Impact Assessment of a Community-based Animal Health Service Program in northern Malawi

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Abstract

Many community-based animal health services have been established in developing countries. There are a large number of publications and references describing these services but only a few researchers have attempted a quantitative analysis of the components and benefits of such programs.

The Basic Animal Health Service (BAHS) Project/GTZ in northern Malawi was established in 1989 and will finish its activities in 2003. An Impact Assessment was implemented during the BAHS field consolidation in 1996/97. The goal was to verify the effectiveness of the scheme and to demonstrate the benefits farmers obtain by using BAHS would pay.

A series of studies were conducted. In Chapter I the characteristics of community-based livestock service programs are described and an overview of different international projects is provided. In addition, the background and philosophy of BAHS is explained and the traditional way of livestock keeping portrayed.

In Chapter II data of a representative livestock population survey for the study area is analyzed. The results provide evidence that more households keep various species of livestock than official data would suggest. An attempt is made to evaluate the link of income status and livestock ownership of the rural people.

The results of a cross-sectional study involving 96 users, 96 part-users and 96 non-users of the scheme are presented in Chapter III. The findings suggest that users owned larger numbers of livestock, were better educated and more open towards new methods compared to their fellow part- and non-users.

Results of interviews with 42 village keymen (KM) and 84 veterinary assistants (VA), who are the key players in service delivery, are analyzed in Chapter IV. Additional information about their visit and treatment patterns are included. The foremost trend emerging from this data was the overall job satisfaction for both, KM and VA, which is a solid basis for further expanding the scheme.

Chapter V contains the results of a longitudinal study. All 288 farms visited for the cross-sectional study were monitored in regard to their livestock performances and husbandry applications between July 1997 and February 1999. The results show that users of BAHS had higher off-take rates in cattle, maintained more stable herds of ruminants and that their livestock mortality was lower compared to both of the other groups. Users also applied a range of livestock husbandry and management measures more frequently than part- and non-users. During concluding interviews in January and February 1999, BAHS-users felt significantly more positive about the past year in terms of livestock health and production compared to both of the other groups.

Chapter VI presents the results of the economic analysis of the BAHS-scheme. Partial budget and cost benefit analysis are applied by using a spreadsheet model. Different farming levels were modeled. Users achieved higher net returns from livestock production compared to part- and non-users. It is assessed that the regional gross benefit farmers obtain through livestock production annually amounts to US$ 45 Mio with BAHS and US$ 44 Mio without, respectively. Different models were applied to evaluate the impact of an increased density in BAHS usage.

The main challenge for the BAHS-program lies in intensified field extension, better support for village keymen and veterinary assistants and a significant increase of involvement of very poor households.

Acknowledgements

Throughout my professional career as a veterinarian I have been involved in fieldwork in one way or the other, which I have enjoyed. However, I often came to the point were I had to consult someone, on how to handle the pool of data and information I laboriously gathered. I found this very unsatisfactory. This brought my family and me to New Zealand.

We have loved to stay here 'down under', to make real friends, to deal with a different culture and to widen our horizons. This was only possible with the right partner on my side.

I have to mention a few names in gratitude of their advisory role, their support or mateship.

First of all I am grateful to Prof. Dirk Pfeiffer, my chief supervisor. Thank you Dirk for your professionalism, your patience but also passion while guiding me through this research project.

I pay respect and gratitude to Dr. Klaus Leidl, my previous team leader in the Malawi Project. It was your idea Klaus, to go into this venture. You on behalf of GTZ supported me throughout the time here at Massey University. Thank you for that.

I thank Prof. Roger Morris, head of the institute. I greatly value your vast professional experience Roger. It has been an honour working under your guidance.

Thank you Joanna and Paul for your friendship. Some day we should meet again.

All staff members, consultants and office mates at the EpiCentre, please receive my gratitude wholeheartedly. I have found you all very approachable. There is a great sense of humor and team spirit in your institute. I have enjoyed your company.

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I. CHAPTER

Project Background

1. The need for Primary Animal Health Activities (PAHA) in developing countries

Characteristics of PAHA

Primary Animal Health Activities is a general term, which takes account of a number of measures focusing on enhanced livestock health and production in developing countries. A number of different phrases were and still will be applied but all of them include similar features and goals. These are:

- Low cost strategies concentrating on vital livestock health and management issues of the farming community supported by strong extension components
- Community participation and principles of self-help to the extent of program-ownership by the beneficiaries
- Commercialization and part-privatization of services involving measures, which can range from long-term subsidization to complete cost recovery

There are no national or cultural boundaries for PAHA. The efforts made by many projects over the past 20 years have proved the efficacy and appropriateness of PAHA-programs (Kleemann, 1999; Huhn, 1990; De Haan and Bekure, 1991; McCorkle et al., 1995; FAO Conference, 1997; BMZ Statement, 1997). This statement, however, does not play down the various difficulties that have been experienced by many projects involved in the implementation of PAHA. Turk (1995) assessed the effect of animal health projects in developing countries between 1960 and 1993 and concluded five major factors that critically impact project longevity. These were (i) initial expenses and recurrent costs; (ii) labour required; (iii) long-term effectiveness; (iv) difficulty in achieving the objectives; and (v) governmental policies or civil strife.

Complementing State Veterinary Service by PAHA

In the light of structural adjustment programs in many developing countries, privatization of Government services in general and veterinary services in particular became a widely and also critically discussed issue (Ellis, 1974; De Haan and Umali, 1992; Huhn, 1991; Leonard, 1993; Mlangwa and Kisauzi, 1994; Leonard et. al, 1999; Schillhorn, 1999). However, in order to improve animal health and production within subsistence farming systems in developing countries, the required changes in service delivery can vary from country to country or even from area to area (Sollod and Stem, 1991; Arambulo et al., 1986). Odeyemi, et al. (1996) refers to the ongoing discussion of restructuring and privatization of Government services, and suggests an analytical framework for animal health service delivery. Different population "segments", their spatial distribution and specific health care needs would require specially tailored delivery systems.
Mugisha et al. (1998) found the up-take of animal health services amongst subsistence farmer generally to be low. How could a system be set up, which allows appropriate service delivery *and* cost recovery while targeting these people? Pritchard (1988) stressed the point that service institutions in the developing world cannot be clones of their Western counterparts. One of the major concerns with animal health programs in developing countries is, that they are often not perceived as part of a system-approach. Animal health delivery has to be strongly inter-linked with feeding, breeding and management but it also has to be seen as a component of agricultural production in general (Kasschieter et al., 1990). The involvement of local communities in setting up such a program is a key element to avoid a single-commodity orientation.

Community-based Primary Animal Health Activities can look back on decades of experience and one can hardly agree with the view of Hohn and Williams (1997) describing veterinary community health as an emerging discipline. In the case of Malawi, existing Government structures have been partly utilized within an animal health care program. Nonetheless, the literature offers a pool of approaches with regards to PAHA although publications in international journals are difficult to obtain.

PAHA - Sources

There are a considerable number of publications referring to similar approaches in other developing countries. Some of those with at least a component of animal health service delivery are listed here:

Indonesia: Sulistiyo et al., (1998); Start and Young, (1999). **India:** Rangnekar (1995). **Kenya:** Chabiri and Mathooko (1995); Grandin et al. (1991); Akabwai (1993); Mariner et al. (1994); Start and Young, 1999). **Madagascar:** Baptist et al., (1994); Rajasmina (1997). **Nepal:** Moktan et al. (1990); Young (1990). **Sudan:** Almond, (1991); Jones (1998). **Thailand:** Meemark (1988); Loehr, (1989); Leidl, (1997). **Zimbabwe:** Chinembiri (1989); (Bamhare (1992) Woods et al. (1998). **Rwanda:** Muberuka (1992). **Peru:** Johnson and Chahuares (1990).

Kleemann (1999) has recently published an in-depth evaluation of livestock service delivery systems. Alternative approaches, by encouraging or reviving the use of indigenous remedies in livestock service delivery have been studied by McCorkle et al. (1991); Kambewa (1996) and David et al. (1996). VETAID, a non-profit overseas development organization currently works on the development of a method to assess the impact of community animal health services (personal communication).

There is a series of forums where PAHA approaches have been discussed and reviewed. Regular International Conferences of the Association of Institutions of Tropical Veterinary Medicine obtain a variety of articles. In 1992, an International Seminar on the Delivery of Animal Health and Production Services has been held in Yogyakarta, Indonesia. During the same year an International Workshop on Livestock Production in Rural Development took place in Wageningen, Holland. GTZ/DSE in Germany have published Conference Proceedings of the International Seminar on Primary Animal Health Activities in Southern Africa, held March 1996 and in February 2000 in Mzuzu, Malawi (Zimmermann et al., 1997; Hüttner et. al., 2000). FAO has organized a number of electronic conferences on this topic.

2. Malawi - Country, Economy, Agriculture & Livestock Sector

The Country

Figure I-1: Malawi and its neighboring countries

Malawi is a landlocked country in the south of central Africa with an area of 118.000 km^2. Bordered by Tanzania, Mozambique and Zambia, it covers diverse geographical patterns ranging from elongated plateaus, rolling plains, rounded hills, a few mountains and the unique Lake Malawi, which covers on third of the State territory. The rainy season from November to April is followed by the dry season, which can vary considerably in temperature, humidity and cloud cover according to elevation and region.

Influenced by tribal settlement and earlier political considerations, Malawi is divided into three regions: The southern (most densely populated), the central and the northern region. There are about 11.5 Mio people living in Malawi, of which 75% are Christians, 20% are Muslims. Almost the entire population consists of Bantu speakers with small minorities of Europeans and Asians. The average life expectancy is 43 years. The population growth rate is 3.1% (6% in towns) and ranks amongst the highest in the world. Only approx. 25% of the people can read and write. Today, Malawi struggles with a huge AIDS burden (22% of the population is HIV infected) and with one of the world worst health indicators. (Malawi social indicator survey, 1996; The World Bank Group, 1999; IMF Framework Paper, 1999).

National Economy and Agriculture

Malawi's economy is based largely on agriculture, which counts for 36% of total GDP and more than 90% of its export revenues.

The main export products are tobacco, sugar, tea, coffee, peanuts and wood products accounting for a total of 556 Mio U$ in export trade in 1997.

There is little industry in Malawi (textiles, cement, sugar). From a total of about 0.5 Mio wage earners, 50% are employed in agriculture.

The vast majority of ordinary people in Malawi are smallholders. One half of rural households (on average about 6.5 members) have less than 1 ha of farmland to make a living. In fact one quarter cultivate less than a 0.5 ha. More than half of the population has an annual income of less than U$ 40 per adult.

Following independence in the 1960s and 1970s the country did well by sub-Saharan standards. Between 1970 and 1977, Malawi had an average annual rate of GDP growth of about 6.3% and GDP per capita grew approximately 4.1% average annual rate. In the late 1970s the situation began to change entirely. The terms of trade had fallen by 18 % mainly due to rapidly increasing oil prices and continued to deteriorate throughout the 1980s. Interest rates on external debts rose. The war in neighboring Mozambique blocked the major outlet for Malawi's exports and resulted in a huge inflow of refugees into Malawi. Frequent droughts added to these shocks.

The downturn exposed structural weaknesses inherent in Malawi's economy, which included dependence on a small range of agricultural exports, a stagnant smallholder sector combined with land tenure and other policies that promoted land and income concentration; and heavy dependence on imports, among other problems. Malawi now ranks amongst the six poorest countries in the world.

(National Family Planning Strategy, 1994; Moriniere et al., 1996; Malawi social indicator survey, 1996; Gondwe and Mwangi, 1998; The World Bank, 1999; IMF Framework Paper, 1999).

The Livestock Sector

There are approximately 2 million smallholder families in Malawi, which depend upon subsistence farming based on mixed crop and livestock activities. Livestock constitute a relatively small sub-sector within Malawi agriculture. It officially contributes around 7% of total GDP and below 20% of the value of total agricultural production. Livestock, however, involve over half of the 2 million smallholder families. Main livestock species are cattle, goats, sheep, poultry and pigs. Most of these are indigenous breeds traditionally kept in low input low output systems. A small proportion of improved breeds and livestock products are produced by commercial enterprises surrounding urban centers. The major predisposing factors to smallholder animal health problems on the national level are malnutrition combined with poor management and husbandry practices. There are high incidences of helminthiasis, fascioliasis and Tick Born Diseases in cattle; Newcastle Disease, coccidiosis and Ecto-parasite infestation in poultry; Helminthiasis and recurrent African Swine Fever in pigs; tick born diseases and Helminthiasis in small ruminants and mastitis in crossbreed dairy cattle. There are additional problems with Trypanosomiasis in cattle close to national parks and game reserves and selected areas were Black-Quarter is considered endemic. Particularly young stock is affected. In addition, a number of zoonoses' such as Tuberculosis and Rabies are of relevance (Malawi Census, 1994; Government of Malawi, 1995; Mission Statement, 1998; Malawi Report, 1999; FAO Statistics, 1999).

Table I-1 shows national livestock figures.

Table I-1: Malawi national livestock estimates

	cattle	sheep/goats	pigs	chickens	other poulty
total	**618,750**	**1,606,310**	**481,108**	**9,300,00**	**1,416,500**
Mzuzu ADD	**135,000**	**140,077**	**90,000**	**1.135,643**	**330,000**
% traditional	95.4	97.5	84.9	79.8	98.3

The field veterinary service is organized by the Veterinary Department within the Ministry of Agriculture. Divisional veterinary officers are in charge of all livestock matters at the regional ADD* level. The line of command follows top-down through project veterinary officers at districts and veterinary supervisors and veterinary assistants at area level based at a dip-tank or a veterinary station. There are a total of 466 veterinary assistants stationed in Malawi. Of those, 160 are working in the northern region (88 Mzuzu-, 72 Karonga-ADD). The difficult situation in the field became obvious already during the 1980's. Lack of funding, diagnostic facilities and equipment, unsustainable dipping policies, inadequate infrastructure and poor motivation of field staff brought the field veterinary service almost to a standstill (Lechner and Böhm, 1990; Pedersen, 1991).

Characteristics of livestock production in the northern region of Malawi

Cattle

Ninety-seven percent of cattle (Table I-1) are traditionally managed. The predominant breed is the Malawi Zebu. It is small framed and well-adapted to local conditions. It takes up to 6 years to attain a slaughter weight of about 300kg. Most cattle are grazed in communal ranges (Jere, 1997). Approx. 29 % of the population owns cattle though one kraal can unify a number of cattle from different owners within the wider family. The average herd size is 9.3 with a bull-cow ratio of about 1:3.5. Before being released for grazing at around 7.30 a.m. cows are usually milked. The herd returns at around 4.30 p.m. A herd boy (typically a family members) attends the herd during grazing. The daily milk yield comes to 2.4 liters. Kraals are built as stake enclosures often close to a termite-hill in order to avoid muddy conditions. During the rainy season, however, they are frequently in extremely poor shape.

* ADD - Agricultural Development Division; Malawi is comprised of 8 ADD's

At some sites mud, up to 70 cm deep, has been measured (Figure I-2). During the night, some calves are kept in separate pens close to the main kraal to avoid excessive suckling of dams by their calves. Typically, there is no provision of bedding or roofing for calf pens. Calf mortality is around 26% with differences according to ecological zones, being highest in the Plains with 36 % followed by the Highlands (24 %) and the Lakeshore (14 %) (Wanda, 1994; Hüttner et al., 1998; Lechner and Böhm, 1990).

Figure I-2: Cattle kraal conditions during the rains in the Ekwaiweni area (Highlands)

Chickens

The importance of village chickens for rural families in Africa is undisputed (Branckaert, 1995). Eighty percent of the rural people in the study area keep chickens. Chickens are used for consumption, sale, manure, rituals and barter. The flock size on average is 17. Fifty percent of those are chicks and approximately 18 % are hens. Man as heads of household are in charge for all major decisions concerning the flock, whereas woman and children do all necessary work. The average number of eggs laid per hen per annum is 36. Between 4 % and 14 % of eggs are lost during brooding. The hatching rate is 70 % while subsequent losses among chicks below 8 weeks of age reach up to 59 %. These figures already indicate the extent of problems regarding chicken health and husbandry in villages. The flock is

typically kept on free range and housed in grass thatched stilted baskets as illustrated in Figure I-3, (Ahlers, 1997).

Figure I-3: Common type of chicken-house (BAHS extension material)

Other livestock

Sheep and goats are usually grazed with cattle. About 42 % of the population own small ruminants. The average number per herd comes to 8 animals. They are commonly housed in separate stilted kraals (Figure I-4). Milking of small ruminants is not typical in the region. On average female animals deliver 3 times in 24 months and 1.8 kids are raised per year and female.

Figure I-4: Common type of kraal for sheep and goats (BAHS extension material)

The information about management and productivity of indigenous pigs is inadequate although 29% of the rural people in the project area own pigs. Figure I-5 illustrates one of the many ways pigs are being kept.

Figure I-5: Traditional pig housing as a combined pigs-pigeons-house (BAHSP library)

The average number of pigs per farm comes to 4. Uncontrolled roaming of pigs accumulates the spread of African-Swine-Fever especially along the western border of Malawi with Zambia. During night times pigs are usually kept in stake enclosures.

3. The Basic Animal Health Service (BAHS) Project

Preface

The Basic Animal Health Service Project is one of hundreds of projects implemented by the German Agency for Technical Cooperation (GTZ) since 1974. The early set-up of the BAHS-Project realistically can be described as a dropped model because of its involvement of expatriates as permanent staff and also because of its original outline towards animal health. GTZ today follows trends to cut down the number of permanent project staff and also to form a wider, integrated approach to community development.

Personally, I am most grateful that I have had the opportunity to participate in the development of the BAHS-concept in Malawi. Our team headed by Dr.Klaus Leidl had always pursued a rather holistic approach to community development avoiding pure veterinary-minded actions.

From the early stages of BAHS, community participation was an integral part of the scheme. In addition, the design of field research but also a carefully drawn extension program had helped to minimize the selection and target group bias, which commonly occurs in this environment. From my perspective, it takes a minimum of two years for an outsider to comprehend the fundamentals of a different culture. However, time is just one of many crucial pre-requisites to avoid what Chambers (1996) called rural development tourism. I believe, the BAHS-team followed the right path to understanding the problems and needs of the people in northern Malawi, thus to be able to fulfill the objectives of BAHS.

The BAHS-Project - background and achievements

The Project was established in 1987. The concept of BAHS has been actively pursued since 1992. The Project was (and still is) funded through the German Federal Ministry of Development and Cooperation and implemented by GTZ. Every two to three years, project progress evaluations were conducted. The evaluation missions constantly recommended further support and funding. The Project will end in 2003. This will conclude 15 years of intensive work, a period certainly necessary to anchor a project of such magnitude and to maintain a lasting impact within the area of operation. This comment is made as there are currently trends to minimize the costs and duration of such enterprises, where long-term sustainability is questionable (Kaasschieter, 1990).

The Project area

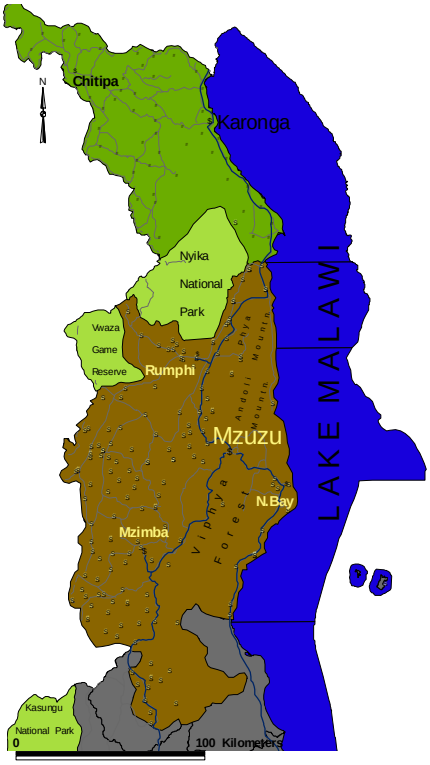


Figure I-6: The Project area comprising of Mzuzu and Karonga Agricultural Division.
Dots indicate locations of drug boxes. Lines show the rural road network

The northern region of Malawi covers approximately 27.000km^2 and includes two agricultural divisions, Karonga and Mzuzu. The latter was the original Project area making up approximately 3/5 of the whole northern region, as illustrated in Figure I-6. The BAHS implementation for Karonga commenced in 1996.

Ecological zones within the study area

A diverse physical environment comprising three zones characterizes the study area. The Lakeshores have warm to high temperatures (mean 24º C, range 15-43º C), are 450-600 m in elevation and have a mean annual rainfall of 1,500 to 1,750 mm. The Central African Plain is 800 to 1,300 m in elevation, has mild to warm temperatures (mean 22ºC, range 12-38º C) and a mean annual rainfall of 1,000 to 1,500 mm. The Highlands are 1,300-2,600 m in elevation, have mild to cool temperatures (mean 18º C, range 5-25º C) and a mean annual rainfall varying from 1,000 to 2,000 mm. Two major seasons determine farming in the northern region. The dry season lasts from end of April to the end of October, with July/August making up the cooler part of it. With the onset of the rains during November, temperatures climb and it remains hot and humid until about February (Wanda, 1994).

Orientation phase

Between 1989 and 1994 extensive field research was carried out. Problem areas in livestock health and production as well as the existing veterinary infrastructure were evaluated. The social background of the rural people, their income and expectations were assessed. Additional studies were conducted in the course of the large scale Project implementation beyond 1994 (Hörchner, 1992; Friedrich et al., 1993; Schuster, 1993; Wanda, 1994; Sondermann et al., 1995; Küttner, 1995; Demel, 1996; Kambewa, 1996; Hüttner et al, 1997; Sondern, 1997; Wanda et al., 1997; Ahlers, 1999; Ahlers et al., 1999).

The BAHS philosophy

BAHS aims at part-privatization of field veterinary services. The central element of the program is a drug supply system based on a Drug Revolving Fund (DRF). Its operational principles had to match existing national policies guidelines. While veterinary assistants serve most of the rural people in easily accessible areas surrounding their station, fellow farmers specifically trained for this job assist the more remote communities. These farmers are called village keymen (KM). They have to meet certain criteria before being accepted by both, their communities and the BAHS team. Village livestock groups have to be formed and a treasurer, amongst other posts has to be selected. A minimum number of 20 paid-up members and the establishment of a Village Trust Fund (VTF) are required before a group can qualify for DRF membership. Special attention is spent with regards to a clear understanding of the BAHS philosophy. A stepwise approach involving all people in an area including their local and Government authorities ensures that misperceptions about the program are minimized. The major issue involved here is of monetary nature. All treatments are performed on a cash basis. Applications for personal credits are a community matter and can be settled through the village trust fund. A second critical issue is pricing. A mark-up of 300% is added to retail prices to ensure cost recovery. This has to be explained in a sensible and patient manner. There are additional concerns such as ownership of the program, ongoing support for the KM and a tendency to expect too many other benefits from BAHS. Keymen and treasurers of the communities, the respective veterinary assistants and their supervisors are then invited for a 4-day training course. Basic principles of animal health & husbandry, bookkeeping & administration as well as practical demonstrations are taught during these courses. Successful participants return back to their communities.
Subsequently, the village livestock groups are provided with a paramedical kit in the form of a drug box, basic equipment and a bicycle. This first package is free whilst all following supplies have to be paid for through drug sale returns. Maintenance of the bicycle and replacement of equipment has to be covered by the group.
The cycle of the DRF is illustrated in Figure I-7.

