A Study of Small-scale Poultry Production Systems in Serowe-Palapye Sub-district of Botswana

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AbstractAbstract

This study set out to describe the main poultry rearing systems on farms in Serowe-Palapye subdistrict of Central District (Botswana), with a view to increasing the benefits to poultry rearers. The two systems studied were small-scale commercial (SSC) and village or backyard poultry.

A total of 106 rearers of chickens (95 village and 11 SSC) and 15 non rearers were studied across three villages (Serowe, Palapye and Maunatlala). Data collection was by formal and informal interviews, group interviews, direct observation, conference and a seminar. Some data were obtained from secondary sources. School children revealed more information on village systems than adults.

SSC enterprises in Botswana constitute over 80% of all commercial enterprises and provide 29% of the total eggs and 64% of chicken meat. SSC enterprises have been promoted by Government with a view to improving standards of living by providing employment for rural families. The major constraints to increased productivity in SSC enterprises were irregular and poor supply of feeds and chicks, lack of transport, poor siting of enterprises and unorganised marketing. Thus, improvement of SSC rearing requires both support from Government and policy-makers, as well as the training of farmers.

The national indigenous poultry population was estimated at

close to 3.5 million (i.e., 56% of the size of commercial flock). Village poultry were kept by most rural households in Serowe-Palapye subdistrict. Rural families kept village chickens to supplement diet, as source of income and for greeting visitors. Sixty-six percent of the rearers owned 1-20 birds and mean flock size across the villages was 18 birds. Village hens produce three clutches (15 eggs per clutch) in a year and hatchability was estimated to be 82%.

Low input husbandry methods contributed to high mortality in village chickens. However, the main constraint to village chicken rearing was Newcastle disease (ND), which frequently cause serious mortalities. Losses from other factors, especially predation, accounted for 35%. Traditional disease control remedies predominated. The productivity of village chickens is likely to be improved by allowing chickens to breed during low disease and predation risk periods (e.g., winter and autumn) and by confining birds during high risk periods (e.g., spring and summer months). Methods of delivery of ND vaccine to SSC and village poultry should be developed. There is need for new extension strategies that encourage farmers and scientists to work together to develop village chicken rearing.

Introduction

Of all livestock reared, poultry (chickens) are the most widespread in Botswana. Almost every rural family owns chickens, which provide a valuable source of family protein and additional income. Commercial chicken production has increased substantially during the past 25 years and urban consumption continues to increase. Production from village chickens continues to be in demand to meet local needs. Village chickens are not recorded in official livestock data. Beef production accounts for the largest proportion of the agricultural sector's contribution to GDP.

In Botswana, as in many developing countries, small-scale poultry farmers including the village chicken rearers constitute the majority. Their enterprises are found mostly in rural areas where production inputs are difficult to obtain, and marketing

outlets not well organised. In contrast, large-scale enterprises are concentrated along the railway line and in big towns, where they have access to production facilities and marketing outlets (Pule 1977).

Literature on Botswana=s chicken population is conflicting and inconsistent. The FAO (1994) estimate of the commercial flock was three million while the Poultry and Piggery Annual Report (PPAR) (1995) puts it at 6.24 million. Based on: Botswana=s average household size of five, that two thirds of the population live in the rural areas (NDP 1991) and on an average flock size of 15 birds per household (Chabanga 1994), the indigenous chicken population could be estimated to be close to three million.

Shaner et al. (1982) described "small-scale" farming as those operations in which the farmers frequently have difficulty obtaining sufficient inputs to allow use of the technology available to medium-scale and large-scale farmers. In the Financial Assistance Policy (FAP) context, small-scale enterprises are those that have a fixed investment of up to P75 000 [Ministry of Finance and Development Planning (MFDP) 1995] and includes SSC enterprises. Village chickens are not included in this category, which means that these rearers do not benefit from FAP.

