	63	73
Women owning pigs	81	60	69
Unemployed respondents	79	77	80
Respondents with basic education (grade 1-7)	50	55	47
Respondents that were Christians	88	84	70
Heads of households living on the farm	70	85	65
Female pig keepers over 60 years of age	51	37	37
Youths reported as interested in pig rearing	66	89	79
Respondents using backyard production system	73	89	36
Respondents keeping indigenous pigs	89	82	97

Table 2. Farmers' perceptions (percentage) about classical swine fever disease outbreak.

Pig production and disease attributes	Elundini (Inland) n = 122	Ngqushwa (Coastal) n = 102	Ntabankulu (Coastal) n = 64
Respondents with culled pigs due to CSF	97	93	0
Respondents who hid some pigs from culling	17	22	0
Respondents who never saw controllers of CSF	2	3	16
Respondents who send pigs for post-mortem	1	6	3
Respondents who thought CSF is dangerous for pigs	60	88	67
Respondents who thought CSF reduces pig production	10	13	12
Respondents who thought CSF decreases pig price	28	86	55
Respondents who had no idea about CSF impact	29	0	21
Respondents who believed in vaccination against CSF	71	50	66
Respondents who believed housing controls CSF	7	22	11
Respondents advocating for educating people about CSF	2	28	10
Respondents who supported culling of pigs	14	0	10
Respondents who supported compensation with pigs	50	0	38
Respondents who received monetary compensation	25	71	0
Respondents satisfied with compensation price	100	83	63
Respondents supported a pig restocking programme	68	80	66
Respondents who wanted loans for pig projects	0	36	20
Respondents who demanded better extension services	56	64	56

the disease are shown in Table 2. The majority of farmers in Elundini and Nqushwa Municipalities had their pigs culled due to CSF. There were differences ($P < 0.05$) in the number of culled pigs in Elundini (4 ± 1.00), Ngqushwa (8 ± 1.76) and Ntabankulu (2 ± 1.00). Generally, most farmers in the current study regarded CSF as a dangerous disease for pigs, which reduce production and profit (Table 2). More farmers in the CSF affected areas hid their pigs whenever they saw government officials. Most farmers in all the municipalities suggested the need for vaccination in order to control the disease (Table 2). Few farmers supported the culling of pigs as a control measure in all municipalities (Table 2). There were more farmers in Ngqushwa Municipality than the other two municipalities who believed that housing pigs and educating people about CSF would help in controlling the disease. All the respondents confirmed that they were aware of the government's compensation price of R2000 per breeding sow. There were few respondents in Elundini Municipality who wanted the government to compensate them with uninfected pigs instead of money (Table 2). Farmers in Ntabankulu Municipality supported the notion that the government should restock any area that would have been affected by CSF though they were not directly affected. Ngqushwa Municipality had the highest number

Table 3. Odds ratio estimates, lower and upper confidence interval (CI) of a household experiencing classical swine fever.

Disease and parasites challenge	Odds ratio	Lower CI	Upper CI
Area of location (inland vs. coastal)	2.482	1.415	4.354
Pig rearing system (free range vs. backyard)	0.766	0.408	1.437
Age of head of household (young vs. old)	1.907	0.567	6.415
Education (educated vs. uneducated)	2.202	1.186	4.089
Employment status (employed vs. unemployed)	0.719	0.376	1.375
Residence of household head (at the farm vs. away)	2.783	1.231	3.869
Household size (large vs. small)	1.158	0.691	1.930
Pig housing (pigs not housed vs. pigs housed)	0.485	0.230	0.824
Marital status (married vs. not married)	0.989	0.775	1.280

The first category in parenthesis was used as the baseline (set to 1).

of respondents who had been compensated for their culled pigs followed by Elundini Municipality (Table 2). Few farmers in Ngqushwa and Ntabankulu Municipalities wanted loans for establishing pig projects. Most people across the three municipalities requested better extension services from the government to prevent future disease outbreaks especially after restocking efforts (Table 2). Across the municipalities, most people were not sending their pigs for post-mortem.

Odds ratios for disease outbreak

The odds ratios of a household experiencing CSF were highest for head of household staying away from the homestead, followed by education level, age of head of household, municipality, size of household and production system (Table 3). The odds ratio of 2.182 showed that heads of households who were staying away from the farm had a higher likelihood of experiencing CSF. The uneducated farmers were more likely to experience CSF than their educated counterparts. Households headed by young people were affected by CSF more than those led by old people. Municipalities at the coastal areas were more challenged by CSF than inland ones.