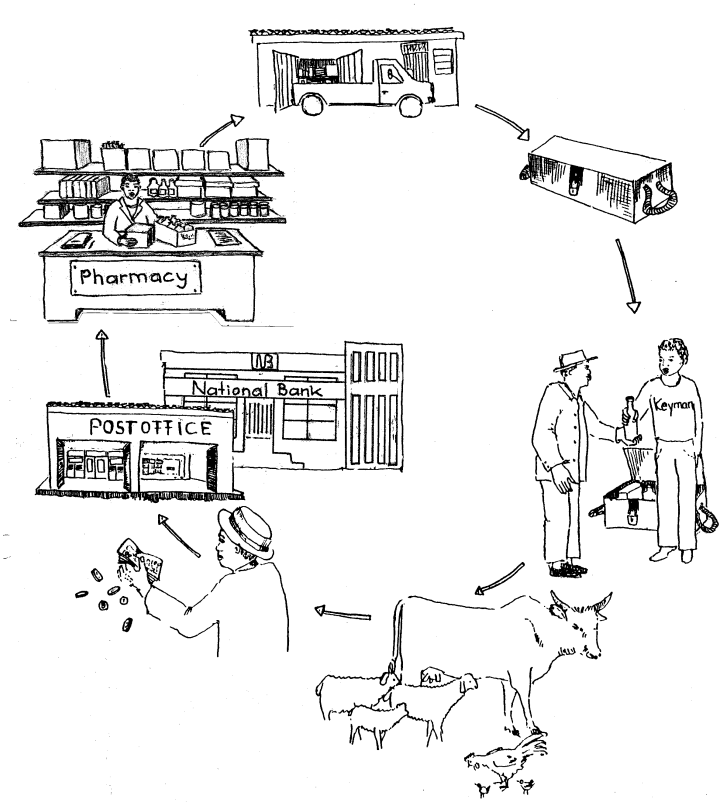


Figure I-7: The cycle of the Drug Revolving Fund
The drawings are part of BAHS extension pictorials, developed to facilitate farmers' understanding of a revolving fund (BAHSP Library**)**

Keymen are meant to focus on preventive treatments particularly of young stock. This primarily comprises of drenching of calves but also that of small ruminants and other domestic animals against roundworm infestation, pour-on application of a range of livestock against ecto-parasites particularly ticks, vaccinations against Newcastle Disease in chickens and Blackquarter in cattle but also wound dressings. There are a number of issues requiring a specific response such as Trypanosomiasis, Liver Fluke infestation in cattle, Nasal Worm Plague in sheep or Coccidiosis in poultry. Treatments to be administered by use of syringes are restricted to veterinary staff. Apart from prevention and also curative measures, much of the focal points of BAHS extension are also on livestock management and husbandry issues across species.The Keyman performs solely on a cash basis. The money is later handed over to the treasurer of the group. The treasurer accumulates this money to a specified amount and deposits it in the post office or bank account of that particular group. Strict bookkeeping is required. Stocktaking is done annually and irregularities are followed-up swiftly. Keymen and veterinary assistants currently receive 10 % of their annual turnover as an incentive.

BAHS Pilot Trial (1993-1994)

In July 1993, a total of 13 VA and 33 KM in the Bolero region had been selected to test the farmers' acceptance for the program. After 18 months and the involvement of approximately 1500 farmers, the response from both, farmers and field staff was unambiguous. Therefore, the BAHS Project went into large-scale implementation during the following years. This was a process of constant amendments and fine-tuning of various BAHS components. A more comprehensive description of this process was presented by Stange (1997).

The Foundation for the Improvement of Animal Health

The incorporation of the revolving fund into a legal entity, the issue of system-ownership and a sustainable perspective for this enterprise was one of the priorities for the BAHS Project. The idea basically was to form a farmers association, which would take over all managerial, administrative and financial issues of the BAHS-program in the long term.
In August 1993, the "Foundation for the Improvement of Animal Health" (FIAH) was registered by the Registrar-General in Blantyre. FIAH was set up as a Trust under the "Trust and Trustees Incorporation Act" of the Laws of Malawi. Figure I-8 outlines its structure.

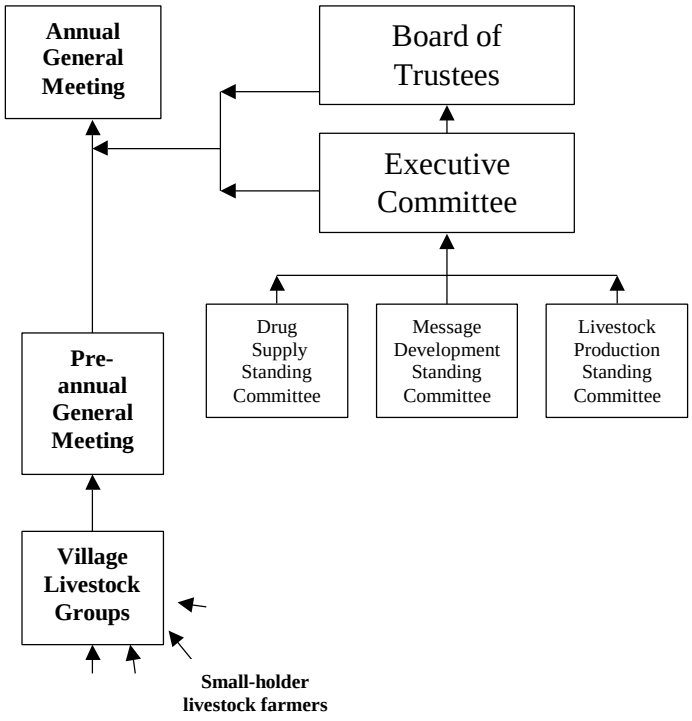


Figure I-8: Structure of the Foundation for the Improvement of Animal Health

The Foundation is a non-profit, non-governmental organization. The representative majority in all decision-making bodies is made up of farmers. Once a year an annual general meeting is held where all major decisions have to pass voting by the representatives of the village livestock groups from all areas. An Executive Committee (EC) governed by rules and regulations conducts the day-to-day business.

Financial affairs of the Foundation for the Improvement of Animal Health (FIAH)

Animal health services in African countries have generally not been funded to an adequate level (Morgan et al., 1984; Heller et al., 1985; Anteneh, 1991; Turkson and Brownie, 1999). Alternative approaches to governmental animal health services such as PAHA have to prove their efficiency. Not only in terms of the benefits through livestock production that farmers can obtain by using the service. These programs also have to come up with viable financial solutions in the long term, which is the more delicate part of it. Information on costs, income or turn over of community-based animal health service programs is sparse (Meemark, 1988; Naipospos-Hutabarat, 1995; Sulistiyo et al., 1998; Jones et al., 1998). Nonetheless there is agreement that charging farmers for these services is the only way to bridge the chronic lack of recurrent cost financing in the livestock sector (Stryker, 1983).

The following Tables and Figures provide an idea about turn over, income and expenditures of the Foundation. These are the most recent figures presented during an International Seminar on Primary Animal Health Activities in Malawi in February 2000 (Hüttner et al., 2000). With the launch of the pilot trial in 1993, the initial capital injection through BAHS/GTZ came to MK 140.000, equivalent to US$ 35.000. The final capital to be received by FIAH is envisaged to reach about 210.000 US$ by 2001.

Income

Figures I-9 and I-10 present the development of income for FIAH between 1995 and 1999. The exchange rate US$: Malawi Kwacha (MK) was 1:45 as of February 2000. Revenues from FIAH drug sales increased steadily over the past years. The overall income of FIAH in US$ reflects the devaluation of the Malawi Kwacha.

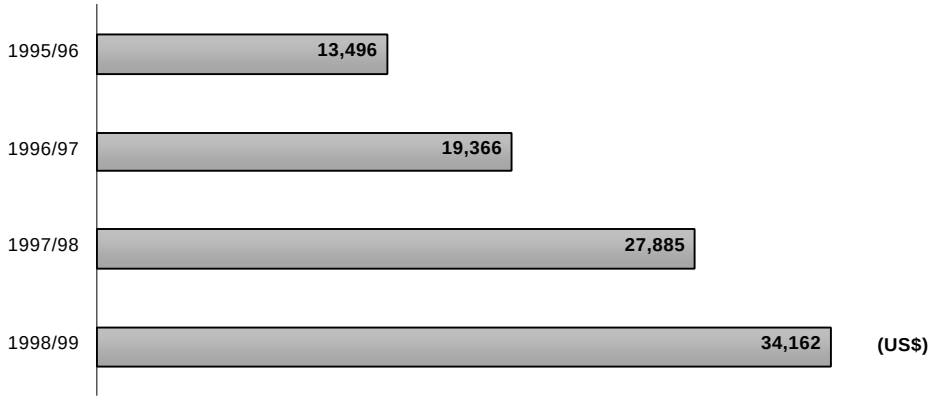
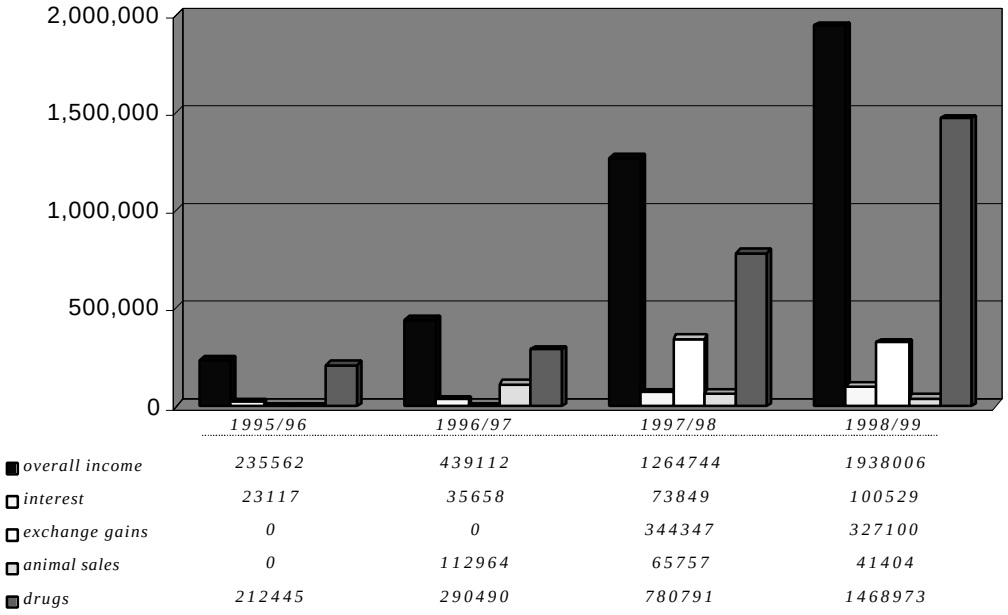


Figure I-9: Development of FIAH income through drug sales between 1995 and 1999 (US$)



	1995/96	1996/97	1997/98	1998/99
overall income	235562	439112	1264744	1938006
interest	23117	35658	73849	100529
exchange gains	0	0	344347	327100
animal sales	0	112964	65757	41404
drugs	212445	290490	780791	1468973

Figure I-10: Development of overall FIAH income between 1995 and 1999 (MK)

The revenue accounts currently comprise of:

1. Sales accounts through
    a) returns from drug sales
    b) other income generating activities such as sales of livestock and feeds
2. Bank accounts using
    a) fixed deposit
    b) savings accounts

FIAH expenditures

The development of FIAH expenditures is presented in and Table I-2.

The increase in expenditures in 1996/97 and 1998/99 are directly connected to the expansion of FIAH activities.

Table I-2: **Development of FIAH expenditures between 1995/96 and 1998/99** (MK)

		1995/96	1996/97	1997/98	1998/99
DRF-Costs	Drugs	48,963	251,245	142,342	441,021
	Salaries	32,839	70,859	216,569	336,664
	Incentives VA/KP	2,680	12,006	27,481	174,560
	Transport	29,770	36,405	39,416	160,651
	Allowances	26,954	46,440	72,183	220,813
	Subtotal	**141,206**	**416,955**	**497,991**	**1,333,709**
Running costs	Stationary	3,164	17,439	6,701	26,297
	Audit	6,500	8,500	13,000	22,000
	Insurance	2,855	-	9,836	8,936
	Fees	26,500	7,464	7,500	6,700
	Bank Charges	1,267	2,393	1,610	14,656
	Water/Electricity	-	4,716	823	13,094
	Mainten.Building	3,001	-	11,818	-
	Mainten.Equipm.	-	-	-	36,772
	Mainten. Cars	49,586	24,255	17,207	108,959
	Subscription	-	-	-	-
	Subtotal	**92,873**	**64,767**	**68,495**	**237,414**
FIAH Activities	Transport Charges	29,770	36,406	39,417	160,651
	Allowances	26,955	46,440	72,183	220,812
	Accom./Food/Training	89,558	108,603	85,980	135,257
	Village Trust Fund	-	1,810	-	100
	Stationary	28,470	156,949	60,307	236,669
	Purchase Animals			31,050	41,404
	Subtotal	**174,753**	**350,208**	**288,937**	**794,893**
Deprectn	Deprec./Disposals	70,449	91,592	159,216	234,426
	Drug Losses	34,599	87,495	4,213	41,099
	Subtotal	**105,048**	**179,087**	**163,429**	**275,525**
	Grand Total	**513,880**	**1,011,017**	**1,018,852**	**2,641,541**

The cost development in US$ presented in Figure I-11 again reflects the devaluation of the national currency over recent years.

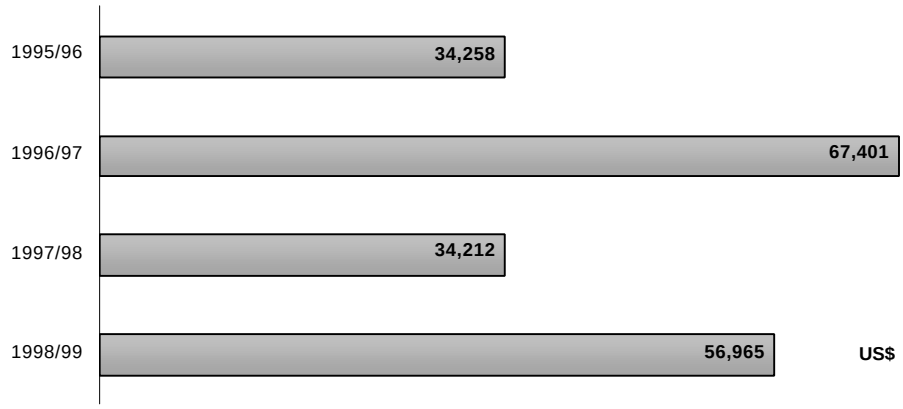


Figure I-11: **Development of costs recovery for FIAH between 1995/96 and 1998/99** (US$)

Table I-3 presents a summary of income and expenditures of the Foundation including subsidies in Malawi Kwacha. The figures account for all costs of BAHS-expansion and for additional development activities.

Table I-3: Summary of FIAH income and expenditures (MK)

	1995/96	**1996/97**	**1997/98**	**1998/99**
FIAH income	235,562	439,122	1,264,744	1,938,006
Subsidies*	752,677	1,092,231	861,984	2,318,533
total income	988,239	1,531,353	2,126,728	4,256,539
total expenditures	513,880	1,062,647	1,018,852	2,641,541
total surplus	**474,359**	**468,706**	**1,107,876**	**1,614,998**

* Subsidies derive from GTZ and the Malawi Government

References

1. Ahlers, C. 1999. Characteristics and constraints of the traditional poultry keeping system in northern Malawi; Doctorate Thesis, Free University Berlin, Germany, 175 pp.

2. Ahlers, C., Hüttner, K., Pfeiffer, D.U., 1999. Comparison between a live and an inactivated vaccine against Newcastle Disease in village chickens. A field study in northern Malawi. Tropical Animal Health & Production, 31, 3, pp. 167-174

3. Akabwai, D.M.O., 1993. Paravet training among Turkana pastoralists of Kenya. In: Daniels, P.W., Holden, S., Lewin, E., Dadi, S. (Eds.): Livestock Services for Smallholder: A Critical Evaluation of the Delivery of Animal Health and Production Services to to the Small-Scale Farmers in the Developing World. International Seminar Proceedings. 15-21 November, 1992, Yogyakarta, Indonesia. pp. 232-234.

4. Anteneh, A., 1991 The financing and staffing of livestock services in sub-Saharan Africa: a cross-country analysis. Working Document - Livestock Economic Division, International Livestock Centre for Africa. Addis Ababa, Ethiopia: no. 16, viii + 131 pp.

5. Almond, M., 1991 Pastoral development and the use of para-vets in southern Sudan. Development in Practice. 1: 1, 34-42

6. Arambulo P.V., Aleta I.R., Vallenas A., 1986. Community participation in veterinary public health and animal health in the Caribbean--results of a preliminary survey. International Journal of Zoonoses, 13 (3) 1986, pp. 162-173

7. Bamhare, C The role of animal management and health centres in the future delivery of animal health services to communal areas. Zimbabwe Veterinary Journal. 1992. 23: 1, 45-48.

8. Baptist R., Rajasmina A., Rakotoarimanana D., Rasambainarivo J.H., 1994. Private Vets for the rural areas of Madagascar. The Kenya Veterinarian 18 (2) 510-512

9. BMZ Statement, 1997. Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung. Grundlagen der Deutschen Entwicklungszusammenarbeit. Nr.97, pp 51

10. Branckaert, R. D. S., 1995. From backyard to commercial poultry production: The key of success. Presentation held on a ACIAR-Workshop on Newcastle Disease in village chickens, 9th December 1995, Onderstepport, South Africa

11. Chinembiri**,** F. M., 1989. Livestock extension programmes and packages in the communal lands of Zimbabwe. People, land and livestock. Proceedings of a workshop on the socio-economic dimensions of livestock production in the communal lands of Zimbabwe, 12-14 September, 1988, Great Zimbabwe, Masvingo. Centre for Applied Social Sciences, University of Zimbabwe,Harare, Zimbabwe: 1989. 139-154

12. Chabiri, F.N. and Mathooko, J.K., 1995. An adaptive animal health delivery system for nomadic pastoralists: An example from northern Kenya. Abstracts of the 8th International Conference of Institutions of Tropical Veterinary Medicine, Berlin, Germany, p. 113

13. Chamber, R., 1996. Rural Development. Putting the Last First. Addison Wesley Longman Ltd., Essex, London, 246 pp.

14. David, A., Blakeway, S. and Linquist, B. J. 1996. Ethno-veterinary knowledge of the Dinka and Nuer in Southern Sudan: A study for the UNICEF Operation Lifeline Sudan Southern Sector Livestock Programme. UNICEF, Nairobi, Kenya, 57 pp.

15. De Haan C. and Bekure S., 1991. Animal Health Services in Sub-Saharan Africa: Initial experiences with alternative approaches. Wold Bank Technical Paper no. 134. The World Bank, Washington : 1991, 49 pp.

16. De Haan, C. And Umali, D.L., 1992. Public and private sector roles in the supply of veterinaru services. In; Public and private roles in agricultural development. Proceedings of the 12th agricultural sector symposium. World Bank, Washington D.C., USA. pp 125-137

17. Demel,W.H., 1996. Follow-up study on prophylactic interventions against East Coast Fever in calves in northern Malawi. Diploma Thesis, Free University of Berlin, Germany, 38 pp.

18. Ellis, P The development of animal health services. Agricultural Administration. 1974. 1: 199-219

19. FAO Conference, 1997: The principles for rational delivery of public and private veterinary services. First FAO Electronic Conference on Veterinary Services. http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAH/Vets-l/Default.htm.

20. FAO Statistics, 1999. The FAOstat Database, Website http://apps.fao.org/lim500/Agri_db.pl

21. Friedrich, U., Wanda, G.W. and Leidl, K., 1993. Prevalence study on the occurrence of Trypanososma species in cattle in the Bolero region of Malawi. 3rd Workshop on Veterinary Epidemiology. 31.8.-11.9.1993, Entebbe, Uganda. 93 pp.

22. Gondwe D. and Mwangi, W.G., 1998. Income distribution in Malawi. A presentation held at the 9th Annual COPE Convention, Barbados. 9th Annual COPE Convention, Barbados

23. Government of Malawi, 1995. Ministry of Economic Planning and Development. Food Security and Nutrition Bulletin, Vol.6 (1)

24. Grandin, B., Thampy, R.. and Young, J., 1991. Village Animal Healthcare: A community-based approach to livestock development in Kenya. Intermediate Technology Publications, UK, 37 pp.

25. Heller, P. S., Aghevli, J. E., Carruthers, I. D., Oram, P. A., Stevens, M. L. O., Jones, D. B., Ramakrishnan, S., Leonard, D., K. Anteneh, A., Fredericks, L. J., Kweku Christian, W. F., Adefolu Akinbode, I., Yayock, J. Y., Sambrani, S., 1985. Recurrent costs and agricultural development. Overseas Development Institute,London, UK: 223 pp.

26. Hohn, E. and Williams, J.H., 1997. Veterinary community health: an emerging discipline. Journal of the South African Veterinary Association, 68 (2), 32-34

27. Hörchner, F., 1992. Consultancy report, Malawi German Basic Animal Health Service Project. GTZ, Eschborn, Germany, 32 pp.