The main poultry production systems world-wide can be broadly classified into: (a) backyard (village) scavenging systems, (b) small-scale commercial systems, and (c) large-scale commercial farms with modern technology (Reddy 1991*b*). Backyard or indigenous poultry production is an old system based on small flocks and minimum production inputs. The birds are mostly of a local, native type (indigenous) that roam the farms or village freely in search of feed. They are occasionally provided with home-grown grains and minimum shelter (Reddy 1991*b*).

Aims of the studyAims of the study

The overall aim of this study was to investigate the main poultry rearing systems on farms in Serowe-Palapye subdistrict, with a view to increasing the benefits to poultry farmers. To this end, the research involved reviews of literature on small-scale poultry production and on farming systems research (FSR), followed by a short field investigation of poultry farming systems in Serowe-Palapye subdistrict. The objectives of the field research are to:

study two major poultry farming systems, ie., SSC and village chickens;
describe the two selected poultry systems;
identify constraints and opportunities for improvement in the selected farming systems.

FSR was reviewed in some depth as an approach to research and development (R & D) amongst small-scale farmers and with a view to developing methods for the use of an FSR approach in this study and beyond.

MethodsMethods

The main methods used in obtaining data on the farming systems were informal and some formal surveys. Through these methods data were obtained on rearing, feeding and overall productivity of small-scale poultry rearing in the subdistrict.

Results and DiscussionResults and Discussion

The main poultry systems were village and small-scale commercial (SSC). Village poultry predominated in the villages. Ninety-five percent of respondents kept single species of poultry (94% chickens and 1% ducks) while the remaining five percent kept more than one species (Table 1). The average flock size per household was 18 birds and 66% of the rearers owned 1-20 birds. Chickens were mainly of the native *Tswana* type, with different colours of plumage. However, some exotic blood was present in indigenous birds as a result of indiscriminate cross breeding with commercial breeds.

Table 1 Poultry species distribution by households in three villages in Botswana

Species	**No. of households**	**% of households**
Chickens	89	94
Ducks	1	1
Chickens and pigeons	3	3
Chickens and ducks	1	1
Chickens and geese	1	1
Total	95	100

Although the roles played by village chickens were manifold, it was apparent that they were kept mainly for (a) home consumption (b) as a source of income, and (c) a source of food for greeting visitors. Chickens were an

important hedge against unexpected cash needs, such as medical and school fees. One or more chickens were sold to meet such emergency expenses.

Village chickens played a role in religion and traditional medicine and in cleaningBup wastes in villages, by picking up grains that spilt during pounding and threshing. The white portion of chicken droppings was mixed with water to treat measles in humans. The mixture of herbs, blood, viscera and meat from chickens was reported to be effective in treating intestinal worms (*eg*., tapeworms) in children, epilepsy, and male sterility. Blood from the smallest digit of a young black chicken was mixed with herbs to treat eye infections in humans. Black and white chickens were used in casting away evil spirits, however, white chickens were generally preferred. In addition, there were beliefs associated with the behaviour of chickens, *eg*., in Maunatlala it was believed that when a cock stands on a wall and crows during the day, it indicates that someone has died.

Breeding and productivity of village chickensBreeding and productivity of village chickens

The most prolific breeding time for village chickens was in autumn and winter months because of low incidence of ND (*mokorobalo)*, low predation rates and abundance of feed supply (Table 1.3). These findings could point to changes in management practices that could result in higher output from village chicken enterprises.

Table 2. A calendar showing relative periods of breeding prolificacy, predation rate, disease risk and feed abundance for scavenging chickens in Botswana.

Attributes	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Breeding prolificacy												
Predation rate												
Disease risk												
Feed abundance												

*Thickness of line represents rate or level (thick line=high; thin line=low

The growth of grass cover following summer rains contributes to low predation rates in autumn. Although grass cover could be used by the chicks to hide from predators (kites and buzzards*i*), it can also contribute to increased predation by dogs, cats and mongooses. However, since flying predators are said to cause more losses than terrestrial predators, predation is likely to be reduced during this period. Migration of some predators (i.e., *nkgodi*) to warmer areas, hibernation of most reptiles and the abundance of feed during and at the end of the harvest season makes winter and autumn ideal time for breeding.