Prospects of restocking areas affected by CSF

On average, 22% of the farmers were resisting culling insisting that they were an important part of their livelihoods. Most people (92%) mentioned that they were infuriated seeing government officials going around killing pigs. These farmers felt that the government was being inconsiderate by destroying their pigs without giving them immediate compensation to survive on. It was mainly piglets that were hid from government officials inside the houses while some tied mature pigs in the nearby bushes or mountain. All the farmers supported the idea of the government initiating a national restocking programme in the areas affected by CSF. It was surprising that after the culling exercise in 2005, pig ownership was fast spreading in the communal households at the time of the study. The only thing that was limiting some farmers from venturing into pig production was shortage of breeding stock.

DISCUSSION

The culling of CSF-infected pigs for the majority of respondents in Ngqushwa and Elundini Municipalities meant that farmers' welfare was affected since pigs are a source of livelihood (food and income generation) for these resource-poor farmers. The hiding of pigs in mountains or indoors and the self-initiated restocking revealed their importance to the respondents, the majority of whom were unemployed. Women were more affected by the culling since they are the ones who rear more pigs than men for food and income generation (Chiduwa et al., 2008). The continued upkeep of local pigs by the resource-poor communal farmers supports sustainable agricultural development (Drucker and Anderson, 2004). The majority of the youths were interested in helping with pig rearing implying pig production may continue into the future in communal areas. In the restocking programme, it can be suggested to fund women because they were the major owners of pigs as men were interested in large stock like cattle.

The majority of the farmers regarded CSF as dangerous since it reduces pig production and profits are supported by previous reports (Widjojoatmodjo et al., 1999; SAPA, 2005; FAO, 2009). More farmers in Ngqushwa Municipality were affected in terms of price drop since they were keeping more pigs for the market when compared to the other municipalities surprisingly, most farmers did not support the government's approach of culling pigs even though they accepted that the disease was dangerous. This could be due to the fear of losing pigs as their source of livelihood through generation of income and provision of pork.

The government's delays in compensating farmers may further explain the hiding of pigs by some farmers. According to the Department of Agriculture (2006), delays in compensation for rural farmers were orchestrated by lack of bank details for most of the rural farmers although efforts were made to pay them through the Post Office. Unless market-related compensation for pigs slaughtered is paid promptly, farmers are tempted to evade the control measures and CSF will continue to spread (Penrith and Thomson, 2004). The finding that some farmers in Ngqushwa and Ntabankulu Municipalities were not satisfied with the compensatory price suggest that the government should pay them more for forced culling because it inconvenienced them. Farmers in subsistence communal production systems might have appreciated compensation in the form of uninfected pigs instead of money. It could be that farmers feared failure to secure breeding stock when permission to restock is granted. This finding further supports the fact that CSF causes loss of pig biodiversity.

The South African government was justified in its culling action since it is recommended to stamp out infected and in-contact pig herds with destruction of the carcasses as one of the traditional control measure to achieve eradication of CSF after an outbreak (Elbers et al., 1999; Garner et al., 2001). Instead of culling, most farmers in Elundini and Ntabankulu Municipalities suggested that vaccination could have been a better option. The farmers' opinion was supported by some authors who reported that effective live-attenuated vaccines are available (Wehrle et al., 2007; Liu et al., 2009). Vaccination is, however, not allowed in the export market such as the European Union, since vaccinated and infected pigs are serologically indistinguishable (Widjojoatmodjo et al., 1999; Wehrle et al., 2007). The use of marker vaccines makes discrimination between vaccinated and infected animals possible (Widjojoatmodjo et al., 1999; Wehrle et al., 2007; Kaden et al., 2008). The acceptability of marker vaccines rests with trade partners. The use of these marker vaccines might not be an option for South Africa because they are costly to produce thus become expensive to the farmer. In addition, they are based on deoxyribonucleic acid (DNA) and proteins, hence are not as efficacious as the live-attenuated vaccines (Greiser-Wilke and Moennig, 2004). The South African government currently depends on serological surveillance to control CSF; therefore, vaccinating pigs as suggested by farmers would interfere with the epidemiological tool (Department of Agriculture 2006; Penrith et al., 2011). Farmers need to be educated on the government's reasons for the choice of the disease control programme so that they cooperate.