28. Huhn J.E., 1990. Need and Constraints to Animal Health and Livestock Services. In: Deutsche Stiftung für Internationale Entwicklung (DSE): Privatisation of Livestock Services. Proceedings of an International Workshop, 5-14 August 1990, Feldafing, Germany, pp. 17-25

29. Hüttner, K., Leidl, K., Jere, F.B.D. and Pfeiffer, D.U., 1998. Target group orientation of a Basic Animal Health Service Program. First results of an Impact Assessment in northern

Malawi. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 296-309

30. Hüttner, K., Leidl, K., Jere, F.B.D. (Eds.) 2000. Primary Animal Health Activities - Topic Day. Proceedings of an International Seminar, 15th to 17 th February 2000, Mzuzu, Malawi. http://epicentre.massey.ac.nz/

31. IMF Framework Paper, 1995. Enhanced Structural Adjustment Facility Policy Framework Paper, - Malawi, 1998/99-2000/01. Prepared by the Malawian authorities in collaboration with the staffs of the International Monetary Fund and the World Bank ,December 3, 1998. Website http://www.imf.org/external/np/pfp/malawi/index.htm

32. Jere, F.B.D., 2000. Set up and Implementation of FIAHS' Drug Revolving Fund. In: Hüttner, K.; Leidl, K. and Jere, F.B.D. (eds.), Proceedings of an International Conference on Primary Animal Health Activities, 17th to 19th February 2000, Mzuzu, Malawi, pp. 15-17 http://epicentre.massey.ac.nz/

33. Jere, F.B.D., 1997. Basic Animal Health Service in Northern Malawi. In: Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (editors): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1997, pp. 211-234, http://epicentre.massey.ac.nz/

34. Johnson, P.J. and Chahuares, C., 1990. Training anyamara veterinary technicians in the southern Peruvian Andes. Convergence, 23: 14-22.

35. Jones, B.A., Deemer, B., Leyland, T. J., Mogga, W. and Sterm, E, 1998. Community-based animal health services in Southern Sudan. The experience and future. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 107-133

36. Kaasschieter, G.A., de Jong, R., Schiere,, J.B., Zwart, D., 1992. Towards a sustainable livestock production in developing countries and the importance of animal health strategies therein. The Veterinary Quarterly, 14 (2), 66-76

37. Kambewa, B.M.D., 1996. Identification of indigenous veterinary remedies for livestock health problems in Malawi. MSc.Thesis, Bunda College of Agriculture, University of Malawi, pp. 82

38. Kambewa, B.M.D., 1996. Identification of indigenous veterinary remedies for livestock health problems in Malawi: A case study of Mzuzu Agricultural Development Division. Masters Thesis, Bunda College of Agriculture, Lilongwe, Malawi. 82 pp.

39. Kleemann, G., 1999. Service Management in Livestock Development, Universum Verlag, Wiesbaden, Germany, 430 pp.

40. Küttner, K., 1995. Report on the characterization of smallholder dairy farming in the Mzuzu milkshed area. Institute for Animal Production in the Tropics and Sub-Tropics, University of Hohenheim, Stuttgart, Germany, pp. 22

41. Lechner, H.L.G. and Böhm, A., 1990. Assessment of the veterinary field service of Mzuzu A.D.D. in 1988/89 and recommendations for an improvement of efficiency. Mzuzu, Malawi, 163 pp.

42. Leidl, K., 1996. Development of efficient animal health care systems: Examples based on the Animal Health Project in Northeast Thailand and Basic Animal Health Service Project

in Northern Malawi. In: Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1996, pp 40-51

43. Leonard, D. K Structural reform of the veterinary profession in Africa and the new institutional economics. Development & Change. 24: 2, 227-267

44. Leonard, D. K., Koma, L. M. P. K., Ly, C., Woods, P. S. A, 1999. The new institutional economics of privatising veterinary services in Africa. Revue Scientifique et Technique Office International des Epizooties. 18: 2, 544-561

45. Loehr, K.-F., 1989. The Basic Animal Health Service in North-East Thailand - The Principle of the Service. In: International Seminar on Animal Health and Production Services for Village Livestock. 2 - 9 August 1989. Khon Kaen, Thailand, 32-37

46. Malawi Census, 1994. Smallholder Livestock Survey Report. National Sample Survey of Agriculture 1992/93, 3: Lilongwe, Malawi. 149 pp.

47. Malawi Report, 1999. Malawi National Livestock Development Masterplan, Final Report. Lilongwe, 114 pp.

48. Malawi Social Indicator Survey, 1995. A survey of the State of Health, Nutrition, Water, Sanitation and Education of Children in Malawi.: Ministry of Economic Planning and Development, National Statistical Office and the Centre for Social Research, 1996: Lilongwe 137 pp.

49. Mariner, J.C., Akabwai, D.M.O., Toyang, J., Zoyem, N. and Ngangyou, A., 1994. Community-based vaccination with thermostable vero cell-adapted Rinderpest vaccine (Thermovax). The Kenya Veterinarian, 18 (2): 507-509.

50. McCorkle, C. M., Mathias, E. and Tjaart, W., 1991. Ethoveterinary Reseach and Development. Intermediate Technology, UK, 48 pp.

51. Meemark, N.., 1988. The Development and Evaluation of a Village-Based Parasite Control Program for Swamp Buffalo and Cattle in Northeast Thailand; Masters Thesis, IVABS, Massey University. Palmerston North, New Zealand, 169 pp.

52. Mission Statement 1998. 1997/98 Programmes, Mission Statements and Performance Indicators. The Planning Division, Ministry of Agriculture and Livestock Development, 55 pp.

53. Mlangwa J.E., and Kisauzi D.N., 1994. Systems approach to Animal Health Services Delivery in Sub-Saharan Africa: concept development. Revue Scientifique et Technique, 13 (3), 665-72

54. Moktan, D., Mitchelhill, B.K. and Joshi, Y.R., 1990. Village Animal Health Workers in the Koshi Hills. PCA Working Paper No .4. Dhankuta District, Koshi Zone, Nepal.

55. Morgan, R. G. Iles, M. J. Dickey, J. R., 1984. Comments on Pastoral Network Paper 17b. (Financing animal health services in some African countries). Pastoral Network Paper, Agricultural Administration Unit, Overseas Development Institute, UK. No. 18b, 9 pp.

56. Moriniere, L., Chimwaza, S. and Weiss, E., 1996. Malawi Vulnerability Assessment & Mapping (VAM) Baseline 1996. A Quest for Causality. USAID/FEWS Malawi Office, Lilongwe, 120 pp.

57. Muberuka, J., 1992. Privatization of the Veterinary Services, the Role of para-veterinary personnel in Rwanda. In Gootejes, C.P., den Herzog, G., de Jong, R., Nell, A.J. (editors.). 5th International Conference on Livestock Production in Rural Development: Development of Livestock Policies. 20-31 January 1992. International Agricultural Centre, Wageningen, The Netherlands

58. Mugisha, A., Koma, L.M.P. and Odeyemi, I.A.O., 1998. The effect of culture on attitude to animal health services. A case study of traditional livestock producers in Uganda. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 285-295

59. Naipospos-Hutabarat, T.S.P., 1995. The Development of an Animal Health Information System for Indonesia. PhD Thesis, IVABS, Massey University, Palmerston North, New Zealand, 525 pp.

60. National Family Planning Strategy, 1994. The Malawi National Planning Strategy: 1994-1998. Government Report, Lilongwe, Malawi 52 pp.

61. Odeyemi, I.A.O., Lillwall, N.B. and Wilson, R.L. (1998). Socio-economic characterisation of the livestock production systems in Africa: An animal health delivery perspective. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I

62. Pedersen, V, 1991. Two years as a veterinarian in Africa: thoughts and observations. Journal of the American Veterinary Medical Association, 198 (11), pp 1866-1871.

63. Pritchard, W. R., 1988. Ways that veterinary medicine can help alleviate hunger in Africa. Journal of the American Veterinary Medical Association, Vol. 192 (12), pp. 1701-1705.

64. Rajasmina, A., 1997. Private veterinarians for rural areas in Madagascar. In: Primary Animal Health Activities in Southern Africa; In: Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (editors): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1996, pp. 318-323

65. Rangnekar, D. V., 1995. Approach and experience of NGO in developing livestock service delivery system. Abstracts of the 8th International Conference of Institutions of Tropical Veterinary Medicine, Berlin, Germany, p. 115.

66. Schuster, R., 1993. Consultancy report, Malawi German Basic Animal Health Service Project. GTZ, Eschborn, Germany, 31 pp.

67. Sollod AE, and Stem C. 1991. Appropriate animal health information systems for nomadic and transhumant livestock populations in Africa. Revue Scientifique et Technique, 10 (1), 89-101

68. Sondermann, L., Nafere, J. and Leidl, K., 1995. A baseline survey on village poultry of the Enukweni area in Malawi. GTZ, Fisch und Vieh, 1994, pp. 255-273

69. Sondern, U., 1997. Testing of two pesticides against ecto-parasites in the village poultry system of Mzuzu ADD/Malawi - a field trial-., Diploma Thesis, Free University of Berlin, Germany, pp. 72

70. Stange, M., 1997. Set-up and implementation of a Drug Revolving Fund (DRF) in Mzuzu Agricultural Development Division (ADD). In: Zimmermann, W., Pfeiffer, D.U., Zessin,

K.H. (eds.): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, February 26 to March 8 1996, pp. 235-260.

71. Start, D. Young, J., 1999. Getting the balance right - public and private livestock services in Indonesia and Kenya. Appropriate Technology. 25: 4, 10-13

72. Stryker, J. D., 1983. Economics of animal health services in Sahelian West Africa. Third international symposium on veterinary epidemiology and economics, Arlington, Virginia, United States of America, 6-10 September 1982. Veterinary Medicine Publishing Company,Edwardsville, Kansas, USA: pp. 507-514

73. Sulistiyo, U., Wahyuni, D. and Leksmono, C.S., 1998. Village Animal Health Workers in Minahasa District North Sulawesi Indonesioa. . In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 340-349

74. The World Bank Group, 1999. Country at-a-glance. Website http://www.worldbank.org/data/countrydata/aag/mwi_aag.pdf.

75. Turk, J. M An assessment of animal health projects: U.S. Agency for International Development, 1960-93. Agriculture & Human Values. 1995. 12: 2, 81-89

76. Turkson, P. and K. Brownie, C., 1999. F Financing the delivery of animal health services in developing countries: a case study of Ghana. Tropical Animal Health & Production. 31: 1, pp. 33-44

77. Urban, A. and Lungu, D., 2000. The Drug Revolving Fund - Financial operations and pre-requisites for long term sustainability. In: Hüttner, K.; Leidl, K., Jere, F. (Eds.): Proceedings of an International Seminar, February 15 to 17, Mzuzu, Malawi, http://epicentre.massey.ac.nz/

78. Wanda, G.W., 1994. Health constraints of calves and young stock in Mzuzu Agriccultural Development Division, Malawi. MSc.Thesis, University of Reading, UK, 85 pp.

79. Woods, P.S.A., Leonard, D., Nielen, M., Brand, A.1998. The importance of proximity, transport and gender as factors affecting the efficiency of veterinary service delivery in Zimbabwe. . In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe (in press) , Volume I, pp. 238-242

80. Young, J.R., 1990. Animal Healthcare Training: Nepal's animal health care improvement training programme. Intermediate Technology , UK.

81. Zessin, K.H., 1991. Report on the short-term assignment for the Basic Animal Health Service Project, Mzuzu/Malawi. Berlin, Germany, 32 pp.

82. Zessin, K.H., 1993. Consultants' report on the short-term assignment for the Basic Animal Health Service Project, Mzuzu/Malawi. Berlin, Germany, 42 pp.

83. Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (Eds): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, February 26 to March 8 1996, 376 pp., http://epicentre.massey.ac.nz/

II. CHAPTER

Results of a livestock population survey

Abstract

The spectrum of people making use of a particular type of private or public service is not necessarily representative of the general population. The effectiveness of any development program associated with such a service can only be evaluated if this difference in service use can be assessed. In the case of the BAHS-program, the distribution of livestock ownership amongst rural farm households is an important parameter for planning and evaluation purposes at the project level. Based on two-stage random sampling, 11 out of 80 veterinary stations in the study area and 40 households from each of the selected veterinary stations were randomly selected for inclusion in a representative population survey. A total of 412 households were interviewed between August and September 1997. Results show that the proportion of households keeping cattle (29%), small ruminants (42%), chickens (79%), pigs (28%), pigeons (26%), ducks (12%) and rabbits (5%) on average is considerably higher than indicated by official government statistics. Multiple correspondence analysis was used to assess the relationship between economic status of households, livestock ownership and utilization of animal health services. The results suggest that there is a need for intensified BAHS-efforts towards extension in order to reach more people in villages and they emphasize the importance of representative survey-data as a basis for policy development.

Introduction

One of the constraints while heading towards full implementation of the BAHS-program was insufficient knowledge about the true species and livestock distribution in villages. Potential sources of such information include data routinely gathered by VA and field assistants (FA). VA primarily keep records for cattle from farmers, who attended dipping for as long as it was provided as a Government service (since 1993, dipping became rather sporadic because of lack of funding). Other data on livestock keeping were either not updated or unreliable. FA who are employed by the Ministry of Agriculture cover agricultural extension in general and gather the most accurate information about the rural people. Their main responsibilities are crop issues but to a limited extent also include livestock husbandry advice. FA are not directly involved in the BAHS-scheme. There are on average about 3.5 FA and one VA operating in each veterinary area within Mzuzu Agricultural Development Division (ADD).

The aim of this study was to obtain accurate data about the livestock distribution amongst rural households in the BAHS area of operation. In addition, knowledge about the existence of the BAHS-program, income status and other social background information about rural households were also of interest in the context of further expansion of the BAHS program. For this reason a livestock population survey was undertaken.

Material & Methods

Sampling

Based on a two-stage sampling approach, a total of 80 veterinary stations in Mzuzu ADD were used as the primary sampling units, of which 11 stations were selected randomly. The secondary sampling units comprised of all households within the area of each of the selected veterinary stations. Based on records of FA, who keep the most complete information about the population (Malawi Report, 1998), 40 households were chosen at random within each of the selected veterinary areas. This resulted in a total of 440 households to be included in this survey.

Questionnaire

A questionnaire was designed in order to obtain basic data about household size, livestock ownership, treatment- and visit-patterns by field staff, knowledge about the BAHS-program as well as indicators of income. The questionnaire was pre-tested on six farms and adjusted accordingly.

Interviews

Four members of the BAHS-Project, assisted by the respective FA, conducted the interviews, which took place between August and September 1997, each lasting about 25 minutes. In some areas less than 40 households were visited due to absence of the farmer, sickness of field staff or inaccessibility of some of the locations. This resulted in data for a total of 412 households being collected. Two global positioning system (GPS) receivers were used to obtain accurate farm coordinate locations. Figure II-1 presents the locations of the households included in the study.

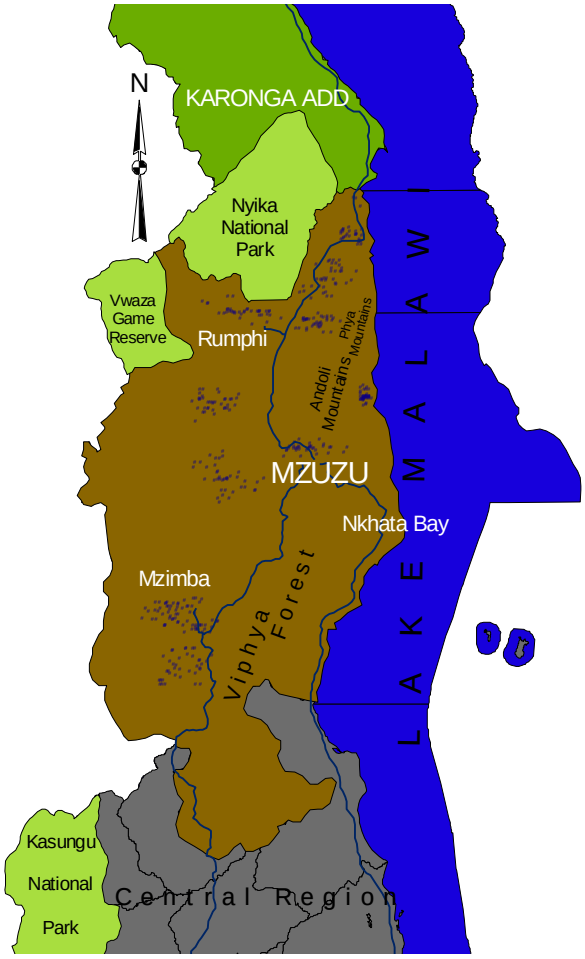


Figure II-1: Co-ordinate locations of farms randomly selected for inclusion in the survey (n=412)

Economic status

Four major indicators of a household's economic status were considered. First, the condition and structure of the house including building material (clay/burned bricks), roofing (grass/iron sheets), material of doors (wooden/cloth), windows (glass/no glass) and presence of door-lock (yes/no) were assessed. Secondly, existence (yes/no) of household and farm items such as radio, bicycle, plough, wheel-barrow, sewing machine or ox-cart was evaluated. Thirdly, the ownership of different livestock species was recorded. A score was generated for each individual item ranging between 0 and 8. The scores were based on a relative value attributed to individual items as perceived by the team of investigators with the final decision being made by our Malawi counterparts. Table II-1 shows a detailed description of scoring categories.

Table II-1: Relative scores attributed to selected livestock, farm items and condition of the house to reflect different economic scores

Livestock	quantity	Score	house + items	description	score
Has cattle	1-5	**4**	oxcart	vs. not	**8**
	6-9	**5**			
	10-19	**6**			
	20-29	**7**	ironsheet-roof	vs.grass	**8**
	>=30	**8**			
Has sheep/goats	1-4	**3**	sewing machine	vs. not	**5**
	5-19	**4**			
	20-29	**5**		vs. not	**5**
	>=30	**6**	plough		
Has chickens	1-4	**1**	brick wall	vs. clay	**4**
	5-19	**2**			
	>=20	**3**	bicycle	vs. not	**4**
has pigs	1-4	**3**			
	5-9	**4**	window glass	vs. not	**3**
	>=10	**5**			
has ducks	1-4	**1**	wheel barrow	vs. not	**3**
	5-15	**2**			
	16-30	**3**	radio	vs. not	**3**
	> 30	**4**			
has rabbits	1-10	**1**	door lock	vs. not	**3**
	> 10	**2**			
has pigeons	<20	**1**	wooden door	vs. mat	**3**
	>20	**2**			

The fourth indicator was the self-assessment of the respondent with emphasis towards land and food resources available for his/her family. The self-assessment was recorded as part of the interview and compared with the economic status categories generated from the sum of individual scores. The score-totals for individual households ranged from 0-70. Using the resulting distribution, scores were aggregated into three economic status categories: 0-10 ‘very poor’, >10-30 ‘poor’, > 30 ‘better’.

The cut-offs for score-totals were defined according to the following criteria: Subsistence farms not having any additional income other than crop and livestock production, keeping less than 15 adult chickens and a maximum of 1 sheep or goat, not having any cattle and not being in the position to afford at least a wooden door or a radio have a score-total of 10 and were defined as ‘very poor’. Small farms with less than 25 adult chickens, less than 5 sheep or goats, a maximum number of 4 cattle, a house without iron-sheets and bricked walls, not owning an oxcart, a plough, a bicycle or a sewing machine had a score-total >10 to ≤ 30 and were defined as ‘poor’. Any household above a score total of 30 was defined as ‘better’.
In 305 of the 412 (74 %) cases, the self-judgment about the economic status did match exactly with interviewer’s aggregated score categories. Nine percent (37) were uncertain while the remaining 17 % (70) considered themselves to be below or above the economic status category based on the quantitative evaluation.
Figure II-2 shows the distribution of score totals overall.

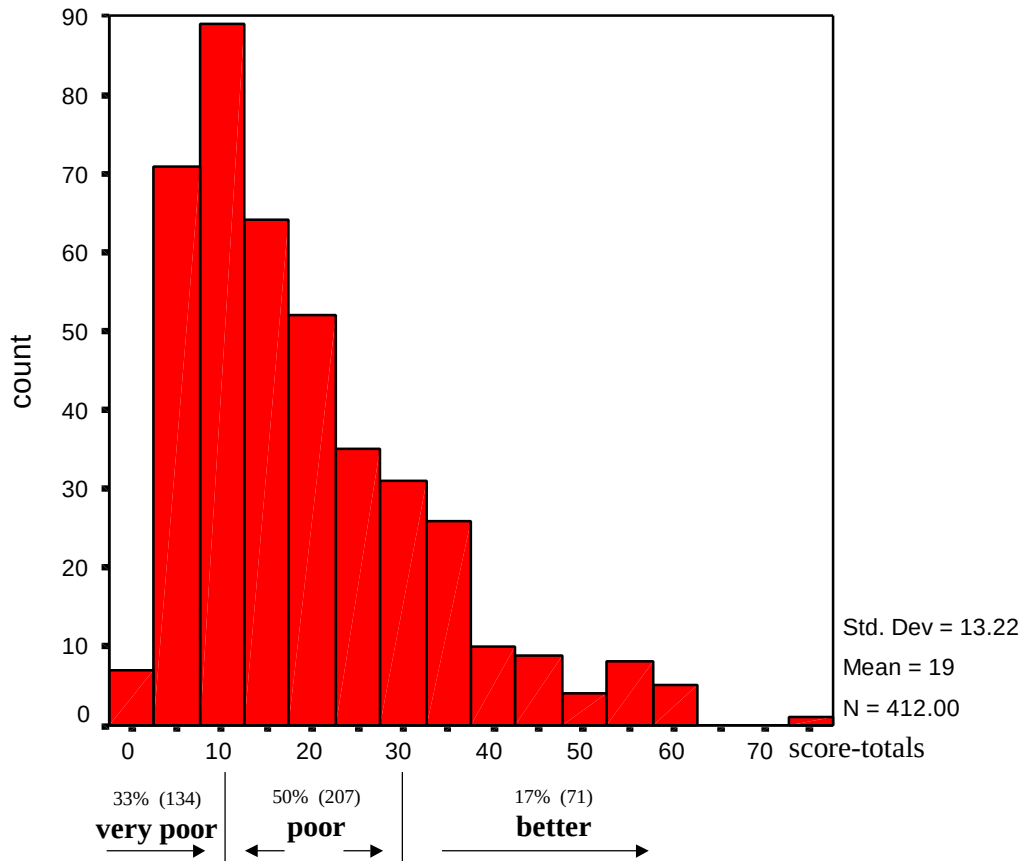


Figure II-2: Histogram of the distribution of score-totals for all interviewed households

Data analysis

Data were stored using the database management software Microsoft ACCESS 97 (Microsoft Corporation, Redmond, USA). Maps were produced using the geographical information system software ARCVIEW for Windows version 3.1(ESRI Inc., Redlands, USA). The statistical analyses were performed using SPSS for Windows version 9.0 (SPSS Inc., Chicago, Illinois, USA) and STATISTICA/W version 5.1 (StatSoft Inc., Tulsa, USA). Variables were coded as follows: Ownership of livestock species and knowledge about the BAHS program as 0/1 for no/yes; existence of additional jobs similarly as 0/1 for no/yes; size of household as small (1-3 persons), medium (4-6) and large (>6), respectively. All variables with a significant effect on economic status in the univariable analysis were then included in multiple correspondence analysis to explore the differences between 'very poor', 'poor', and 'better' farmers. The goal is to represent the entries in the table as distances between individual rows and/or columns in a low dimensional graphical space. Another way of looking at MCA is to consider it as a method for decomposing the overall Chi-square-statistic (or Inertia = Chi-square/total N). What is important are the distances of the points in the two-dimensional display, which are informative in that row points that are close to each other are similar with regard to the pattern of relative frequencies across the columns. Adding supplementary column points to the design matrix (in our case the status of BAHS-usage), allows performing the equivalent of a multiple regression for categorical variables. The summary statistics (total inertia) provides an indication of how well one can explain user-status as a function of the other variables in the design. Secondly, the column points in the final coordinate system would provide an indication of the nature (e.g., direction) of the relationships between the columns in the design matrix and the supplementary column points indicating BAHS user-status (Greenacre, 1992).