Winter appears to be a better time for breeding than autumn because of the lower level of predation and abundance of harvest wastes. However, cold is another main problem that can contribute to high mortalities in chicks. Chick mortality can be reduced by confinement of the brood and the hen for 2-3 months. Paraffin lamps and *mbaula* can be used to provide warmth to the chicks. A simple structure suggested for the rearers is one with a roof of metal sheets or thatch grass, while the walls can be of concrete or mud (Aini 1990) and the floor of concrete or soil-cement type for ease of cleaning and disinfection.

Three clutches produced by hens per year in this study, is consistent with findings by Chabanga (1994), but differs from those of Sazzard (1993) and Siegmann (1996) who reported 3.5 and 5.2 clutches respectively. Egg production estimates for indigenous birds in this study were higher than those of Sazzard (1993). In that study, 12.5 eggs per clutch were found while 15 were estimated in this study. This means that an average of 46 (∀13.59) eggs can be produced by a hen per annum, at present input and management levels.

The hatchability of 82% found in this study was consistent with figures reported by Kingston (1979) and Kingston and Creswell (1979) in Indonesia. Lower hatchability rates observed in summer and early spring were attributed to high ambient temperature and high relative humidity. The combination of high temperatures (especially in December and January) and rainfall could result in high egg deterioration and hence low hatchability rates during this period. The age at which chicks were separated from the mother hen (2 months) confirms findings of a study by Sazzard (1993), but is lower than three months reported by Guneratne *et al.* (1992) in Sri Lanka.

Of all the chicks that are hatched from a clutch size of 15 eggs, an average of 7.7 chicks manage to reach maturity, which means that only 23 chicks per hen reach maturity in a year. Sixty-five (43-78%) percent of chicks reach maturity,

this represents a very high chick mortality and perhaps offers the greatest area of potential improvement. Mortality could be reduced by confining birds during high risk periods, and vaccinating them against *mokorobalo*. Confinement during summer months should reduce mortality and contribute to an increase in the number of chicks that reach maturity, which could result in more birds being sold or consumed by the rearers.

Some possible opportunities that require testing in village chicken enterprises include:

creep feeding of chicks during confinement.

Chicks could be fed mixed fowl feed (sunflower, sorghum and maize), which the rearers could make at home. This could be supplemented with complete feeds, *e.*g., broiler starter mash or pellets up to one month of age.

early separation of chicks from the mother hen could increase clutches.

Future research should look into increasing clutches by early weaning of chicks. Separating chicks from the hen at one month of age could increase clutch number from three to about five per year, raising the number of chicks that reach adulthood from 23 to 40 per hen.

confining breeding and brooding to cooler months of the year.

Breeding should be controlled such that birds are allowed to be broody in cooler months (February to August) when hatchability is high and predation and disease incidence low. Eggs sales and consumption should be increased during periods of low hatchability rates (Table 3).

Table 3. A suggested management calendar for village chickens in Botswana.

	J	F	M	A	M	J	J	A	S	O	N	D
Confinement												
Vaccination												
Egg sales												

Table 3 shows that to increase benefits to the rearers, village chickens should be confined during high risk periods (September to February) and that four vaccinations against *mokorobalo* should be carried out using Hitchner B1 and La Sota vaccine (in case a suitable carrier for Australian V4 vaccine has not yet been

found). It is suggested that birds are confined permanently (or in the afternoons when predation rates are high) during periods of high risk. Alternatively the chicks can be confined while the adult birds are allowed to scavenge. The proposed vaccination schedule could decrease higher incidence of *mokorobalo* and thus lead to increased benefits to the rearers.