The finding that farmers in Ngqushwa Municipality believed in educating people about the disease and housing pigs as control measures may be due to their market-orientation which makes them stricter. NAFU (2007) reported that the spread of CSF in Eastern Cape Province of South Africa was mainly due to free ranging pigs. Farmers in Ntabankulu and Elundini Municipalities, however, indicated that they could not afford the government's recommended pig housing structure unless the government is to construct it for them. Most farmers in these municipalities are resource-poor and, hence, largely depend on government.

The continued free ranging of pigs increases the chance of them mixing with infected wild pigs thereby compromising the CSF control effort (Penrith et al., 2011). Acutely infected pigs are a potent source of infection for other pigs (Penrith et al., 2011). The disease is also transmitted from pregnant sow to foetuses (Penrith et al., 2011) or from one farm to another through equipment, vehicles and people (Van Oirschot 2004). After the CSF outbreak, farmers in affected areas were prohibited from slaughtering any pigs at the abattoirs to stop the spread of the disease through the food chain. Generally, all farmers considered local pigs to be tolerant to disease challenges although it was not clear this includes CSF.

Across all Municipalities, the majority of farmers were not sending their pigs for post mortem which makes it difficult for the Department of Agriculture to quickly detect any disease outbreak especially in communal areas. Delays in detecting outbreak of contagious diseases like CSF (Ruggli et al., 1996; Liu et al., 2009; Podgórska and Stadejek, 2010) will result in the virus travelling long distances affecting many pigs hence increased costs of controlling the disease (Edwards et al., 2000; Leifer et al., 2005; Rowlands et al., 2008).

The odds ratios for a household experiencing CSF were affected by demographic factors, area of location and production system as was also reported by Mapiye et al. (2009). Pigs for a household head who was resident at the farm were less likely to experience CSF outbreaks because the farmer was always available to better take care of the pigs. A mature resident head of household's pigs have less risk because the farmer may be more experienced and likely to comply with government's recommendations to control diseases like CSF such as confining the pigs. Many people in each household may share responsibilities and better take care of pigs to avoid outbreak of diseases. The level of education of the farmer may also assists in better understanding and cooperation with the government in disease control. Coastal municipalities like Ngqushwa and Ntabankulu are more likely to experience CSF outbreaks because of their hot humid conditions which harbour diseases (Rowlands et al., 2008; Jutla et al., 2010; Ortiz-Pelaez et al., 2010). Pigs that were free ranging were likely to experience CSF than those that were either in the backyard or housed.

When pigs are free ranging, they are likely to mix with infected herds and the disease will spread. The pigs that were owned by employed people were likely to be affected by CSF probably because these farmers had little time available to take care of their pigs.

Municipalities wanted the government to come up with a restocking programme in affected areas in order to restore the local pig biodiversity. Currently, the efforts from local municipalities are not capable of providing loans to all farmers who want to revive their piggery projects. Farmers requested the government to promote the production of Kolbroek, Windsnyer and their crosses with imported breeds because they are hardy and resistant to diseases as was reported by Halimani et al. (2010). Farmers in Ngqushwa Municipality wanted the government to avail loans to individuals who could not be part of a cooperative but have pig structures and experience in pig rearing. In addition, these farmers wanted access to a reliable market so that they can boost pig production. Coupled with restocking, the majority of farmers wanted the government to provide better veterinary and extension services in terms of disease control and pig husbandry. This will go a long way in preventing future disease outbreaks and supporting the conservation of threatened local pig genetic resources.

Conclusions

The odds ratios showed that coastal areas are more likely to have CSF disease outbreaks when compared to dry inland areas. More pigs were culled in coastal areas of Ngqushwa Municipality when compared to inland Elundini Municipality. The culling of pigs affected pork availability, income generation and caused ecosystem disturbance in the crop-livestock communal production systems. The same challenges were not witnessed in unaffected coastal area. To facilitate restocking or conservation of local pig genetic resources, farmers requested the government to assist with loans, local breeding stock, proper housing structure and improved extension services. We concluded that the risk of CSF disease outbreak is high in coastal areas than inland areas but the disease can have equally devastating effects once there is an outbreak in an area.

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