Results

Descriptive analysis

Table II-2 presents some descriptive statistics about household size and livestock ownership for the population in the study area.

Table II-2: Household size and ownership of different livestock species within Mzuzu ADD in 1997 stratified by ecological zone
(using Kruskal-Wallis test for continuous data; Pearson's chi-squared tests for categorical data)

variable	Highlands n = 195	Lakeshore n = 68	Plains n = 149	total n = 412	p-value
mean size of households (SD)	**6.0** (3.7)	**6.8** (3.2)	**5.3** (2.2)	**5.9** (3.2)	.004
% cattle owners mean no. cattle (SD)	**17.4** 10.1 (11.4)	**19.1** 9.3 (11.1)	**48.3** 8.9 (8.5)	**28.9** 9.3 (8.5)	.000
% sheep/goats owners mean no. sheep/goats (SD)	**34.4** 8.5 (7.6)	**57.4** 5.8 (6.7)	**45.2** 8.2 (6.7)	**42.2** 7.8 (7.1)	.002
% chicken owners mean no. chickens (SD)	**75.4** 10.2 (11.6)	**85.3** 9.9 (11.2)	**81.9** 6.9 (6.5)	**79.4** 8.9 (10)	.226
% pig owners mean no. pigs (SD)	**31.3** 4.7 (3.7)	**13.2** 4.8 (3.7)	**32.9** 3.9 (2.8)	**28.9** 4.3 (3.4)	.007
% pigeon owners mean no. pigeons (SD)	**24.6** 17.3 (15.9)	**11.8** 10.1 (6.7)	**34.9** 12.3 (13.9)	**26.2** 14.4 (14.7)	.001
% duck owners mean no. ducks (SD)	**15.9** 8.8 (11.9)	**11.8** 4.1 (5.2)	**7.4** 2. (1.7)	**12.1** 6.7 (9.9)	.063
% rabbit owners mean no. rabbits (SD)	**4.0** 4.2 (2.1)	**10.5** 10.5 (13.4)	**4.2** 4.1 (2.5)	**4.9** 4.7 (4.2)	.075

The average size of families varies by 1.5 persons between the different zones. The livestock distribution differs considerably with almost 50% of households owning cattle in the plains and less than 20% in both the Highlands and at the Lakeshore. There are more than twice as many households with pigs in the Highlands and the Plains compared with the Lakeshore. Almost 60 % of people living at the Lakeshore keep small ruminants, whereas only 34 % in the Highlands and 45 % in the Plains do so.

Sixty-nine percent of interviewees reported health problems in their livestock while 81 % mentioned not having received any advice from field staff concerning livestock. Exposure to BAHS-extension material or advice was confirmed by 17 % of households and of these 78 % indicated, that this advice was provided by VA.

House-walls made from clay as distinct from burned bricks are predominant (66 % of households) and only 16 % of the interviewees were able to afford iron sheets as roofing material. Similarly, only 15 % of houses had glass windows. Ownership of radios and bicycles was reported for 31 % and 38 % of households, respectively. Seven percent of farmers interviewed owned an ox cart and 18 % mentioned that they owned a plough. Asked for a final comment, a quarter of all interviewees considered poverty and lack of income to be their most pressing problems. On the basis of the scored economic status, 33 % (134) of households were categorized as 'very poor', 50 % (207) as 'poor ' and only 17 % (71) as 'better'. In fact, only 4 % of larger farms in the study area owned ≥ 20 cattle, ≥ 15 sheep or goats and more than 40 adult chickens.

Table II-3 presents descriptive cattle herd composition data, comparing routinely recorded official data with the survey findings.

Table II-3: Cattle herd composition in the study comparing survey results with Government statistics

Survey results (n=120)

	male calves	female calves	heifers	cows	immat. bulls	mature bulls	oxen	cattle total
Avg.	**1.03**	**1.04**	**1.23**	**3.50**	**0.59**	**0.42**	**1.44**	**9.25**
SD	1.57	1.42	1.74	4.66	1.21	0.89	1.51	9.61

Data from Veterinary Office / Mzuzu ADD, 1995/96 (n=5273)

Avg.	**1.09**	**0.94**	**2.43**	**4.16**	**0.89**	**0.37**	**1.71**	**12.12**
SD	1.38	1.24	3.53	4.31	1.26	0.73	1.87	11.03

The official data are derived from 17 veterinary stations reporting cattle numbers within Mzuzu ADD in 1995/96. The remaining 63 stations did not submit their forms in time or at all. Our averages are based on the sample of 120 (28.9 %) farmers owning cattle amongst the total of 412 households.

The data show, that average cattle numbers drawn from official data are above the averages resulting from our survey results, which is significantly different (Kruskal-Wallis test, chi-square 928.7, df 1, p=.006). Figure II-3 summarizes the score-totals of relative economic status for individual households by ecological zone. There are no significant differences between mean scores of interviewed households according to zone (Kruskal-Wallis test, Chi-Square 0.68, df 2, p = .71). The spread of score-totals appears to be larger in the Highlands and the Plains compared with the Lakeshore.

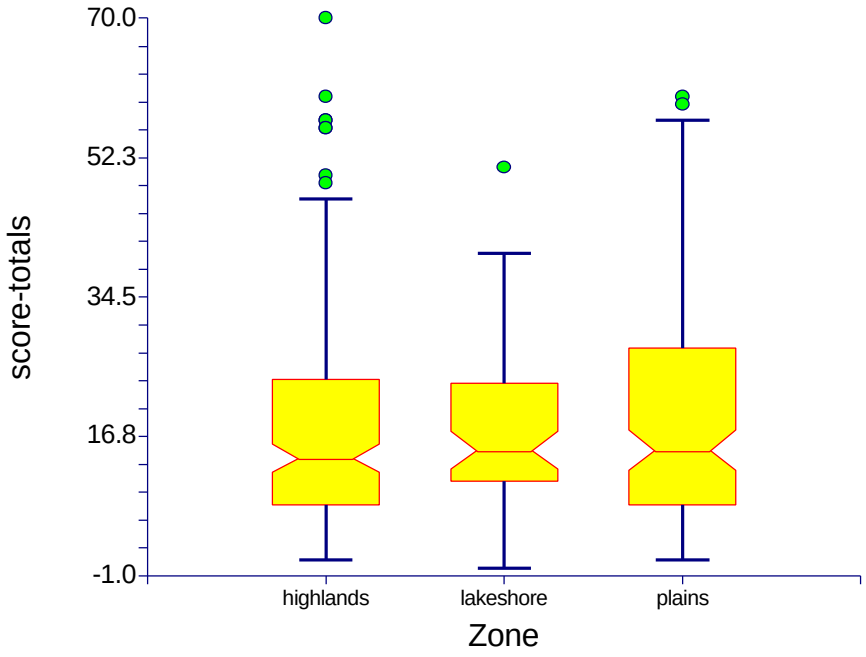


Figure II-3: Box and Whisker plots for distributions of economic status score-totals for individual households stratified by ecological zone

Multivariable analysis

The 2D-plot in Figure II-4 was generated using multiple correspondence analysis. It includes variables defining ownership of different livestock species and exposure to veterinary field services. The two dimensions presented in the plot explain 49.3 % of inertia. The first dimension distinguishes between ownership of different livestock species, whereas the second further separates according to usage of animal health services.
The graph underlines the link between economic status of interviewed households and livestock ownership, which was part of the purposive selection (Section 2.4). Households that have a 'better' economic status are more likely to own cattle and small ruminants compared with the 'poor' and 'very poor' households. 'Very poor' households are not likely to keep either large animals or chickens. Receiving treatment or husbandry advice appears to be independent of economic status.

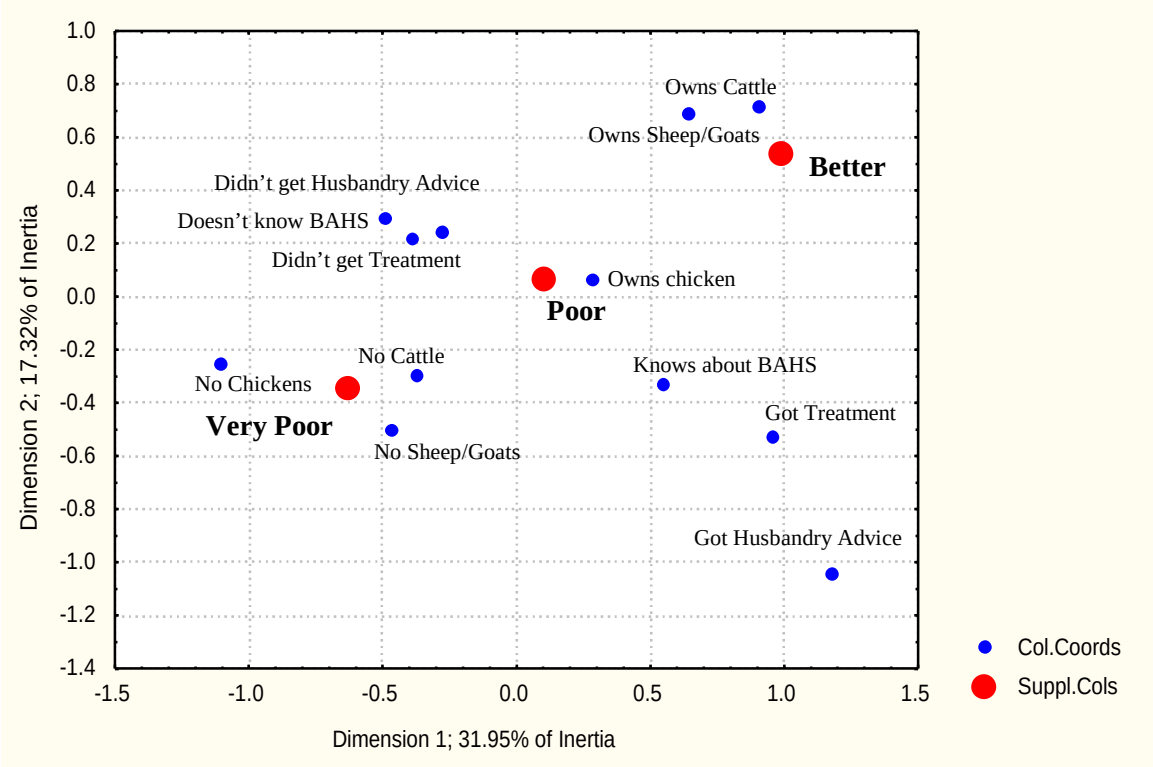


Figure II-4: 2D Plot based on multiple correspondence analysis of ownership of selected livestock and field services received.

The indicators of livestock ownership and field services received are displayed as column coordinates (Col.Coords) while the economic status category is added as supplementary column points (Suppl.Cols).

Discussion

The results of the descriptive analysis suggest that on average there are many more households keeping various species of livestock than indicated by official records. Governmental statistics derived in 1993 (Malawi Census, 1994), for instance, state an average of 14.8 % of households owning cattle, while our figure is twice as high. An estimated 10.4 % of households, according to the same source, keep chickens while 3 % of households do not keep any livestock. In contrast, the results of our study suggest that almost 80 % keep chickens and that there is not a single household without any livestock species. Recently, a comprehensive report has been submitted to the Malawi Veterinary Department by the Danish Aid Agency, which explains possible causes of such conflicting information (Malawi Report, 1998). The issue of bias in official governmental records is not new and not just applicable to developing countries. With regard to the situation in Malawi, we suggest an additional factor potentially may cause such discrepancies. It is that simple counts of animals in cattle-kraals (sheds) do not necessarily reflect actual cattle ownership because of the complex patterns of exchanging, lending and moving cattle within the wider family. For instance, households, who own cattle, keep them with the herd of a relative in a kraal somewhere else within the region. As a result herd sizes can be easily over-estimated while at the same time the proportion of families that own cattle may be rated far below the true level. Another explanation for the observed discrepancy could be that in the current study the distribution of primary sampling units did not correctly represent the spatial variation in livestock ownership as suggested by the differences between ecological zones, so that too many herds were selected from geographic areas with smaller numbers of animals per household. If this information had been available beforehand, a proportional stratification of the sample by ecological zone could have been used to prevent this potential bias.

It would be useful for the BAHS-program to compare the degree of attention that farmers direct towards their own cattle and the one towards animals managed but not owned by them. This example illustrates the importance of understanding traditional customs in livestock keeping when investigating smallholder livestock production, which has also been emphasized by authors such as Perry et al. (1984) and Rodgers and Homewood (1986).

Estimates of livestock ownership are often the basis of economic development strategies, which are being devised by Governments and donor agencies. The results of this study suggest that correctly designed random sample surveys should be conducted to generate reliable data forming the basis of policy development.

The questionnaire survey also shows that two thirds of households report health problems in their livestock, which in turn are often not dealt with by veterinary field staff. Only 17 % of the farmers mentioned having seen extension material or having had husbandry advice provided by the BAHS-program. Fourty-eight percent of respondents said that they had heard about the drug box kept by KM or VA. These findings suggest a need for the BAHS-team to strengthen its already existing outlets in the field. This should have at least the same priority as the expansion towards other area. A manuscript "Characteristics and performance of village animal health workers and veterinary assistants in northern Malawi" tat has was submitted recently describes possible reasons for unsatisfactory services by KM and VA involved in the BAHS-scheme. The results stress that the support and training of these people have to be improved. It is likely that this would provide an environment where more people in villages will consider the use of the BAHS-program.

The objectives of any development program will include the improvement of the standard of living. In the context of the BAHS-program, which is an approach towards decentralized and privatized veterinary services this means, that it is aimed at reaching all sections of the community, including the poor. In the current study economic status indicators were used to define the relative poverty status of households in order to describe trends and to define future needs with respect to BAHS-program extension across different sections of the farming community. Using these criteria, the majority (83 %) of farm households included in this study were categorized as poor or very poor, and only 17 % had a comparatively ‘better’ economic status. There were no differences in the distribution of economic status categories between ecological zones. It should also be kept in mind that poverty is a relative term. The World Development Report 1999/2000 (Anon 1999) emphasizes that economic status is only one measure of standard of living together with for example political stability, education, life expectancy, child mortality, and gender equality. Moriniere et al. (1996) reported a high proportion of poverty stricken districts in the study area, but found a relatively low index of vulnerability of the rural population. This is possible because poverty does not necessarily imply food deficiency and malnutrition, as has been confirmed

by findings from a survey conducted by the Malawi Government (Social Indicator Survey, 1996). Nonetheless, Malawi ranks amongst the seven poorest countries in the world (The World Bank Group, 1999) and 54% of the population are considered to live below the poverty line (Anon, 1999). The BAHS-team as any other agency or project operating in such an environment, have to consider very carefully the economic and social constraints of the people whenever development planning is undertaken. This affects pricing policies in particular but also consideration of traditional customs and flexibility of services provided. The results of multiple-correspondence analysis confirm the separation of the three economic status categories particularly with respect to livestock ownership and to a lesser extent in relation to usage of BAHS. Particularly the strong relationship to livestock species ownership had to be expected as these variables contributed to the economic status score calculation. This analysis was still considered useful because it pointed out the most important of these parameters as well as their relative weighting.

Having knowledge about the BAHS-program is more common in households with a ‘better’ economic status compared to the ‘poor’ or ‘very poor’ farmers. Higher economic status is associated with ownership of cattle, hence animal health problems may be more apparent in this species, than they are with some of the other common species. An individual cattle beast would also represent a higher economic value entity and may therefore be more likely to justify expense in the eyes of the owner. While this may be one reason, it is also possible that very poor or poor farmers simply do not consider animal health important enough given the limited amount of disposable income they have.

In conclusion, results of our survey shows that in the area of BAHS-operation livestock farming is more common in the population than shown by official data. This survey therefore demonstrates the importance of an active demographic population data collection for policy development purposes. With respect to BAHS-program adoption, the knowledge about and utilization of BAHS is far more limited among households defined as very poor and poor when compared with farms defined as better in terms of income categories. As a consequence, the BAHS field implementation should be intensified with particular consideration of poorer families. Their specific needs with respect to livestock species kept, which mainly are chickens and pigeons have to be taken into account.

References

1. Anon, 1999. World Development Report 1999/2000 - Entering the 21st Century: The Changing Development Landscape. Oxford University Press, Oxford, 312pp.

2. Hüttner, K., Leidl, K., Jere, F.B.D, Pfeiffer, D.U., 1998. Target group orientation of a Basic Animal Health Service Program - First results of an impact assessment in northern Malawi. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, pp. 296-309

3. Jere, F.B.D., 1996. Basic Animal Health Service in Northern Malawi. In: Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (eds): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1996, pp 211-234.

4. Lechner, H.L.G., Böhm, A., 1990. Assessment of the veterinary field service of Mzuzu A.D.D. in 1988/89 and recommendations for an improvement of efficiency. Mzuzu, Malawi, 169 pp.

5. Leidl, K., Jere, .F., Wanda,G., Hüttner,K., Stange, M., 1995. Establishment of a Basic Animal Health Service Program in northern Malawi - Dimensions of activities through field work prior to implementation. Proceedings of the 8th International Conference of Institutions of Tropical Veterinary Medicine, 25-29 September 1995. Berlin, Germany. p. 113

6. Malawi Census, 1994. Smallholder Livestock Survey Report. National Sample Survey of Agriculture 1992/93, 3, Lilongwe, Malawi.

7. Malawi Report, 1998. Malawi National Livestock Development Masterplan, Draft Final Report. Ministry of Agriculture and Irrigation, Department of Animal Health and Industry, Lilongwe, Malawi.

8. Malawi Social Indicator Survey, 1996. A survey of the State of Health, Nutrition, Water, Sanitation and Education of Children in Malawi 1995/1996. Ministry of Economic Planning and Development, National Statistical Office; and the Centre for Social Research. Lilongwe, Malawi, 137 pp.

9. Moriniere, L., S.Chimwaza and E.Weiss, 1996. Malawi Vulnerability Assessment & Mapping (VAM) Baseline 1996. A Quest for Causality. Ministry of Agriculture, Irrigation and Livestock Development, Lilongwe, Malawi. 121 pp.

10. Perry, B. D., Mwanaumo, B., Schels, H. F., Eicher, E., Zaman, M. R., 1984. A study of health and productivity of traditionally managed cattle in Zambia. Preventive Veterinary Medicine, 2: 633-653.

11. Rodgers, W. A., Homewood, K. M., 1986. Cattle dynamics in a pastoral community in Ngorongoro, Tanzania, during the 1982-3 drought. Agricultural Systems, 22: 33-51

12. Schillhorn, van Veen, T.W., 1999. Agricultural policy and sustainable livestock development. International Journal for Parasitology, 29: 1, 7-15

13. The World Bank Group, 1999. Country at-a-glance, Website, 1999. http://www.worldbank.org/data/countrydata/aag/mwi_aag.pdf

III. CHAPTER

Farm and personal characteristics of the clientele of the BAHS-Program*

* Edited version of a paper accepted by Tropical Animal Health & Production (in press)

Abstract

The social background, farm characteristics, indicators of income and self-evaluation returns of 96 randomly selected users of the BAHS-Program in northern Malawi were compared with 96 matched part-users and 96 non-users, respectively. All 288 farms were visited between July and October 1997. Data analysis was performed using univariate and multivariable techniques. The results showed that BAHS-users on average had larger cattle herds (16.3) than part-users (14.7) and non-users (12.4). Similarly, the annual yields of crops were higher in users compared to both other groups. Users occupied better houses and owned a larger number of farm and household items as compared to part-users and non-users. A third of all farmers were engaged in additional income generation in order to lessen the risk of poverty.

However, analysis of livestock management and the educational background of farmers suggested, that usage of the BAHS-program is not just determined by already existing "wealth". Users compared with either of the other groups more frequently applied improved livestock husbandry and management measures, which do not require capital investment. Non- and part-users had attained a lower level of education, were less open towards improved farming methods and felt less knowledgeable than BAHS-users. The average straight-line distances from farms using BAHS to their respective village animal health worker (2.2 km) or veterinary assistant (2.9 km) were similar but varied according to ecological zone.

Intensified extension and awareness meetings in villages will be required to get more non-users involved in BAHS.

Materials & Methods

Selection of study farms

Eleven KM and 21 VA were randomly selected from the 126 drug-box holders within Mzuzu Agricultural Development Division (ADD), who had a minimum BAHS-involvement of 12 months. At each of those 32 locations, BAHS-users owning cattle were selected randomly from the list of paid-up members. Another 3 part-users and 3 non-users of BAHS were selected in each area as matched cases, emphasis being given on similar livestock ownership to the BAHS-users. The respective KM and VA selected these cases together with the BAHS-team.

Questionnaire and interviews

A comprehensive questionnaire was drawn. Major sections comprised of household and social characteristics, self-perception, livestock ownership and husbandry applications, crop estimates, condition of the house and ownership of farm and household items. The latter are listed inFigure III-2. The questionnaire was tested at 5 farms and amended before it was applied in this study. Interviews lasted on average about 70 minutes. Completing the visits to all 288 selected farms took four months (July to October 1998). A team of three veterinary area supervisors (technical level) and one veterinarian conducted the interviews.

Measurement of distances between farm locations and respective KM or VA

The distances have been measured in kilometers as one-way straight lines between farm locations and VA/KM's houses, respectively, using standard functions in the mapping software (see section data analysis). These values are under-estimated as KM and VA would have to travel on tracks and roads, which will not lead in a straight line to farms to be visited. No statistical tests were performed comparing distances between farmer-groups as part- and non-users are matched cases resulting from purposely selection.

Data analysis

Data were stored using Microsoft ACCESS 2000 (Microsoft Corporation, Redmond, USA). Maps and distances between locations were produced using the geographical information system software ArcView for Windows version 3.1 (ESRI Inc., Redlands, USA). The statistical analyses were performed using SPSS for Windows version 9.0 (SPSS Inc., Chicago, Illinois, USA), NCSS 2000 (NCSS statistical software, Kaysville, Utah, USA) and STATISTICA/W version 5.1 (StatSoft Inc., Tulsa, USA).