Health management in village chickensHealth management in village chickens

Modern methods of disease control were found to be lacking and most rearers depended on traditional and human medications to treat diseases and parasites. *Mokorobalo* was a major constraint in village poultry, causing up to 100% mortality in unprotected flocks. This shows that village poultry is very risky. The views of rearers on the effectiveness of traditional remedies conflicted.

The wide use of traditional remedies could be ascribed to (a) lack of knowledge in the use of vaccines, (b) lack of cooling facilities, (c) unavailability of vaccines, and (d) possible effectiveness of the remedies in curing some diseases. Vaccines appeared to be inaccessible to rearers especially to those in the remote villages because of lack of cooling facilities, suggesting that the V4 vaccine could be appropriate in this difficult husbandry system.

The belief that traditional remedies are effective in controlling diseases appeared to be hindering the use of vaccines. Similar observations on the use of traditional remedies in treating infections have been reported in various African countries. For instance, while *Aloe vera* was used in the control of diarrhoea in Somalia (Ahmed 1990*), Cassia abbreviata* (*monepenepe*), *Senna italica* (*sebete)* and *Aloe marlothii* (*sekgophana*) were used in this study. The common method of parasite control was by the use of wood ashes and *Peltophorum africanum* (*mosetlha*) and *Combretum imberbe (motswere*) were preferred.

Health management of village chickens could be improved by:

mass vaccination with Australian V4 vaccine (Spradbrow 1994).

Future research should identify a suitable carrier for Australian V4 vaccine from the cereal grains grown in

Botswana, *eg*., maize, sorghum and millet.

evaluation of traditional remedies on a research station to determine their effectiveness in controlling diseases and parasites.

Marketing and economic returnsMarketing and economic returns

Village birds were sold all year round. The farmers indicated that village chickens and eggs were only occasionally sold, but estimates of output showed that the rearers may have had inaccurate recall. Various methods of selling village chickens were identified. The common method was through spreading word of sales to the neighbours and friends.

Village chickens were regarded as a walking bank by many families, and were often sold to meet emergency needs. Village chickens fetched a higher price (P15) than commercial chickens (P12.50). The price of village birds in this study varied according to age and sex, but was not related to colour of plumage as was reported by Ngoupayou (1990) in Cameroon.

Kingston and Creswell (1979) reported that seven percent of eggs enter the market in Indonesia, but this study could not quantify the amount of eggs sold as rearers lacked recall of sales. However, it is evident that most of the eggs are used for hatching. Egg sales and consumption are likely to rise in spring and summer months though not significantly because of *mokorobalo* occurrence during this period. Sales could be increased by: (a) control of diseases and confinement of birds during high risk periods by the rearers and (b) developing strategies that promote rearing of village chickens. This involves participation of government and Non Governmental organisations (NGOs). The extension service could provide transport service to a group of rearers to assist them in selling eggs during periods of high temperature when hatchability is low, until farmers organise their own means of transport. Higher sales would result in increased benefits to the rearers.

Over 90% of commercial enterprises in Serowe-Palapye are small-scale. The others are medium scale. Two of the three categories of SSC identified in this study are important in that they help in improving standards of living of the rural populace by providing employment and supplying protein sources. These are backyard SSC and industrial SSC. The third category, hardly fits in the SSC category as birds are mainly for educational purposes.

Constraints in Small-scale Commercial PoultryConstraints in Small-scale Commercial Poultry

Poor siting of projects was shown to be a major constraint to improving output. In this study, more than one third of SSC production occurred in areas without electricity and water resulting in high transportation costs, which contributed to low profit margins. The average distance between water sources and enterprises was 13 km. Costs involving water increased during the killing and cleaning processes, especially in broilers. In addition, the absence of electricity in most enterprises affected the slaughtering and cooling processes. Again, lack of cooling facilities contributed to high feed costs as birds were reared for a longer periods. The extension of power supply is essential to the successful growth of SSC poultry production.