Uni- and multivariate analyses were used to describe the differences between BAHS-users, part-users and non-users. Multiple Correspondence Analysis (MCA) was used to explore the data for relationships between categorical variables contained in simple two-way or multi-way tables. For multinomial regression analysis, a stepwise backward approach was used, which included all variables screened in MCA. The highest code level for categorical variables with more than two levels was used as the reference category. All the variables included in the final main effects regression model were screened for possible interactions.

Location of study farms

Figure III-1 shows the location of the selected farms within the study area.

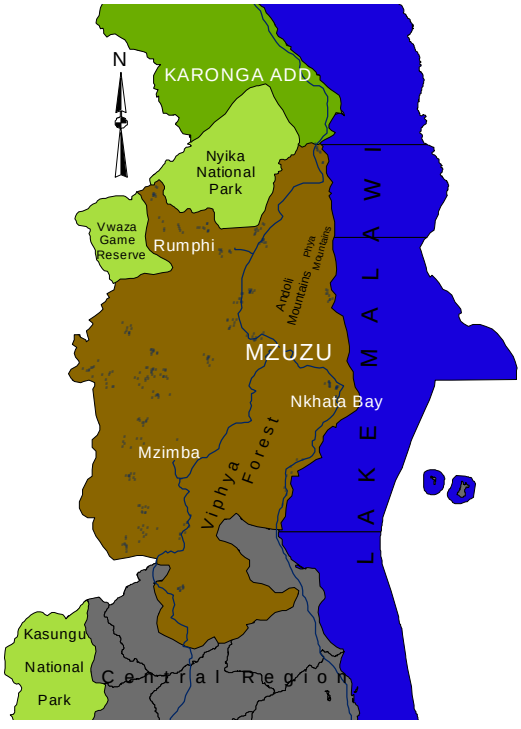


Figure III-1: Locations of study farms (n=288) **and sealed roads within Mzuzu ADD**

Results

Farm characteristics

Farmers were 55 years of age on average and had to care for 8.8 family members. There was a wide variety in age, family size and composition, although the averages for the three farmer-groups were similar. Table III-1 summarizes these data.

Table III-1: Distribution of age and household members according to farm- status (n=288)

status	**avg. age** (range)	**avg. household size** (range)	**avg. no. of kids** (range)	**avg. no. of women >18 yrs,** (range)	**avg no. of men >18 yrs** (range)
non-users	**55.0** (29-84)	**8.7** (2-21)	**6.4** (1-17)	**1.4** (1-4)	**1.10** (1-5)
part-users	**55.5** (28-85)	**8.7** (2-25)	**6.5** (1-21)	**1.5** (1-7)	**1.02** (1-2)
users	**54.7** (24-75)	**9.0** (2-23)	**6.7** (1-19)	**1.4** (1-3)	**1.06** (1-4)
p-value (K.Wallis statistics)	0.87 (0.26, df 2)	0.59 (1.03, df 2)	0.73 (0.61, df 2)	0.7 (0.71, df 2)	0.86 (0.29, df 2)

Table III-2 shows the average numbers of livestock kept by farmers and crop estimates for the previous season.

Table III-2: Annual mean numbers of livestock owned and estimated annual crop yield, stratified by farmer-status

(same superscripts are used to indicate statistically significant differences between individual groups using Kruskal-Wallis test), (n=288)

mean	**non-users** (sd)	**part-users** (sd)	**users** (sd)	p-value (K.Wallis statistics)
cattle	12.4 [a] (8.1)	14.7 (8.2)	16.3 [a] (9.3)	0.00 10.6, df 2)
sheep/goats	11.6 (10.7)	10.3 (8.5)	11.2 (7.5)	0.56 (1.2, df 2)
chickens	16.7 [a] (19.5)	23 [b] (17.3)	20.7 [a b] (15.8)	0.00 (12.2,df 2)
milk (no of .33 bottles milked/day)	5.2 (3.5)	3.7 (1.5)	5.6 (3.6)	0.15 (3.8, df 2)
maize yield (50kg sacks)	29.9 [a] (25.2)	35.9 (33.2)	49.8 [a] (54.6)	0.00 (9.9, df 2)
cassava yield (50kg sacks)	33.5 (45.4)	36.5 (55.6)	36.6 (50.4)	0.86 (.28, df 2)
g/nuts (50kg sacks)	8.9 [a] (26.1)	7.3 (15.1)	11.4 [a] (18.2)	0.00 (9.1, df 2)
tobacco yield (90kg bails)	8.7 (8.5)	9.0 (11.9)	11.4 (35.1)	0.08 (4.9, df 2)
beans (50kg sacks)	1.4 [a] (.6)	1.9 [b] (2.7)	2.7 [a b] (2.6)	0.00 (6.9, df 2)

BAHS-users produce significantly more maize, beans and groundnuts than part- or non-users and they owned significantly more cattle and chickens. The average numbers of livestock species kept indicate that our study farmers operated already at a larger farming level, which has been discussed in Chapter 2.

Additional jobs

Approximately one third of the farmers within all groups engaged in one or more additional sources of income other than crop sales or livestock off-take. They ranged from the sale of homemade beer to more demanding business. Table III-3 provides a description as to how additional income was generated on the study farms.

Table III-3: Additional sources of income other than livestock off-take or sales of crops, stratified by farmer-status including c^2 results (n=288)

description of income	non-user (n=96)	part-user (n=96)	user (n=96)	p-value (χ^2-statistics)
total number with additional income	31	39	30	.33 (2.23, df 2)
own business (African doctor, butcher, maize mill, oxcart hire, shop)	12	13	17	.55 (1.17, df 2)
receives a pension or salary from employment	3	7	8	.29 (2.48, df 2)
supported by relatives	5	7	6	.84 (0.36, df 2)
other activities (wood sales, beer brewing, brick burning, fishing, craftsman, bicycle repair etc)	13	16	12	.69 (0.74, df 2)
sale of fresh farm milk (estimated value per 0.33 bottle in MK*)	60 (2.54)	61 (2.67)	73 (2.55)	

Users and part-users tended to receive pensions or some form of salary more frequently than non-users. Users apparently were more involved in "larger" businesses such as groceries and maize mills compared to either of the other groups. However, none of the cross-tabulated numbers between groups were significantly different.

* MK - Malawi Kwacha, exchange rate U$/MK as of August 1998: 1/42

Indicators of income

Figure III-2 displays the differences between the three groups with regards to the ownership of selected farm and household items and the condition of the house using multiple correspondence analysis.

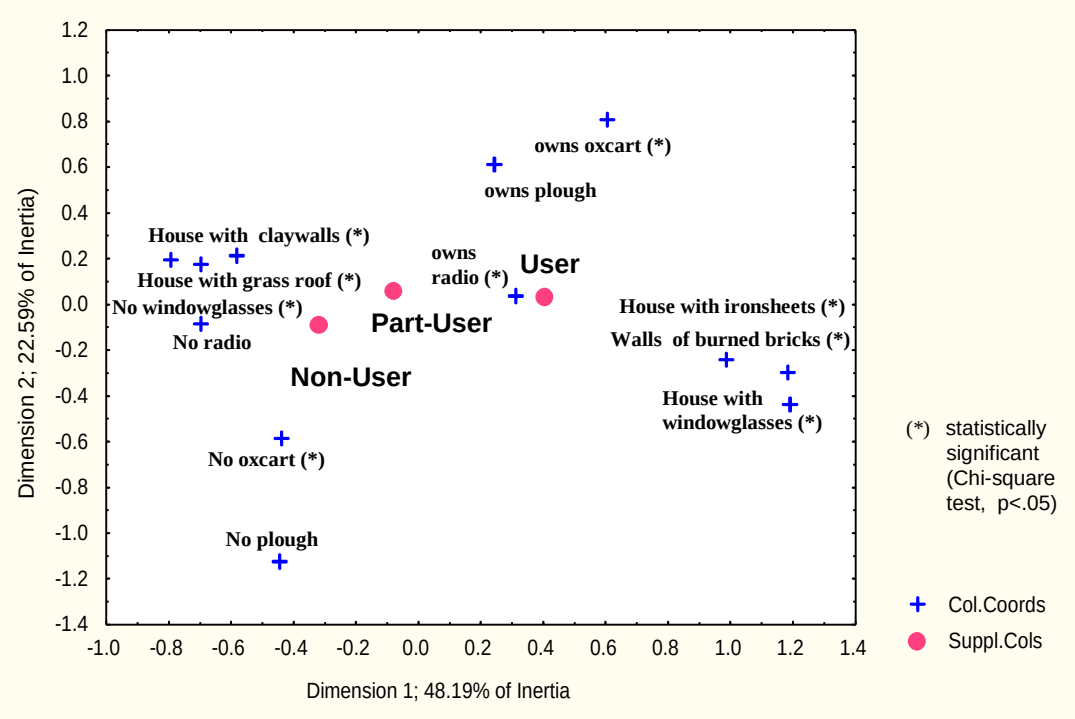


Figure III-2: 2D Plot based on multiple correspondence analysis of farmer's economic indicators

The economic indicators of farmers are displayed as column coordinates (Col.Coords) while the farmer-status is added as supplementary column points (Suppl.Cols).

The plot explains 70.1 % of the total inertia using two dimensions. The first dimension focuses more on characteristics of the farmer's house, and the second on equipment required for work. The categories of the supplementary variable are separated to a limited extent along the first dimension, and even less along the second. It shows that household "wealth" clearly separated the three different farmer types involved in the study. For instance, column points representing the frequencies of houses with a grass roof (as distinct from "better" house with iron sheets) are much closer to the supplementary column points representing non-users and part-users as they are to users. BAHS-users were more likely to be "wealthier" than non-users, and part-users are in between the two other groups in terms of relative "wealth". Quantifying these relationships was attempted using multinomial logistic regression as presented in Table III-4.

Table III-4: Final multinomial logistic regression model of the relationship between indicators of farmer's income and farmer- status as the dependent variable

("non-user" and "part-user" versus "user"; Deviance Statistic: Chi-Square 29.9, df 4, sig. .00)

Independent variable	compared with users	OR	CI lower	CI upper
Doesn't have glass windows	**non-user**	2.9	1.5	5.6
	part-user	1.6	.9	3.0
Doesn't own a radio	**non-user**	3.2	1.6	6.6
	part-user	2.8	1.4	5.8

Compared with BAHS users, non- and part-users were 2.9 and 1.6 times more likely, respectively to have a house without glass windows. Similarly, non- and part-users were 3.2 and 2.8 times more likely, respectively, not to own a radio compared with BAHS users. There were no interactions between independent variables. From the information provided in Figure II-2 and Table III-4, it therefore appears that BAHS membership as well as part usage is partly determined by the pre-existing "wealth" of the farmers.

Livestock husbandry measures

Table III-5 describes the use of specific husbandry measures according to user-status.

Table III-5: Frequency of use of selected husbandry measures stratified by farmer-status including c^2 analysis results (n=288)

animal husbandry measures (yes in %)	**non-users** (sd)	**part-users** (sd)	**users** (sd)	p-value (χ^2-statistics)
chicken house thatched?	47	53	60	0.16 (3.6, df 2)
nests for hens provided?	74	68	81	0.09 (4.6, df 2)
chicken manure utilized?	57	53	64	0.33 (2.2, df 2)
water provision for chickens?	43	48	66	0.00 (11.1, df 2)
sheep/goats kraal thatched?	22	21	26	0.66 (.83, df 2)
sheep/goat manure utilized?	40	39	44	0.76 (.54, df 2)
sheep/goats ever treated?	1	12	14	0.00 (10.9, df 2)
calf shed thatched?	15	18	28	0.07 (5.3, df 2)
cattle kraal shady?	44	47	55	0.26 (2.7, df 2)
cattle kraal well maintained?	28	28	41	0.10 (4.6, df 2)
average time of morning cattle release (range)	8:56 (6-12.00)	8:55 (6-11.00)	8:45 (6-13.00)	

The farmers using BAHS were more likely to apply specific husbandry measures than part- or non-users, although most differences were not statistically significant. Users tended to release their cattle slightly earlier than part- and non-users.

As a next step, the educational background as well as the personal habits and self-evaluation of the farmers were considered. The results are shown Figures III-3 and II-4 in conjunction with Table III-6 and Table III-7, respectively.

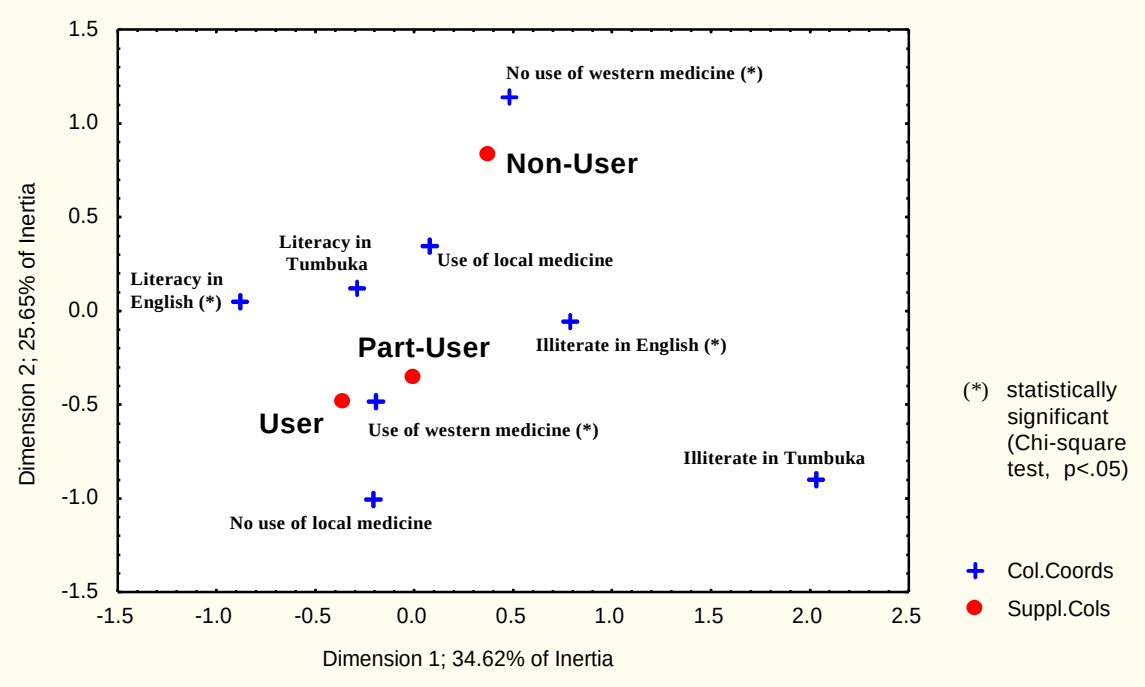


Figure III-3: 2D Plot based on multiple correspondence analysis of literacy and attitude towards use of drugs in animal as indicators.
The indicators of literacy and use of drugs are displayed as column coordinates (Col.Coords) while the farmer-status is added as supplementary column points (Suppl.Cols).

The plot explains 60.3 % of the inertia using two dimensions. The first dimension explains variation in literacy and the second usage of traditional and western medicines in livestock. Separation in the supplementary variable occurs mainly in relation to the second dimension, and here in particular between non-users and part-users/users. More users (54 %) and part-users (46 %) were associated with English literacy than non-users (37 %). Illiteracy in their own local language (Tumbuka) was uncommon in all groups. In addition, the plot shows an association between the farmer-status and their involvement in utilizing "modern" or traditional medicine, respectively. Not applying western medicine (81 %) and the use of local remedies (76 %) was more likely in non-users as compared to users (0 %, 67 %).

The results of multinomial regression analysis are shown in Table III-6.

Table III-6: Final multinomial logistic regression model of the relationship between farmer's literacy and farmer-status as the dependent variable

("non-user" and "part-user" versus "user"; Deviance Statistic: Chi-Square 218.5, df 8, p=. .00)

Independent variable	compared with users	OR	CI lower	CI upper
Doesn't use western medicine	**non-users**	441.9	57.1	3421.4
	part-users	6.9	.80	58.9
Use of local medicine*speaking tumbuka only	**non-users**	8.8E+08	6.3003769.48	1.223E+10
	part-users	1.2E+09	5.70E+09	2.77E+11

Non-users and part-users of the BAHS-program were 442 and 7 times, respectively, more likely not to use western drugs compared to BAHS users. There was a significant interaction between the ability to only speak the local language and the use of traditional medicine for treating livestock in the respective households.

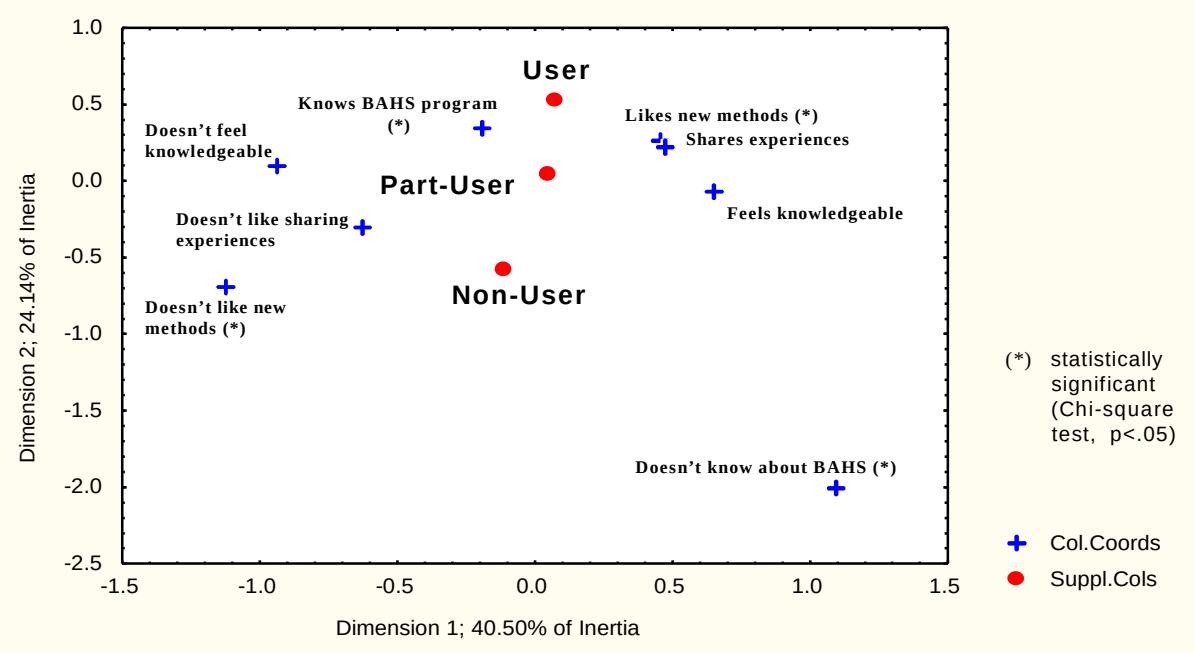


Figure III-4: 2D Plot based on multiple correspondence analysis of farmer's self-evaluation

The indicators of farmer's self-evaluation are displayed as column coordinates (Col.Coords) while the farmer-status is added as supplementary column points (Suppl.Cols).

The plot in Figure III-4 explains 64.6 % of the inertia using two dimensions. The first dimension explains differences in BAHS-awareness, whereas the second distinguishes between personal habits of the farmers. Separation for the supplementary variable occurs only along the second dimension. The plot suggests that users and part-users were more likely to be receptive to new methods in livestock production. Non-users in turn were less likely to share experiences amongst themselves compared to users and part-users. Multinomial logistic regression was used generate quantitative estimates of the relationship between self-perception and farmer-status as shown in Table III-7.

Table III-7: Final multinomial logistic regression model of the relationship between self-perception and farmer-status as the dependent variable

("non-user" and "part-user" versus "user"; Deviance Statistic: Chi-Square 81.53, df 4, p= .00)

Independent variable	compared with users	OR	CI lower	CI upper
Doesn't know BAHS	**non-user**	36.7	8.3	161.1
	part-user	17.2	3.9	75.3
Doesn't like new methods	**non-user**	7.4	3.5	16.0
	part-user	2.9	1.4	6.4

There were no interactions between independent variables. Farmers having the status of non- and part user were 37 and 17 times more likely, respectively, not to know about the BAHS-program compared to users. Similarly, the odds against being open to new methods and farming techniques were 7 and 3 times higher in non- and part-users, respectively, than in BAHS users.

Distances between farm locations and respective KM or VA

The average straight-line distances to farms covered by KM and VA were 2.2 km and 2.9 km, respectively. These are not significantly different (Kruskal-Wallis test, 2.3, df 1, p= .13).

Table III-8 provides a summary of these data.

Table III-8: Distances (km) between farm locations and KM and VA houses by farmer status (n=288)

Distance		**non-users**	**part-users**	**users**
Average	KM	2.06	2.28	2.21
	VA	3.28	2.99	2.86
SD	KM	1.52	1.38	1.73
	VA	3.18	1.82	2.06
Range	KM	0.08 - 5.47	0.30 - 4.85	0.02 - 7.65
	VA	0.17 - 19.01	0.25 - 7.88	0.30 - 11.23

On average KM had to travel longer distances to serve BAHS-users compared with non-users, whereas the reverse was the case for VA. However, the maximum distance of 19 km was between the farm location of a non-user and the corresponding VA. The furthest distance to be managed by a KM was almost 8 km for visiting a BAHS-user.

Figure III-5 represents zonal differences for distances to farms.

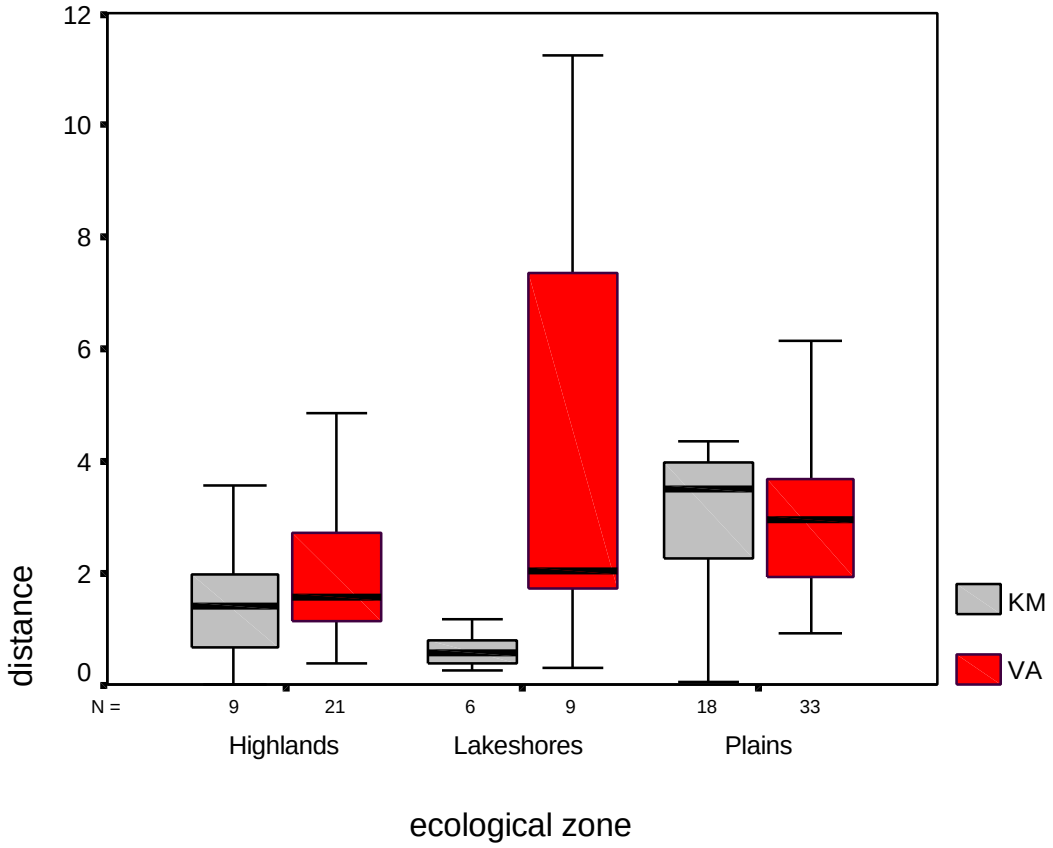


Figure III-5: Box and Whisker Plots of one-way straight line distances in km between the locations of users' farms and the houses of their nearest KM or VA according to zone (n=96)

The distances, which KM and VA covered in order to serve BAHS-users were fairly similar in the Plains (Kruskal-Wallis test, 1.1, df 1, p= .75) and in the Highlands (Kruskal-Wallis test, 0.9, df 1, p= .34), but there was a statistically significant difference between both groups at the Lakeshores (Kruskal-Wallis test, 4.02, df 1, p= .045). By cross-tabulating accessibility (yes/no) to the official rural road-network, the percentage of VA (38 %) being able to use rural roads to reach the selected farmers was significantly higher than the percentage (8.1 %) of respective KM (χ2 229.17, df 1, p= .00).

Discussion

The average age (55 years) of farmers included in this study is well above the average life expectancy for Malawi currently at 43 years, which is one of the lowest in the world (The World Bank Group, 1999). The farmers in the study had to care on average for 8.8 family members, while the figure for the general population is lower, averaging 5.9 people. Also the average number of animals for the different livestock species kept is higher on study farms than that of the general population. Comparing the farms in the study, users kept more cattle and chickens and harvested higher yields of selected crops than either of the other groups.

About a third of all respondents engaged in additional jobs other than livestock off-take and crop sales, which is a common strategy towards income generation. Meemark (1988) found only 5.2% (range 0-17.1%) of his interviewees in northeast Thailand engaged in other jobs. Users, who were more likely to be literate in English and more open to new methods, tended to occupy a higher proportion of "larger" business and had a higher percentage of current or previous employment compared to either of the other groups.

Sale of fresh milk was common among all farmers and provided a substantial contribution towards day-to-day cash in rural areas, which agrees with findings by Mukasa-Mugerwa and colleagues (1989) and Agyemang and colleagues (1991). More users than part- and non-users sold milk and they also put up a higher number of bottles per household for sale. The latter can be attributed to the significantly higher number of cattle per user as compared to non- and part-users (Table 2). Similarly, Figure 3 in conjunction with Table 4 illustrates the enhanced situation for BAHS users with regards to quality of housing and ownership of selected items, compared to either of the other groups. BAHS-users are clearly farmers with a better income.

Cross-tabulating the three groups according to the proportion of livestock husbandry measures applied (Table III-5) shows that BAHS-users were more innovative farmers. The findings in Figures II-3 and III-4, in conjunction with Tables III-6 and III-7, suggest an association between the educational and personal background of individual farmers and their respective attitude towards BAHS-uptake. This agrees with Suradisastra (1989), who found that the farmer's personal or farm characteristics in western Kenya were significantly associated to exposure to extension personnel and media. Particularly, the greater the family and farm size, the amount of crops grown, numbers of livestock kept and the better the education, the more likely were farmers to be visited by extension staff. Arene (1994), who investigated agricultural extension approaches in Nigeria found, that formal education, farm size and the age of the farmer were significantly and positively related to their attitude towards extension and willingness to adopt new ideas. It should be mentioned here, that in terms of education, Malawi has one of the worst social indicators in the world. Although the percentage of children enrolling at school in the northern region is comparatively high (90 %), illiteracy amongst males and females older than 15 years is officially 27 % and 57 %, respectively (Malawi Social Indicator Survey, 1996; The World Bank Group, 1999).

The issue of geographical distance between their clientele and animal health service personnel is likely to influence the extent of service delivery, as indicated by Woods and colleagues (1998). Meemark (1988), who investigated the uptake of village animal health services by comparing farmers with high and medium acceptance, found 25 % and 20 % complaining that the KM was too far away from their farms. In our study, a direct statistical comparison of mean distances to farmer-groups was not performed because the selection process for part- and non-users was not random. Descriptive analysis (Table III-8), however, showed that the differences between farmer-groups were negligible. Also the average distance between BAHS-users and the KM or VA, respectively was similar. However, there appeared to be a significantly different zonal influence on distances between users and their respective KM and VA (Figure III-5) at the Lakeshore. This is probably an issue of accessibility. There is basically only one main road existing at the shore. VA in general have a better access to the road-network compared to KM. Most VA's houses have been established along with the official infrastructure in rural areas. KM in turn have been specifically selected to serve fellow farmers in remote places. It must be mentioned, however, that cross-country pathways are often in better shape than rural roads,

particularly during the rains between November and April.

It was expected that more users than part- and especially non-users would know about BAHS. However, non-users are unlikely to be averse to western medicines in principle. About 20 % of non-users applied western drugs for treating their livestock, which they had obtained from sources other than BAHS. Additional factors other than education or personal characteristics influencing uptake of BAHS might exist. There are strong traditional believes including that of witchcraft in the Project area, and tribal senses may also influence farmers' decisions. This all remains to be investigated.

The results of our study suggest that education is the key to involving more farmers in BAHS. Gurung (1996) concluded his account of the success of 20 years of livestock extension in western Nepal by pointing at two key elements: These were home based and well trained technical field staff and a committee approach of extension. We are in agreement with the author. Also the BAHS-Project should intensify a well-balanced extension approach by targeting both, livestock farmers by rendering appropriate messages and services, but also field staff, who need ongoing support from the Project. Targeting non-users should not be restricted to farmers as they were defined in this study.

The majority of rural households in the Project-area only keep chickens, ducks or a few sheep or goats but usually cannot afford cattle. Encouraging more of these farms to utilize BAHS would meet one of the core objectives of the Project, which is involvement of the very poor families.

References

1. Agyemang K., Dwinger, A., Grieve, A.S. and Little, D. A., 1991. Studies on the effects of milking on calf growth and viability and on cow reproductive performance in traditionally managed N'Dama herds. Animal Production, 53: 11-18

2. Arene, C.J., 1994. Economic impact analysis of the Training and Visit system of agricultural extension on small-holder rice production in Nigeria. Quarterly Journal of International Agriculture, 33: 4, 393-403

3. BMZ, 1999. The German Ministry for Economic Development and Cooperation. Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung. *Statement*: Grundlagen der Deutschen Entwicklungszusammenarbeit. Nr. 97, 51 pp

4. Chabiri, F.N. and Mathooko, J.K., 1995. An adaptive animal health delivery system for nomadic pastoralists: An example from northern Kenya. Abstracts of the 8th International Conference of Institutions of Tropical Veterinary Medicine, Berlin, Germany, p 113

5. De Haan C. and Bekure S., 1991. Animal Health Services in Sub-Saharan Africa: Initial Experiences with Alternative Approaches. World Bank Technical Paper no. 134. The World Bank, Washington : 1991: 49 pp

6. FAO, 1997: The principles for rational delivery of public and private veterinary services. First FAO Electronic Conference on Veterinary Services. http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAH/Vets-l/Default.htm

7. Greenacre, M., 1992: Correspondence analysis in medical research, Statistical methods in medical research, 1992 I: 97-117

8. Gurung, D.B., 1996. Twenty years of livestock extension in the hills of western Nepal: A review of Lumle Agricultural Research Centre's livestock extension activities 1975-1995. LARC Review Paper, Kaski, Nepal, no 96/1, iii, 21 pp.

9. Jackson, R. and Ward, D., 1999. Negotiating Framework for Rationalizing Delivery of Public and Private Veterinary Services. FAO Publication, pp. 49

10. Jemal, A., Justic, D. and Hugh-Jones, M.E., 1995. The estimated long-term impact of Tsetse control on the size of the population of cattle in the Didessa Valley, Western Ethiopia. Veterinary Research Communications *19*, 479-485

11. Jere, F.B.D., 1997. Basic Animal Health Service in Northern Malawi. In: Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (Eds.): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1996, pp. 211-234

12. Johnson, P.J. and Chahuares, C., 1990. Training anyamara veterinary technicians in the southern Peruvian Andes. Convergence, 23: 14-22

13. Kleemann, G., 1999. Service Management in Livestock Development, Universum Verlag, Wiesbaden, Germany, 430 pp.

14. Leidl, K., Jere, .F., Wanda, G., Hüttner, K. and Stange, M., 1995. Establishment of a Basic Animal Health Service Program in northern Malawi - Dimensions of activities through field

work prior to implementation. In: Proceedings of the 8th International Conference of Institutions of Tropical Veterinary Medicine, 25-29 September 1995. Berlin, Germany, p. 113

15. Malawi Social Indicator Survey, 1996. A survey of the State of Health, Nutrition, Water, Sanitation and Education of Children in Malawi 1995/1996. Ministry of Economic Planning and Development, National Statistical Office; and the Centre for Social Research. Lilongwe, Malawi, 137 pp.

16. Mariner, J.C., Akabwai, D.M.O., Toyang, J., Zoyem, N. and Ngangyou, A., 1994. Community-based vaccination with thermostable vero cell-adapted Rinderpest vaccine (Thermovax*)*. The Kenya Veterinarian, 18: 507-509

17. Meemark, N., 1988. The Development and Evaluation of a Village-Based Parasite Control Program for Swamp Buffalo and Cattle in Northeast Thailand; Masters Thesis, Massey University, New Zealand, 169 pp.

18. Moktan, D., Mitchelhill, B.K. and Joshi, Y.R., 1990. Village Animal Health Workers in the Koshi Hills. *PCA* Working Paper No *.4*. Dhankuta District, Koshi Zone, Nepal

19. Mukasa-Mugerwa, E., Bekele, E. and Tessema, T., 1989. Type and productivity of indigenous cattle in Central Ethopia, Tropical Animal Health & Production, 21, 120

20. Ngategize, P.K., 1989. Economic Evaluation of Improved Management for Zebu Cattle in Northern Tanzania. Agricultural Systems, 31, 305-314

21. Rangnekar, D.V., 1995. Approach and experience of NGO in developing livestock service delivery system. Abstracts of the 8th International Conference of Institutions of Tropical Veterinary Medicine, Berlin, Germany. p. 115

22. Schreuder, B. E. C., Noorman, N., Halimi, M. and Wassink, G., 1996. Livestock mortality in Afghanistan in districts with and without a veterinary program. Tropical Animal Health & Production, 28, 129-136

23. Suradisastra, K., 1989. Farmers perception of extension activities in western Kenya. Dissertation Abstract International, *A* (Humanities and Social Sciences), 49: 7, 1671 pp.

24. The World Bank Group, 1999. Country at-a-glance, Website, http://www.worldbank.org/data/countrydata/aag/mwi_aag.pdf

25. Wanda, G., W., 1994. Health constraints of calves and young stock in Mzuzu Agricultural Development Division, Malawi. Masters Thesis, University of Reading, UK, 75 pp.

26. Woods, P.S.A., Leonard, D., Nielen, M. and Brand, A. 1998. The importance of proximity, transport and gender as factors affecting the efficiency of veterinary service delivery in Zimbabwe. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe (in press)

IV. CHAPTER

Characteristics and performance of Keymen and Veterinary Assistants*

* Edited version of a paper accepted by the Journal of the South African Veterinary Association (in press)

Abstract

Fourty-two Keymen and 84 Veterinary Assistants involved in the BAHS-Program were interviewed in 1998. The general characteristics and perceptions of both groups were analyzed using uni- and multivariable techniques. Detailed sales and treatment patterns of six KM and 12 VA were evaluated for the period September 1996 to August 1997. Results indicate the overall job-satisfaction for 82 % of KM and 83 % of VA. The extent of estimated weekly involvement in livestock service delivery, particularly of KM with 3.7 days on average, is remarkably high. Total annual drug sales of KM and VA between 1996 and 1997 on average were equivalent to US$ 124 and US$ 218, respectively. Most prescriptions were issued for treatment of calves followed by adult cattle, chicken-flocks and small ruminants.
The changes suggested by VA and KM in order to improve field performance focus on regular refresher training by the BAHS-Program.

Introduction

The idea of involving trained farmers (village animal health worker, laymen, keymen, barefoot-vets) is one of the key-elements in almost every program in order to develop practicable approaches for livestock service delivery in remote areas (Arambulo et al., 1986; Loehr, 1989; Johnson et al., 1990; Moktan et al., 1990; Grandin et al., 1991; Akabwai, 1993; Baptist et al., 1994; Abdel-Messieh, 1997).. Despite the significance of this group, only a few studies have been published that describe the characteristics and experiences of these people in more detail (Meemark, 1988; Sulistiyo et al., 1998; Jones et al. 1998).
The aim of the current study was to describe characteristics, perceptions and performance of KM and veterinary assistants (VA) involved in the BAHS scheme. The identification of factors limiting the effectiveness of the field service and motivation of field workers was seen as important information required to develop strategies for continued enhancement and adaptation of the program to the needs of the target population.

Materials & Methods

Selection of VA and KM

A total of 135 VA and KM were operating a drug box as of June 1998 in the study area. Of these, 42 KM and 84 VA with a minimum of 12 months involvement in the BAHS-program were included in the study. The survey questionnaire was pre-tested with 3 KM and 4 VA, and adjusted accordingly. Interviews were conducted between July and December 1998, each lasting about 30 minutes.

Detailed drug sales and treatment patterns of 6 KM and 12 VA were evaluated. The selection was based on completeness of annual accounting and prescription form data entries for the period of 9/96 to 8/97. These results are therefore not representative of the whole study population, but sufficient to provide a general indication of the performance of KM and VA.

Data analysis

Data were stored using the database management software Microsoft ACCESS 97 (Microsoft Corporation, Redmond, USA). GPS receivers were used to determine the precise locations of KM-houses and VA-stations within the study area. Maps were produced using the geographical information system software Arcview for Windows version 3.1 (ESRI Inc., Redlands, USA). Multiple Correspondence Analysis was used to explore the data for relationships between categorical variables contained in simple two-way or multi-way tables. The statistical analyses were performed using NCSS 2000 (NCSS Statistical Software, Kaysville, Utah, USA) and STATISTICA/W version 5.1 (StatSoft Inc., Tulsa, Oklahoma, USA).

Results

General description of VA & KM

Table IV-1: Comparison of VA and KM characteristics and work related issues

Factor	**VA** (% yes)	**KM** (% yes)	p-value
Keeps livestock?	86.9	100	.014 (χ^2 6.03; df 1)
Location by Zone			.107
Lakeshore	7.1	14.3	(χ^2 4.46; df 2)
Highlands	31.0	42.9	
Plains	61.9	42.9	
Tribal background			.001
Ngoni	14.3	7.1	(χ^2 15.94; df 3)
Chewa	20.2	2.4	
Tumbuka	38.1	73.8	
Other	27.4	16.7	
Organised farmer livestock meeting?	98.8	88.1	.007 (χ^2 7.09; df 1)
Farmer meeting was a success?	72.6	61.9	.220 (χ^2 1.5; df 1)
Husbandry issues taken into account?	95.2	88.1	.14 (χ^2 2.15; df 1)
BAHS training was adequate?	51.2	52.4	.899 (χ^2 .016; df 1)
What changes needed?			.428
None	56.0	57.1	(χ^2 2.77; df 3)
Teach extension skills	1.2	4.8	
More demonstrations	20.2	11.9	
More refresher ourses	22.6	26.2	

All KM and VA were of male gender. The average age of VA and KM was 37.4 years (SD 8.7) and 42.6 (SD 10.1), respectively (Kruskal-Wallis One Way ANOVA: Chi-Square 7.72; df 1; p = .005). VA estimated their weekly BAHS workload with 4.1 days (SD 1.7), which is higher than the estimate provided by the KM (3.7 days, SD 1.8; Kruskal-Wallis One Way ANOVA: Chi-Square 2.58; df 1; p = .107). On average VA had received their drug box 2.8 years ago compared with 3.4 years in KM (Kruskal-Wallis One Way ANOVA: Chi-Square 2.79; df 1; p = .094).

Table IV-1 is a summary of additional key-characteristics of both groups.

More KM than VA own livestock themselves. A higher proportion of VA than KM is based in the Plains. The population in the study area includes people from 14 different tribes, with the majority belonging to the Tumbuka. This variety is more reflected in the case of the tribal origin of KM than of VA. The Tumbuka-tribe seems to be under-represented in the VA-group.

More than half of both groups were satisfied with the training received. Fourty-four percent of VA and 43 % of KM suggested some changes with more than two thirds from both groups asking for regular refresher courses and practical demonstrations, respectively. Almost every VA and 88 % of KM organized livestock meetings in villages. A lower proportion of KM than VA was satisfied with the outcome of the meeting(s) they conducted. Both groups were highly likely to include advice on livestock husbandry and management in addition to treatments as part of their field services.

Annual drug sales and treatment regime

Table IV-2 provides a summary of treatment patterns across species summarized for all 18 selected drug box locations included in this detailed survey. Most prescriptions were issued for treatment of calves followed by adult cattle, chicken-flocks and small ruminants. A relatively small number of pig prescriptions were given out. The VA at Kachere appears to be the most active person followed by the KM in Mdolo when the total number of visits is taken into account. The average annual number of farm visits by KM is 81.3 (SD 32.7) involving 42.2 (SD 23.6) farms compared to 78.4 visits (SD 40.4) and 33.6 (SD 31.5) farms for VA. Comparing medians statistically did not show any significant differences between KM and VA.

Table IV-2: Annual number of farm visits and total treatments by KM/VA per species between 9/1996 and 8/1997

(Kruskal-test to compare between KM and VA groups, p<.05)

			no. animals (no. of farms involved)				
Location	**total no. of farms**	**no. of visits**	**calves (<12 months)**	**adult cattle**	**sheep/ goats**	**chickens**	**pigs**
KM-locations							
Kavululanga	57	80	35 (25)	36 (27)	1 (1)	861 (29)	1 (1)
Madede	14	90	65 (6)	26 (4)	48 (1)	1584 (5)	3 (1)
Matete	23	41	57 (22)	46 (18)	2 (1)	171 (9)	1 (1)
Mdolo	75	132	91 (36)	55 (21)	99 (33)	732 19)	18 (8)
Visenthe	55	94	49 (27)	44 (29)	15 (2)	472 (21)	23 (8)
Yakuwata	31	51	23 (14)	34 (16)	2 (2)	1455 (8)	0
KM averages of species (SD)	**42.2** (23.6)	**81.3** (32.7)	**53.3** (23.8)	**40.2** (10.2)	**27.8** (39.2)	**879.2** (550.9)	**7.7** (10.1)
VA-locations							
Chitanga	28	78	35 (9)	56 (9)	42 (7)	630 (8)	78 (8)
Chitimba	17	47	28 (11)	17 (8)	31 (3)	480 (17)	6 (1)
Jata	44	66	111 (40)	57 (28)	6 (3)	219 (10)	14 (1)
Kachere	114	187	167 (62)	116 (18)	30 (4)	3909 68)	1 (1)
Kampupu	63	97	71 (23)	54 (32)	19 (6)	185 (9)	6 (1)
Kapopo	26	39	55 (14)	37 (13)	0	98 (7)	1 (1)
Katumbi	38	58	45 (17)	45 (11)	4 (1)	2115 (13)	32 10)
Luzi	41	70	72 (29)	44 (14)	8 (3)	288 (12)	23 (7)
Magido	17	68	238 (13)	10 (5)	3 (1)	261 (8)	0
Mzikubola	9	72	44 (5)	15 3)	54 (3)	937 (4)	5 (1)
Ng'onga	27	44	38 (15)	24 (14)	36 (7)	41 (2)	4 (1)
Vibangalala	39	115	200 (45)	69 (36)	32 (5)	1280 (21)	7 (2)
VA averages of species (SD**)**	**33.6** (31.5)	**78.4** (40.4)	**92** (71.3**)**	**45.3** (29.2)	**22.1** (17.8)	**870.3** (1130.3)	**14.8** (22.1)
p-value		.57	.37	.74	.64	.45	.35

Table IV-3 provides a summary of drug sales as per selected drug box location. The calculation is restricted to the four most wanted drugs. There are no significant differences between drug sales of KM and VA. Since KM are not entitled to use injectables a statistical comparison was not performed for long-acting oxy-tetracycline (OTC). The average drug sales turnover for VA of MK* 3271.5 (U$ 218) is almost twice as high than that for KM with MK* 1859.3 (U$ 124), which is significantly different.

Table IV-3: Sales of most wanted BAHS drugs as per selected location between 7/1996 and 7/1997
(Kruskal-Wallis test to indicate statistically significant differences between KM and VA, p<.05)

location	Dewormer 1	Dewormer 2	Pour-on (sum in cc)	OTC (sum in ml)	Total in MK *
KM Kavululanga	34	32	51	0	1,619.80
KM Madede	40	33	262	0	1,978.10
KM Matete	31	39	815	0	1,828.00
KM Mdolo	47	61	525	0	2,638.70
KM Visenthe	29	67	124	0	2,176.40
KM Yakuwata	11	25	161	0	915.00
KM averages (SD)	***32.0*** *(12.2)*	***42.8*** *(17.1)*	***323*** *(292.0)*	***0***	***1,859.33*** *(578.3)*
VA Chitanga	42	43	183	150	3,234.20
VA Chitimba	22	1	292	99	1,986.20
VA Jata	48	37	331	363	3,874.30
VA Kachere	97	54	1731	296	5,679.50
VA Kampupu	12	35	1242	353	4,079.95
VA Kapopo	15	23	72	236	2,214.50
VA Katumbi	33	19	185	121	2,883.60
VA Luzi	29	15	637	312	2,865.98
VA Magido	57	26	287	398	3,072.10
VA Mzikubola	17	34	253	267	2,468.00
VA Ng'onga	11	7	383	336	2,221.50
VA Vibangalala	63	80	102	470	4,677.70
VA averages (SD)	***37.2*** *(25.8)*	***31.2*** *(21.5)*	***474.8*** *(505.5)*	***283.4*** *(114.2)*	***3,271.46*** *(1114.6)*
p-value	.85	.26	.45	n/a	.003

* 1 MK (Malawi Kwacha) = 15 U$ (December 1996)

Job satisfaction and self-perception

Eighty-two percent of KM and 83 % of VA stated that they enjoy their job. When asked for reasons, 59 % of KM and 55 % of VA mentioned drug availability after years of ineffective field services. Twenty five percent of KM and 31 % of VA felt they had gained knowledge about livestock production. Almost half of all KM (47 %) and a third of VA (34 %) reported that their ego had been boosted. All KM and 96 % of VA indicated that they were satisfied with the job because farmers show their appreciation. Figure IV-1 provides a graphical summary of these findings based on multiple correspondence analysis.