The irregularity and inadequacy of supplies of feed and chick and pullet supplies in this study, contributed to understocking of most enterprises. Consequently most enterprises underutilised capital resources and had poor production continuity. In addition, the qualities of feed and stock were often believed to be poor by farmers. Adejoro (1994) in Nigeria reported similar findings. The poor availability and the supply of quality chicks were main constraints in SSC production. The irregularity of chick supply and poor growth rates are possible contributory factors to fluctuations in production levels and lengthened rearing periods. It seemed likely that high mortality reported in the first two weeks of rearing resulted from long distance transportation in vehicles that were not climate controlled. It was also revealed that there was no back up service from the suppliers of chicks and feeds.

The supply and quality of feeds and chicks could be alleviated by:

encouraging local production of the chicks and feeds; Government (Poultry Unit) could conduct experiments involving feeds from different suppliers;

Department of Agricultural Research could play an active part in quality control through feed analysis;

A bureau of standards needs to be set up to ensure that feed millers produce quality feeds. It is evident that hatcheries that operate without a parent stock do not operate efficiently, which means that to ensure a constant supply of chicks the existing hatcheries should establish their own parent stock;

the SSC farmers should also be encouraged to mix their own feeds, as has been the case in Zambia (Sayila 1994) and in the Ngamiland district of Botswana. Sorghum and maize could be used as sources of energy while vitamin and mineral premixes would be imported.

Training and marketing were identified as major constraints in SSC poultry. Difficulties in selling products appeared to be a result of lack of farmer cooperation, improper pricing of commodities, understocking and poor processing by the farmers. Lack of marketing and business skills possibly led to overpricing of products, which affected sales. Marketing constraint could be alleviated by training farmers in business management and formation of a farmers= cooperative society that would be responsible for processing and marketing of poultry products. The cooperative society can solicit financial assistance from FAP and NGOs to establish a broiler processing plant and make available to the farmers poultry requisites, *e*.g., feed, equipment and stock.

Lack of transport was also a serious constraint in SSC poultry. The rearers reported difficulties in transporting inputs to farm enterprises and finished products to markets, which affected their productivity. The transport constraint was aggravated by its exclusion from the FAP finance and lack of access to other credit. Lack of access to credit also hampered growth of enterprises. Making further credit available to SSC enterprises and the inclusion of transport in the FAP grant could alleviate transport constraint.

The low number of courses held in a year suggested that the extension service was inadequate in raising the performance in SSC enterprises. PPAR (1990, 1991), Mosinyi (1990), Pule 1977 and Reddy (1991*a*) all claimed that lack of trained staff, lack of transport, and large size of the area covered by the extension agents contributed to inadequate service.

Although disease appeared not to be a major constraint in SSC poultry it was probable that the data collected underestimated the extent of disease. Vaccinations were seldom performed. The low incidence of diseases reported by the farmers may be related to lack of support by Veterinary Diagnostic Laboratory (VDL). The delays in releasing diagnostic results by the VDL (MOA 1987) appeared to dissuade most farmers from sending birds for disease diagnosis and hence farmers had no certain knowledge of diseases experienced.

Farmers appeared to lack knowledge of vaccine administration. The relatively low education level of farmers, unskilled labour and lack of knowledge of vaccine use by LAC staff affected the efficiency of vaccines. To improve vaccine efficiency, extension agents could hold field demonstrations on vaccine administration. In addition, the VDL should develop a vaccination program that takes into account the current disease situation and speed up diagnosis.

New Approaches to Research and DevelopmentNew Approaches to Research and Development

Small-scale poultry can be improved in future by adopting more Abottom-up≅ methods such as farmer participatory research (FPR), which are regarded as capable of empowering people to seek and generate their own solutions to problems (Okali *et al*. 1994). By employing the initial stages of farming systems research (FSR) in this study it was possible to better understand farmers= situations and what they needed to overcome production constraints. FSR can allow small-scale farmers to determine research priorities, evaluate their needs and in technology development.