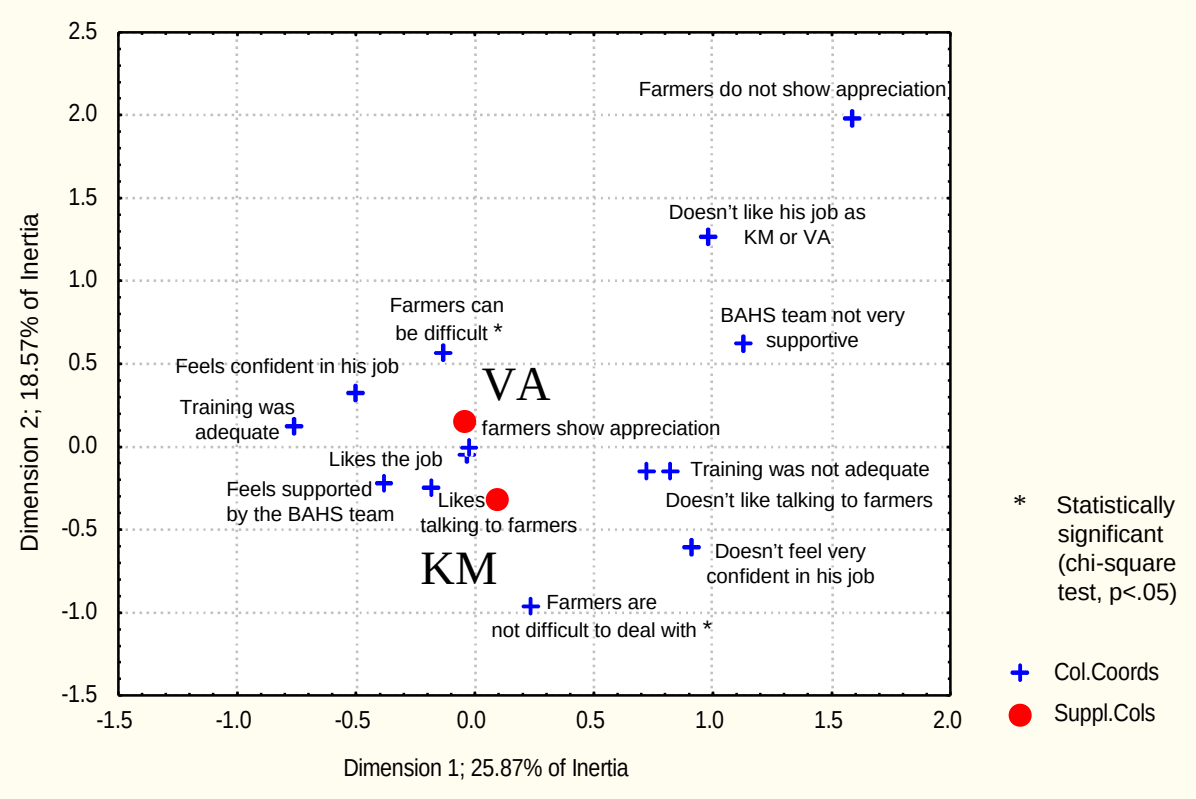


Figure IV-1: 2D Plot based on multiple correspondence analysis of job satisfaction and self-perception

The indicators of job-satisfaction and self-perception are displayed as column coordinates (Col.Coords) while the KM/VA-status is added as supplementary column points (Suppl.Cols). Chi-squared analysis results for cross-tabulated data are included.

The model explains 44 % of inertia using 2 dimensions. The first dimension mainly relates to BAHS-program aspects, whereas the second separates the study population according to their relationship with farmers.

The overall job satisfaction is clearly reflected by the closeness of a range of variables to both, KM and VA. These are statements such as "I like my job as a KM/VA", "I feel supported by the BAHS-team", "Farmers do show their appreciation for my efforts" and "I enjoy talking to farmers on BAHS issues".

Not getting positive feedback from farmers or not feeling supported, in turn are fairly unlikely for both groups.

There is, however, one issue perceived very differently by KM and VA. VA do experience difficulties more frequent when dealing with livestock farmers (73 %), as compared with KM (43 %), which is significantly different. When asked to specify those difficulties the following was disclosed: Fourty-percent of all 126 interviewees mentioned a misunderstanding of the BAHS concept by farmers, namely the principle of prevention rather than cure, issues of self-help, lack of co-operation by the Village Livestock Group and treatments on a cash rather than a loan basis.

Another 30 % of all VA and KM stated that there are communication problems (getting farmers together, inability to explain certain technical issues, cultural borders) and 17 % said, that farmers do have problems in accepting the current drug and treatment prices.

Discussion

The fact that the communities tended to select comparatively older farmer as KM is part of a culture of respecting elders in their communities. Meemark (1988) found the average age of keymen in northeast Thailand to be 39 years, almost identical to our situation. The BAHS project team advises against selection of KM of an advanced age (eg. four KM are older than 60 years) because of the physical nature involved in service delivery.

A weekly estimated BAHS workload of 3.7 days for KM as compared to 4.2 for VA is a remarkably high figure, considering the additional commitments of KM as farmers themselves. Although KM as well as VA are provided with a bicycle as part of the initial drug-box delivery, it is known that distances and absence of roads can result in every farm visit becoming a tiresome and time-consuming job. Woods (1998) found proximity to the clientele to be a crucial determinant of the quality and frequency of livestock services for the performance of veterinary technicians in Zimbabwe. Apart from farm visits, activities of KM and VA include bookkeeping, group-meetings and cash transfer and counts. The latter involves hand-over of cash to the treasurer of the village livestock group but also stocktaking whenever requested by either the BAHS-team or the village group. For a basic animal health project in north-east Thailand, keymen's bookkeeping is limited to filling in forms for drugs received/drugs sold (Meemark, 1988), whereas it is much more demanding in the case of the BAHS-program in Malawi. The differences in KM/VA locations according to ecological zones including distances to their BAHS-clientele have been evaluated recently (Hüttner et.al., 2000).

The vast majority of both groups enjoy their role in livestock service delivery. Almost all of the VA and 88 % of KM did organize meetings to promote the program and about two thirds of both groups thought that they did so successfully. The BAHS training, however, was not perceived to be adequate by half of KM and VA. Their first suggestion was regular refresher courses followed by more applied demonstrations and sessions on development of extension skills as shown in Table IV-1. It should be mentioned here, that the BAHS Project conducted regular refresher courses until 1997 and then committed VA and their supervisors to play an active part in KM training and supervision. This has apparently not worked well. One of the reasons is certainly due to changes (reduction) in the number of staff involved

with the BAHS-team.

Jones (1998) referred to an initial two weeks training for village animal health workers in southern Sudan followed by a refresher course after another 6-12 months. Apart from the initial training of 4 days mentioned earlier, the BAHS-team places much emphasis on ongoing supervision of KM in particular by veterinary field staff. The regular BAHS drug delivery tours provide an additional opportunity for supervision and discussion as is the annual stocktaking event attended by each livestock group.

In terms of service delivery, cattle as the economically most valued animals receive most of the attention. Pigs receive the least input in terms of drugs. This comes as no surprise because efforts by BAHS to promote enhanced pig production in villages so far have been rather modest. It is noticeable that KM as lay practitioners on average visited more farms more often than VA. There are, however, no significant differences between KM and VA in regards to average visit numbers, drug sales or treatments performed. KM apparently spent more visits on fewer animals when compared with VA, while VA at the same time sold more drugs. The latter figure is increased by sales of antibiotics and other relatively expensive injectables through VA. Even though VA on average had almost twice the turnover of KM, the large data variation and small sample size makes it difficult to reveal a clear picture. We would like to refer to our earlier statement that the number of VA and KM included in this calculation is not representative of all drug-box holders.

Seventy-three percent of VA and 43 % of KM said that they sometimes have difficulties when dealing with farmers. VA and KM attribute this problem to difficulties in being able to attract sufficient farmers on the one hand and poor understanding of the BAHS concept by farmers on the other. Government field staff in general have a reputation of passivity and inefficiency, which is inherited from previous days of pure state services Lechner and Böhm, 1990). It is also possible that tribal issues influence farmer's interest in the scheme. This is supported by almost two thirds of VA not belonging to the Tumbuka, who are predominant in the study area. This may be a factor that should be taken into consideration during future phases of the BAHS-program but remains to be further investigated.

When interpreting the responses that VA and KM provided in this survey, it has to be taken into account that there might have been a tendency to give positive rather than negative information in relation to the program, as VA and KM themselves receive a financial benefit from BAHS. This subjectivity and potential response bias does not invalidate the conclusions of the analysis, as it provides an important summary of VA/KM perceptions in relation to BAHS.

As illustrated in Figure IV-1, the overall job satisfaction of VA and KM involved in the BAHS-program is the foremost pattern emerging from this study. To a significant extent it is the result of the encouraging response they receive from their clientele. The feeling of support by the BAHS-team and enjoyment from talking to farmers is common in both groups. This is closely related to personal perceptions such as increased self-confidence and positive learning experiences. It is clear that for community-based livestock programs to be successful in the short- and sustainable in the long-term, village animal workers have to receive a perceived benefit from the program, which does not necessarily have to be measurable on purely economic grounds.

References

1. Abdel-Messieh, F., 1996. Basic Animal Health Services in the Kingdom of Lesotho. In: W. Zimmermann, D.U. Pfeiffer and K.H. Zessin (Eds.). Primary Animal Health Activities in Southern Africa. Proceedings of an International Seminar, 26 February - 8 March 1996, Mzuzu, Malawi. German Foundation for International Development, Feldafing, Germany. Pp. 324-331

2. Akabwai, D.M.O., 1992. Paravet training among Turkana pastoralists of Kenya. In: Daniels, P.W., Holden, S., Lewin, E., Dadi, S. (eds.): Livestock Services for Smallholder: A Critical Evaluation of the Delivery of Animal Health and Production Services to the Small-Scale Farmers in the Developing World. International Seminar Proceeding. 15-21 November 1992. Yogyakarta, Indonesia. pp 232-234

3. Arambulo P.V., Aleta I.R., Vallenas A., 1986. Community participation in veterinary public health and animal health in the Caribbean - Results of a preliminary survey. International Journal of Zoonoses13 (3), 162-73.

4. Baptist, R., Rajasmina, A., Rakotoarimanana, D., Rasambainarivo, J.H., 1994. Private Vets for the rural areas of Madagascar. 1994. The Kenya Veterinarian 18 (2) 510-512

5. Grandin, B., Thampy,R., Young, J., 1991. Village Animal Healthcare: A community-based approach to livestock development in Kenya. Intermediate Technology Publications, UK

6. Greenacre, M., 1992: Correspondence analysis in medical research, Statistical methods in medical research, 1992 I: 97-117

7. Hüttner, K., Leidl, K., Jere, F.B.D, Pfeiffer, D.U., 1998.. Target group orientation of a Basic Animal Health Service Program - First results of an impact assessment in northern Malawi. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 296-309

8. Hüttner K., Leidl K., Pfeiffer D.U., Jere F., Kasambara, D., (2000): Farm and Personal Characteristics of the Clientele of a community-based Animal Health Service Program in northern Malawi. Tropical Animal Health & Production, in press

9. Johnson, P.J., Chahuares, C., 1990. Training Anyamara veterinary technicians in the southern Peruvian Andes. Convergence, 23 (2): 14-22.

10. Jones, B.A., Deemer, B., Leyland, T.J., Mogga, W., Sterm, E., 1998. Community-based animal health services in Southern Sudan - The experience and future. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 107-133

11. Lechner, H.L.G. and Böhm, A., 1990. Assessment of the veterinary field service of Mzuzu A.D.D. in 1988/89 and recommendations for an improvement of efficiency. Mzuzu, Malawi, 162 pp.

12. Loehr, K.-F., 1989. The Basic Animal Health Service in North-East Thailand - The Principle of the Service. In: Proceedings of an International Seminar on Animal Health and Production Services for Village Livestock. 2 - 9 August 1989, Khon Kaen, Thailand, pp 37-39

13. Meemark, N., 1988. The Development and Evaluation of a Village-Based Parasite Control Program for Swamp Buffalo and Cattle in Northeast Thailand; Masters Thesis, Massey University. Palmerston North, New Zealand. 169 pp

14. Moktan, D., Mitchelhill, B.K., Joshi, Y.R., 1990. Village Animal Health Workers in the Koshi Hills.. Dhankuta District, Koshi Zone, Nepal, PCA Working Paper No. 4

15. Sulistiyo, U., Wahyuni, D., Leksmono, C.S., 1998. Village Animal Health Workers in Minahasa District North Sulawesi Indonesioa. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 340-349

16. Woods, P.S.A., Leonard, D., Nielen, M., Brand, A., 1998. The importance of proximity, transport and gender as factors affecting the efficiency of veterinary service delivery in Zimbabwe. . In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe, Volume I, pp. 238-242

V. CHAPTER

The effect of the BAHS-scheme on farm herd dynamics and husbandry applications *

* Edited version of a paper submitted to Livestock Production Science (under review)

Abstract

Livestock dynamics, off-take, mortality and husbandry measures of 96 randomly selected users of the BAHS-program were compared with 96 matched part-users and 96 non-users, respectively. More than 5000 farm visits were conducted between July 1997 and February 1999, of which 3724 visits were used for this evaluation.

Univariate and multivariable analyses were performed to compare farm characteristics and livestock performance among the three user categories. The results showed that users of the program maintaind larger herds of ruminants and more chickens compared to part-users and non-users. For non-users, mean monthly mortalities in calves (3.2 %), sheep and goats (2.8 %) and chickens (4.4 %) were twice as high compared to user farms (1,4 %, 1,3 % and 2.0 %). All livestock species monitored in this study showed a decline in numbers during the 14 months period of evaluation. There were large movements of cattle into and out of kraals. These were animals that were managed but not owned by respective farmers. Off-take rates varied considerably between different species and at different periods. The adjusted annual cattle off-takes between December 1997 and November 1998 on average were 10.5 % (users), 9.5 % (part-users) and 7.8 % (non-users). Users of the BAHS-program applied various livestock husbandry and management measures more often than either of the other groups.

During concluding interviews in January and February 1999, BAHS-users felt significantly more positive about the past year in terms of livestock health and production compared to part- and non-users. Overall, the results indicated a positive effect of the BAHS-program on animal health and productivity.

Materials & Methods

Farm-selection

Eleven KM and 21 VA were randomly selected from the 126 drug-box holders that operated within Mzuzu ADD as of June 1997. A minimum BAHS-involvement of 12 months was required for eligibility. At each of those 32 locations, three BAHS-users were selected randomly from the list of paid-up members. Another 3 part-users and 3 non-users of BAHS were selected in each area as matched cases, emphasis being given on similar livestock ownership to the BAHS-users. The selection was based on the knowledge of the respective KM and VA at those locations with the final decision being made together with the BAHS-team comprising of two veterinarians and three veterinary field supervisors.

Interviews

An initial questionnaire was conducted at all 288 farms in order to describe the social background, farm characteristics, livestock ownership and self-evaluation of farmers (Hüttner et al., 2000b). Interviews were conducted between July 1997 and October 1997 by the BAHS-team. In addition, a concluding interview was conducted at the end of the study period in January and February 1999. The final herd inventory, current prices for livestock and summary remarks of farmers were recorded.

Follow-ups

Follow-ups commenced after the initial questionnaire in July 1997 and finished in December 1998. Respective KM and VA serving the communities in selected areas conducted them. Farms were visited at 4-week intervals and all changes in livestock numbers and husbandry methods were recorded on a prepared farm-monitoring sheet. During the monitoring period the BAHS-team had to intervene only on few occasions. For instance, there were difficulties during the beginning of this exercise, mainly with KM who were not used to handling the relatively complex farm sheets. In some locations accessibility became an issue during the rainy season. We also had to handle expectations by a number of farmers, whereby some kind of regular bonus was anticipated in return of being involved in this exercise. A total of 5003 visits were conducted of which 3724 were used for the evaluation. This reduction became necessary because complete records of all 288 farms were obtained for the period between November 1997 and December 1998 only.

Calculation of rates

Off-take rates

Off-take rates were based on monthly totals of animals, which were sold, slaughtered or used for ceremonial purposes versus the respective number of animals kept during the very months. The denominator for 12- and 14-months off-takes was made up by the average herd-size. Off-take records were only determined for ruminants but not for chickens.

Mortality rates

Calculation of mortality rates were based on monthly totals of animals that died versus the respective number of animals kept during the very months

Data analysis

Data were stored using Microsoft ACCESS 2000 (Microsoft Corporation, Redmond, USA). GPS receivers were used to determine the precise locations of KM-houses and VA-stations within the study area. Maps were produced using the geographical information system software Arcview for Windows version 3.1 (ESRI Inc., Redlands, USA). The effect of user-status, visit number (month) and VA/KM-status as explanatory variables on mortality in calves, small ruminants and chickens was examined using a generalized estimated equations (GEE) model suitable for analysis of longitudinal data. GEE allows the mean of a population parameter to depend on a linear predictor through a non-linear link function and allows the response probability distribution to be any member of a range of different distributions (Zeger and Liang, 1986). The analysis of correlated data arising from repeated measurements when the measurements are assumed to be multivariate normal has been studied extensively. However, the normality assumption may not always be reasonable. GEE models provide a practical method with reasonable statistical efficiency to analyze such data.

Mortality as the dependent variable was expressed as a binomial variable (events/ trials). Farm visits, where the population at risk for a particular livestock species was zero, were excluded from the analysis. The first category of the categorical explanatory variables was used as the reference category as outlined in Tables 3,4 and 5. The statistical analyses were performed using NCSS 2000 (NCSS Statistical Software, Kaysville, Utah, USA) and PROC GENMOD in SAS for Windows version 8.0 (SAS Institute, Cary, NC, USA).

Results

Livestock Dynamics

Figures were summarized as averages according to the user-status for the period November 1997 to December 1998.

Herd sizes

The average cattle herd-size of BAHS-users of 16.2 (SD 9.5) was higher compared with part-users (13.8, SD 9.0) and non-users (11.5, SD 8.2), (Kruskal-Wallis test; Chi-square 183.6, df 2, p= .000). BAHS-users also kept larger herds of sheep and goats (mean 10.2, SD .37) than part- (8.4, SD .57) and non-users (9.6, SD .99), (Kruskal-Wallis test; Chi-square 26.4, df 2, p= .000). Similarly, BAHS-users maintained larger chicken flocks (22.2, SD 1.9) followed by part-users (19.1, SD 2.0) and non-users (16.9, SD 1.8) (Kruskal-Wallis test; Chi-square 48.4, df 2, p= .000).

Overall, there was a decline for all livestock species under investigation during the study period. The average cattle population across farmer-groups decreased by 10 % during the 14 months observation period (Figure V-1).

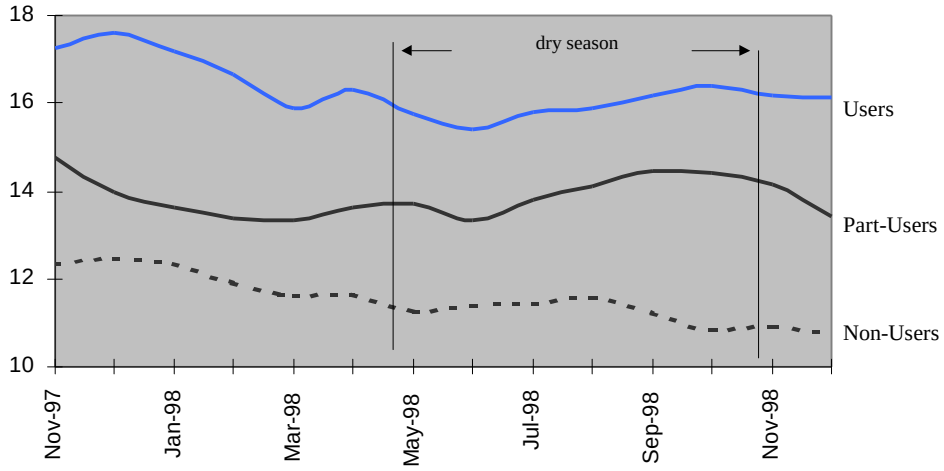


Figure V-1: Mean cattle herd-sizes between 11/1997 and 12/1998 stratified by farm-status (n=276)

This trend was more evident among non-users (13 %) than part-users (9 %) and users (6 %).

Figure V-2 shows the respective decline in small ruminants that came to 16 % of the opening stock (25 % for non-users, 19 % for part-users and 4 % for users).

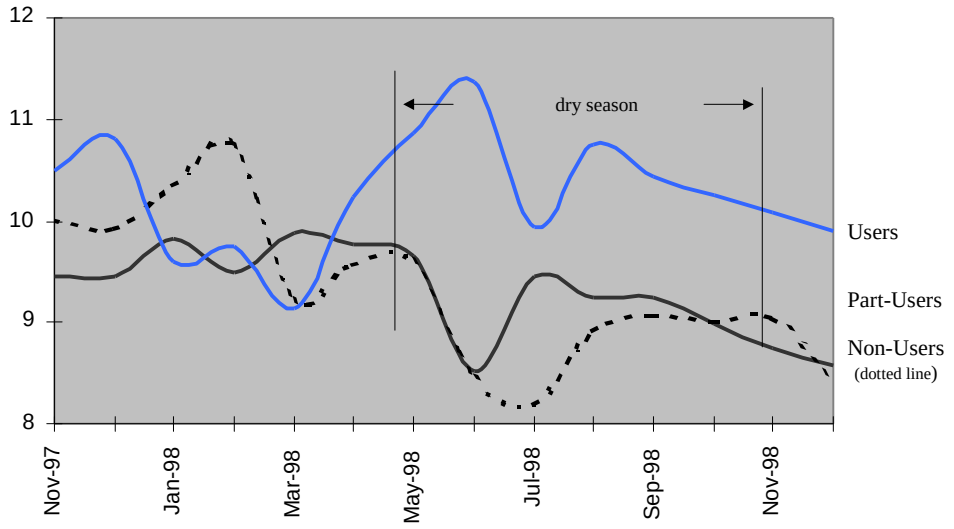


Figure V-2: Mean herd-sizes of small ruminants between 11/1997 and 12/1998 per farm-status (n=213)

Chicken flock sizes also decreased by 13% (9 % for non-users, 17 % for part-users and 14 % for users) which is illustrated Figure V-3.