A FSR approach could be used in future, for example, to improve the productivity and benefits of village chickens by controlling *mokorobalo* with V4 vaccine. Farmers can be involved in choosing and testing vaccine carriers and in setting up trials, managing trials and in evaluation. As FSR places the farmer at the centre of research and addresses policy issues, it is apparent that there is need for discussion on how FSR concepts can be integrated with existing research and development (R & D) for the poultry industry.

Future intervention by government and NGOs involving technology development and assistance schemes for SSC farmers should involve farmer participation at all stages of the R & D processes. Farmer participation in evaluation of government schemes such as FAP could enable policy-makers to develop strategies or packages that bear on the circumstances and conditions of the farmers and that can contribute to increased productivity.

ConclusionsConclusions

The main conclusions that can be drawn from this study are:

1. Village chickens play an important role in the nutrition, welfare and incomes of most rural households. There have been no research or extension efforts in this area of poultry production that represents about 35% of the national flock (and 56% of the size of commercial flock).

2. Improved outputs from small-scale commercial poultry are constrained by technical, socio-economic and institutional factors. The main constrains are irregular and poor quality supply of feeds and chicks, poor transport, poor availability of water and unorganised marketing.

3. Disease control and husbandry in general is lacking in village chickens. *Mokorobalo* (ND) is the main constraint in village poultry. Mass vaccination of

village chickens using the Australian V4 vaccine could reduce heavy mortalities. In addition, birds should be allowed to breed only in low risk periods (autumn and winter) and confined during high-risk periods (spring and summer). This could lead to low mortality and increased sales and consumption by the rearers.

4. Small-scale farmers lack access to credit to purchase feed, transport and birds. They lack capital to pay down payments before FAP grants could be disbursed.

5. Village poultry already provides substantial benefits to the population but can be much more profitable if management is improved, *e.*g., housing, disease control and feeding. However, improvement of village poultry would require a more participatory approach to R & D and also a change from the emphasis on commercial poultry. Such changes are a matter for policy-makers and scientists to consider.

6. Small-scale commercial production could be an important vehicle for rural development. It is necessary that studies are conducted to clarify what support is needed and what employment and other benefits would be.

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ACRONYMS AND ABBREVIATIONS

ADF	African Development Foundation
AHP	Animal Health and Production
APAR	Animal Production Annual Report
ARC	Agricultural Research Council
AUSAID	Australia Agency for International Development
BAMB	Botswana Agricultural Marketing Board
CDSS	Central District Settlement Strategy Survey
CSO	Central Statistics Office
CYMMT	Centro Internacional de Mejoramiento de Maiz y
TrigoBInternational	Maize and Wheat Improvement Centre (Mexico)
DAPS	Division of Agricultural Planning and Statistics
DDT	DichlorBdiphenylBtrichlorBethane
DHAP	Department of Animal Health and Production
EEC	European Economic Community (Belgium)
FAO	Food and agriculture Organisation of the United Nations
(Italy)	
FAP	Financial Assistance Policy
FPR	Farmer Participatory Research
FSR	Framing Systems Research
g	Gram
GDP	Gross Domestic Product
ha	Hectare
ICARDA	International centre for Agricultural Research in Dry Areas (Syria)
ICRISAT	International Crops Research Institute for the SemiBarid Tropics
India)	

IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Agriculture (Ethiopia)
ISS	Infectious Stunting Syndrome
kcal	Kilocalories
kg	Kilogram
km	Kilometre
km^2	Square kilometre
l	Litre
LAC	Livestock Advisory Centre
m^2	Square metre
MOA	Ministry of Agriculture
MFDP	Ministry of Finance and Development Planning
MLGLH	Ministry of Local Government, Lands and Housing
mm	Millimetres
NGOs	Non Governmental Organisations
ND	Newcastle Disease
NDP	National Development Plan
NRC	National Research Council
PANVAC	Pan African Veterinary Vaccine Centre
P	Pula (Botswana=s currency, see page iv)
PDC	Production Development Committee
PPAR	Poultry and Piggery Annual Report
PRA	Participatory Rural Appraisal
PUAR	Poultry Unit Annual Report
RTC	Rural Training Centre
RRA	Rapid Rural Appraisal
RSA	Republic of South Africa

SSC	Small-scale Commercial
SSCB	Small-scale Commercial (backyard)
SSCI	Small-scale Commercial (industrial)
WMA	Wildlife Management Areas
UNECA	United Nations Economic Commission for Africa
VDL	Veterinary Diagnostic Laboratory
WPSA	World Poultry Science Association
^{0}C	Degrees Celsius

LIST OF FOREIGN WORDS

Tswana Terms Used

bogoma grass that has sticky flowers that attaches to the plumage of chicks and expose them to predation.

masimo Rainfed fields used to raise crops and some animals.

mbaula a traditional method of supplying artificial warmth to chicks by heating a drum using firewood.

nkgodi buzzard, common predator of chicks that causes heavy mortality in summer and spring.

sebete a plant whose roots are used for treatment of diarrhoea in calves and poultry.

sekgophana local name for *Aloe marlothii,* a common traditional remedy.

Other Foreign Terms

kraal an enclosure for livestock in Southern Africa

veld grasslands of Eastern and southern Africa that are usually level with trees and shrubs.

Exchange Rate

The exchange Rate at the time of study was approximately

P2.70 = A$1.00

OVERALL AIM OF THE STUDY:

To investigate the main poultry rearing systems on farms in Serowe-Palapye Subdistrict, with a view to increasing the benefits to poultry farmers

Objectives

To study two major poultry farming systems, ie., SSC and village chickens

To describe the two selected poultry systems

To identify constraints and opportunities for improvement in the selected farming systems

A STUDY OF SMALL-SCALE POULTRY PRODUCTION SYSTEMS IN SEROWE-PALAPYE SUB-DISTRICT (BOTSWANA)

CONCLUSIONS

1. Village chickens play an important role in the nutrition, welfare and incomes of most rural households.

2. Improved outputs from small-scale commercial poultry is constrained by technical, socio-economic and institutional factors. The main constraints include:

irregular and poor quality supply of feeds and chicks

poor transport

poor availability of water

unorganised marketing

Poor extension service

3. Disease control and husbandry in general is lacking in village chickens. *Mokorobalo* (ND) is the main constraint in village poultry.

4. Small-scale farmers lack access to credit to purchase feed, transport and birds.

5. Village poultry already provides substantial benefits to the population but can be much more profitable if management is improved, *eg*., housing, disease control and feeding. Improvement of village poultry would require a more participatory approach to R & D and also a change from the emphasis on commercial poultry. Such changes are a matter for policy-makers and scientists to consider.

6. Small-scale commercial production could be an important vehicle for rural development. It is therefore necessary that studies are conducted to clarify what support is needed and what employment and other benefits would be.

Table 7.8 Approximate reproductive performance of *Tswana* chickens under extensive management

Production parameters	**Average & SD**	
at sexual maturity (months)	6.37 ∀ 2.55	
of eggs per clutch per hen	15.45 ∀4.53	
of clutches per year	3.0 ∀ 0.00	
of eggs laid per hen per year	46.38 ∀ 13.59	
chability (percent)	81.90 ∀ 11.24	
aning age (months)	2.24 ∀1.14	
ıbation period (days)	21.00 ∀ 0.00	
of chicks reaching maturity	7.67 ∀ 3.28	
centage of chicks reaching maturity	65.30 ∀ 14.34	

Source: Informal and group interviews

Table 7.9 Village poultry disease control methods in three villages (n=95)

Control measures	Response	Percent response
Traditional	78	79
ccines only	2	2
ombination	15	16
ne	3	3
als	95	100

Figures are rearers responses and percentages for each category of disease control measures