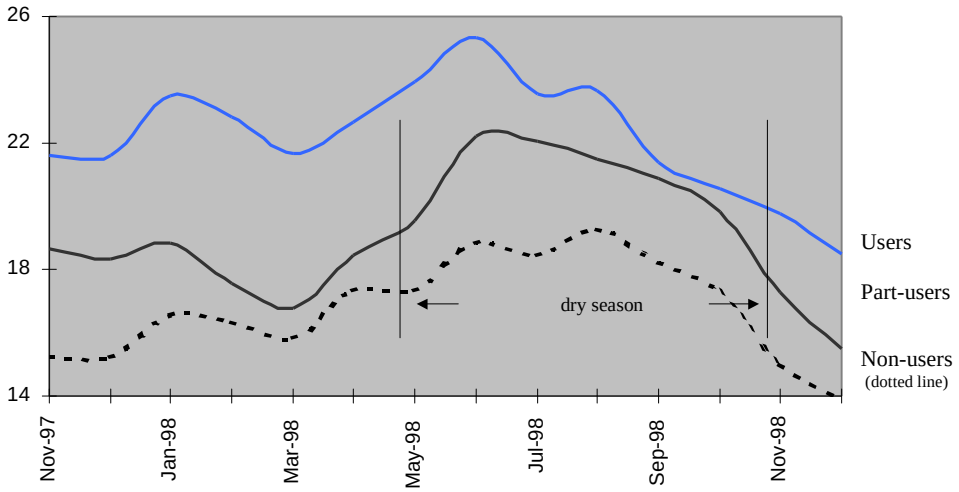


Figure V-3: Mean flock-size of village chickens between 11/1997 and 12/1998 stratified by farm-status (n=288)

Cattle movements in and out of herds

Large numbers of cattle were "brought in" or "moved away" from cattle kraals. These are animals, which were kept but not owned by respective study-farmers. In addition, animals such as oxen or bulls are commonly hired out and return later. Our monthly records allowed to distinguishing between cattle used as true off-takes and those moved. Figure V-4 shows the percentage of cattle moved into or out of the kraal summarized across farmer-groups because the temporal patterns were very similar. The calculation is based on monthly totals of cattle moved, against the annual average herd-sizes. There were no significant differences (Kruskal-Wallis test; Chi-square 2.2, df 2, p= .33) between farmer-groups. Two peaks in May and November 1998 occurred almost similar for both curves.

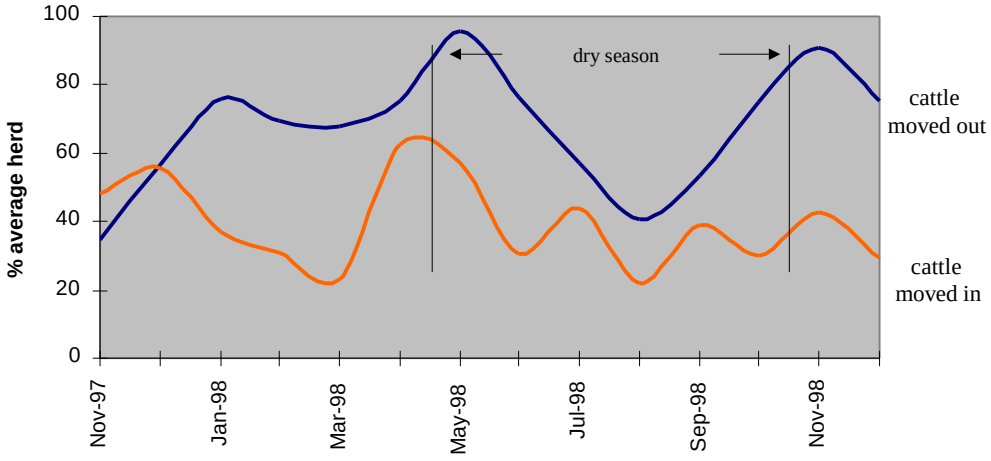


Figure V-4: Monthly percentage of cattle moved out of and into the kraal between 11/1997 and 12/1998 (n=276)

The average relative percentage of cattle moved out was 67.5 % (SD 23.4) compared to 39.4 % (SD 13.7) of cattle moved into kraals. Users on average moved the largest proportion of cattle out of their kraals (73.5 %, SD 17.2), followed by non- (68 %, SD 23.4) and part-users (60.4 %, SD 19.1). The percentage of cattle moved into kraals was 44.1 % (SD 25.3) for users, 37.2 % (SD 16.5) for part- and 37.0 % (SD 13.7) for non-users. The respective out/in ratios were 1.7, 1.6 and 1.9. These ratios were used to calculate adjusted cattle off-take rates. Out/in ratios also differed according to ecological zone. They were highest in the Highlands (2.6), followed by the Lakeshore (2.2) and the Plains (1.4).

Livestock off-take

Mean monthly cattle off-take

The mean monthly off-take rate between November 1997 and December 1998 was 1.74 % for BAHS-users (SD 0.64), 1.67 % for part-users (SD 1.1) and 1.62 % for non-users (SD 1.0), which is not significantly different (Kruskal-Wallis test; Chi-square 2.5, df 2, p= .28). Overall there was a common off-take pattern across all three groups. One peak occurred in January followed by larger peaks around May and again between September and November. Low monthly off-take rates occurred before the onset of the rains in October/November and between July and August.

Period-specific cattle off-take

Cattle off-take rates for periods of 12 and 14 months per farmer-group and ecological zone between November 1997 and December 1998 are shown in Table V-1.

Adjusted off-takes rates were calculated under the assumption of equal proportions of cattle being "moved in and out" of kraals for reasons other than off-takes. Average herd-sizes, therefore, have been multiplied with out/in-ratios as explained earlier.

BAHS-users had the highest 12- and 14-months (adjusted and non-adjusted) off-take rates followed by part- and non-users throughout all periods. There were fairly large variations within the groups during different underlying periods. No significant differences were found between groups. Looking at ecological zones (not adjusted for cattle movements) shows, that Lakeshore-farmers had the highest off-takes and farmers in the Plains sold or slaughtered the lowest number of cattle off their herds, which is significantly different for all periods under investigation. Applying adjusted rates change this sequence, whereby farmers in the Plains had the highest off-take followed by those at the Lakeshores and the Highlands, which is independent of farm-status and remains significantly different.

Table V-1: Adjusted and non-adjusted cattle off-take rates according to farm-status and ecological zone (n=276)

	non-adjusted off-take rate no consideration for in/out ratios				**adjusted off-take rates** including ratios as specified below	
	annual off-take rates (SD)			14 months off-take rates (SD)	annual off-take rates (SD)	14 months off-take rates (SD)
status / zone	**11'97-10'98** n=3200	**12'97-11'98** n=3192	**1'98-12'98** n=3181	**11'97-12'98** n=3719	**12'97-11'98** n=3192	**11'97-12'98** n=3719
non-users	14.2 (15.3)	14.6 (15.1)	15.4 (15.7)	17.1 (16.8)	7.69 (7.93)	9.0 (8.9) ratio = 1.9
part-users	13.54 (15.6)	15.2 (16.7)	16.4 (18.8)	17.3 (18.2)	9.50 (10.47)	10.8 (11.4) ratio = 1.6
users	16.4 (17.7)	18.0 (18.9)	18.5 (18.6)	20.5 (20.0)	10.5 (11.13)	12.1 (11.8) ratio = 1.7
p-value and $\chi 2$ statistics	0.39 (1.84, df 2)	0.47 (1.54, df 2)	0.38 (1.95, df 2)	0.37 (1.96. df 2)	0.45 (1.51, df 2)	0.32 (2.11. df 2)
Highlands	17.3 (17.2)	18.2 (17.0)	18.9 (18.6)	20.9 (19.9)	6.98 (6.54)	8.0 (7.7) ratio = 2.6
Lakeshore	16.7 (17.0)	20.5 (20.8)	22.3 (21.9)	22.9 (21.5)	9.29 (9.46)	9.5 (9.0) ratio = 2.2
Plains	10.9 (15.1)	11.7 (15.6)	12.3 (15.4)	13.8 (16.2)	9.51 (11.13)	11.0 (11.5) ratio = 1.4
p-value and $\chi 2$ statistics	.034 (6.79, df 2)	.022 (7.61, df 2)	.019 (7.89, df 2)	.023 (7.56, df 2)	.019 (7.84, df 2)	.021 (7.93, df 2)

Mean monthly off-take for small ruminants

Farmers sold or slaughtered sheep and goats more frequent compared to cattle. Users and part-users followed a fairly similar pattern with peaks around January, June and November, while non-users showed recurrent peaks more frequently.

Non-users on average had a monthly off-take rate of 5.4 % (SD 3.0) followed by part-users with 4.4 % (SD 3.3) and BAHS-users with 4.3 % (SD 2.8), which is not significantly different (Kruskal-Wallis test; Chi-square 1.32, df 2, p = .52). Off-takes were commonly low during February/March and again during August/September.

Period-specific off-take rates for small ruminants

Period-specific off-take rates for sheep and goats between 11'97 and 12'98 are shown in Table V-2.

Non-users maintained the largest off-take rates throughout the specified period, followed by either BAHS-users or part-users. The annual off-take was generally high amongst study-farms ranging between 31 % and almost 45 % of the annual average herd-size. No significant differences were found between groups. There were no indications of large movements of sheep and goats due to reasons other than off-takes unlike the data for cattle. Thus, no adjusted off-takes were calculated.

Table V-2: Off-take rates of sheep and goats according to farm-status and ecological zone (n=213)

	annual off-take rates (SD)			14 months off-take rates (SD)
status/zone	**11'97-10'98**	**12'97-11'98**	**1'98-12'98**	**11'97-12'98**
non-users	42.2 (39.9)	44.3 (38.9)	44.8 (38.9)	52.2 (44.5)
part-users	35.1 (30.4)	37.1 (37.3)	34.8 (32.9)	40.6 (37.0)
users	31.6 (29.6)	36.4 (33.0)	36.4 (35.1)	42.9 (38.6)
p-value (χ2 statistics)	0.37 (1.98, df 2)	0.47 (1.50, df 2)	0.32 (2.29, df 2)	0.39 (1.86. df 2)
Highlands	33.7 (34.4)	36.6 (36.3)	37.1 (36.9)	42.9 (40.4)
Lakeshores	49.5 (36.7)	57.4 (47.8)	49.4 (40.2)	58.7 (48.8)
Plains	35.4 (32.5)	37.6 (33.7)	37.4 (34.2)	44.0 (38.3)
p-value and χ2 statistics	0.14 (3.95, df 2)	0.10 (4.48, df 2)	0.36 (2.07, df 2)	0.33 (2.22, df 2)

Comparing off-take rates according to ecological zones shows that farmers at the Lakeshores had the highest rates followed by farmers in the Plains and in the Highlands. There were no significant differences between the zones.

Livestock mortality

The monthly pattern of mortalities in calves, adult cattle, small ruminants (kids plus adults combined) and adult chickens is shown in Figure V-5.

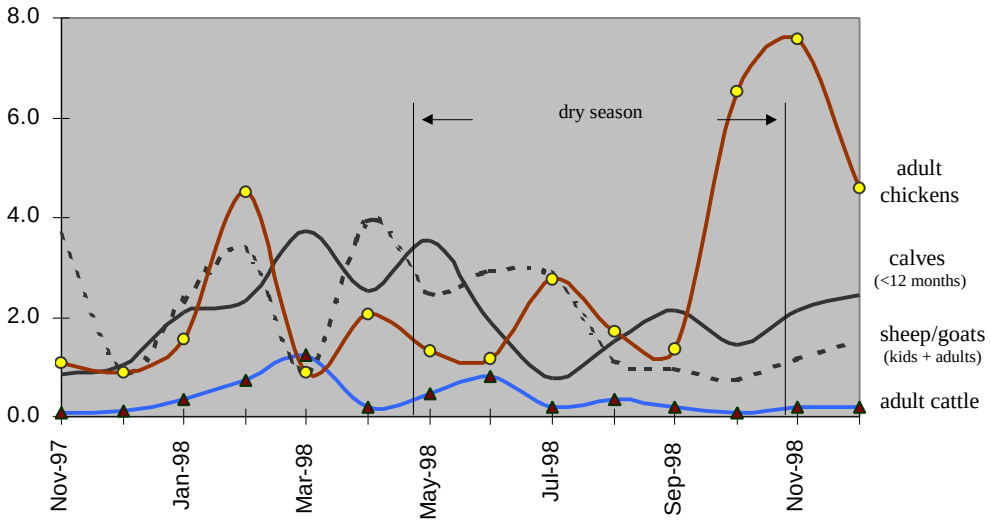


Figure V-5: Mean monthly mortality rates for calves, adult cattle, sheep and goats and chickens between 11/1997 and 12/1998

The lowest monthly mortality of all species occurred towards the end of the dry season around September/October 1998.

Calf mortality

Non-users on average had a mean monthly calf mortality rate of 3.2 % (SD 1.9) followed by part-users (1.5 %, SD 1.1) and BAHS-users (1.4 %, SD 0.9), which is not significantly different in the univariate analysis (Kruskal-Wallis test; Chi-square 2.31, df 2, p= .31). Fifty percent of BAHS-users (47/94) did not experience any calf mortality. Similarly, 45 % (41/91) of part-users and 43 % (39/91) of non-users did not loose any calf. The results of multivariable analysis of calf mortality using a GEE model are presented in Table V-3.

Table V-3: Final generalized estimating equation model looking at the effects of farm-status, visit number and KM/VA-status on calf mortality between 11/1997 and 12/1998 (n=264)

parameter	level	estimate	standard error	OR	Z	P
intercept	-	-5.3737	-	-	-	-
visit	1 (Nov.'97)	-	-	1	-	-
	2 (Dec.'97)	0.8457	.6238	2.330	1.36	.111
	3 (Jan.'98)	1.3578	.6110	3.888	2.22	.001
	4 (Feb.'98)	1.7909	.5779	5.995	3.10	.000
	5 (Mar.'98)	1.6391	.6001	5.151	2.73	.001
	6 (Apr.'98)	1.6888	.6037	5.413	2.80	.000
	7 (May'98)	1.8398	.5791	6.295	3.18	.000
	8 (Jun.'98)	1.7393	.5969	5.693	2.91	.000
	9 (Jul.'98)	1.3171	.5728	3.733	2.30	.010
	10 (Aug.'98)	1.0530	.6086	2.866	1.73	.045
	11 (Sep.'98)	1.3689	.5887	3.931	2.33	.007
	12 (Oct.'98)	1.0875	.6637	2.967	1.64	.037
	13 (Nov.'98)	0.9728	.6637	2.645	1.47	.067
	14 (Dec.'98)	1.0851	.5777	2.960	1.88	.040
farm-status	user	-	-	1	-	-
	part-user	0.2651	.2095	1.304	1.27	.1001
	non-user	0.3802	.2121	1.463	1.79	.0218

Visit number (month) had a significant effect on calf mortality. Calves being monitored at the first (November 1997) compared to the following visits had higher odds of death for all but the second (December), and the 13th (November 1998) visit. The respective odds ratios varied between 1.6 (October 1998) and 3.2 (May 1998). In addition, user status was significantly associated with calf mortality. Non-users had a 1.8 higher odds of experiencing calf mortality compared to users of BAHS.

Cattle mortality

Part-users on average had a mean monthly adult cattle mortality rate of 0.44 % (SD 0.77) followed by non-users (0.39 %, SD 0.53) and BAHS-users (0.3 %, SD 0.16), which is not significantly different (Kruskal-Wallis test; Chi-square 2.4, df 2, p= .91). Relatively higher adult cattle fatalities occurred between February and June (calving season commences in May).

Mortality in small ruminants

Mortality in small ruminants was assessed for kids and adults combined. Animals were not tagged, which made it difficult to accurately distinguish between young and mature animals especially at 4-7 month of age.

Non-users had a mean monthly mortality rate in sheep and goats of 2.8 % (SD 2.2) followed by part-users with 2.1 % (SD 1.8) and BAHS-users with 1.3 % (SD 0.8), which is not significantly different (Kruskal-Wallis test; Chi-square 3.0, df 2, p= .22). A peak occurred during the rains between November and May and a general decline towards the end of the dry season in October. The final GEE model for mortality in sheep and goats is presented in Table V-4.

Table V-4: Final generalized estimating equation model looking at the effects of farm-status, visit number and KM/VA-status on small ruminant mortality between 11/1997 and 12/1998 (n=212)

parameter	level	estimate	standard error	OR	Z	P
intercept	-	-4.4489				
visit	1 (Nov.'97)	-	-	1	-	-
	2 (Dec.'97)	-0.8676	.4247	0.420	-2.04	.011
	3 (Jan.'98)	-0.2052	.4368	0.814	-0.47	.482
	4 (Feb.'98)	0.1159	.4180	1.123	0.28	.601
	5 (Mar.'98)	0.1168	.5096	1.124	0.23	.584
	6 (Apr.'98)	0.6096	.4460	1.840	1.37	.007
	7 (May'98)	0.8441	.4561	2.326	1.85	.000
	8 (Jun.'98)	0.6071	.4079	1.835	1.49	.007
	9 (Jul.'98)	0.5760	.4561	1.779	1.26	.013
	10 (Aug.'98)	-0.4500	.4833	0.638	-0.93	.141
	11 (Sep.'98)	-0.1546	.4821	0.857	-0.32	.615
	12 (Oct.'98)	-0.4588	.4941	0.632	-0.93	.155
	13 (Nov.'98)	-0.3817	.4977	0.683	-0.77	.235
	14 (Dec.'98)	-0.4734	.5254	0.623	-0.90	.129
zone	Plains	-	-	1	-	-
	Highlands	0.4771	.2115	1.611	2.26	.000
	Lakeshore	0.2228	.4547	1.250	0.49	.369

The animals had a significantly higher probability of death between the sixth and ninth visits (cool dry) compared to the first visit in November 1997. The respective odds ratios varied between 1.4 and 1.9 whereas the odds of death were about half during the time of the second visit (December 1997) compared to the first visit.

Ecological zones too had a significant effect on small ruminant mortality. The odds of death for animals kept in the Highlands was 2.3 compared to those kept in the Plains.

Adult chickens mortality

Non -users had a monthly adult chicken mortality rate of 4.4 % (SD 7.7), followed by BAHS-users with 2.6 % (SD 2.2) and part-users with 2.0 % (SD 1.8), which is not significantly different (Kruskal-Wallis test; Chi-square 2.0, df 2, p= .98). The highest mortality occurred between September and December 1998. The final GEE model in Table V-5 shows a significant association between adult chicken mortality and visit number.

Table V-5: Final generalized estimating equation model looking at the effects of farm-status, visit number and KM/VA-status on chicken mortality between 11/1997 and 12/1998 (n=283)

parameter	level	estimate	standard error	OR	Z	P
intercept	-	-4.2642	-	-	-	-
visit	1 (Nov.'97)	-	-	1	-	-
	2 (Dec.'97)	-0.6523	.5048	0.521	-1.29	.019
	3 (Jan.'98)	0.0943	.4510	1.099	0.21	.636
	4 (Feb.'98)	0.3121	.4501	1.366	0.69	.116
	5 (Mar.'98)	0.0829	.4768	1.086	0.17	.670
	6 (Apr.'98)	0.1488	.4285	1.160	0.35	.474
	7 (May'98)	-0.5998	.4693	0.549	-1.28	.030
	8 (Jun.'98)	0.0849	.4799	1.089	0.18	.654
	9 (Jul.'98)	0.4381	.4506	1.550	0.97	.028
	10 (Aug.'98)	-0.6998	.5487	0.497	-1.28	.008
	11 (Sep.'98)	-1.2260	.5359	0.293	-2.29	.000
	12 (Oct.'98)	0.3001	.4767	1.350	0.63	.139
	13 (Nov.'98)	-0.1829	.4505	0.833	-0.41	.451
	14 (Dec.'98)	0.7459	.5162	2.108	1.45	.000

The odds of death for these animals was lower at the second, seventh, tenth and eleventh visit compared to the first visit and varied between 0.29 and 0.55. A higher odds of death was 2.1 for the last- and 1.6 for the ninth compared to the first visit.

Livestock Husbandry Applications

Table V-6 shows the results of chi-squared cross-tabulation of the frequencies of selected husbandry measures, which were applied by the farmers.

Table V-6: Frequency of use of selected husbandry measures between 11/1997 and 12/1998 stratified by farm status including c^2 statistics (n=276)

measure	**percent yes**			p-value
	non-users n=92	**part-users** n=90	**users** n=94	(χ^2 statistics)
Cattle kraal repaired?	42.7	52.1	58.3	.09 (χ^2 4.75, df 2)
New cattle kraal built?	27.1	24.0	26.0	.88 (χ^2 .25, df 2)
Calf house repaired?	5.2	6.3	17.7	.005 (χ^2 10.5, df 2)
New calf shed constructed?	14.6	15.6	22.9	.26 (χ^2 2.72, df 2)
Chicken house repaired?	24.0	20.8	25.0	.77 (χ^2 .50, df 2)
New chicken house built?	13.5	16.7	21.9	.03 (χ^2 2.37, df 2)
Sheep/goats shed repaired?	27.1	27.1	35.4	.34 (χ^2 2.12, df 2)
New sheep/goat shed built?	13.5	20.8	21.9	.27 (χ^2 2.59, df 2)
Cattle manure applied?	86.5	84.4	87.5	.82 (χ^2 .41, df 2)
Chickens manure applied?	67.7	64.6	64.6	.87 (χ^2 6.28, df 2)
Sheep/goat manure applied?	56.3	62.5	58.3	.67 (χ^2 .80, df 2)
Drinkers for chickens in use?	75.0	76.0	83.3	.31 (χ^2 2.32, df 2)
Nests provided for hens?	78.1	79.2	79.2	.98 (χ^2 .04, df 2)

Most of the husbandry measures are not significantly different between farmer-groups but their frequencies indicate a higher adoption of improved husbandry by BAHS-users for almost all selected measures.

Seasonal pattern of selected husbandry measures

Figure V-6 presents the total number of monthly cattle-kraal repairs.

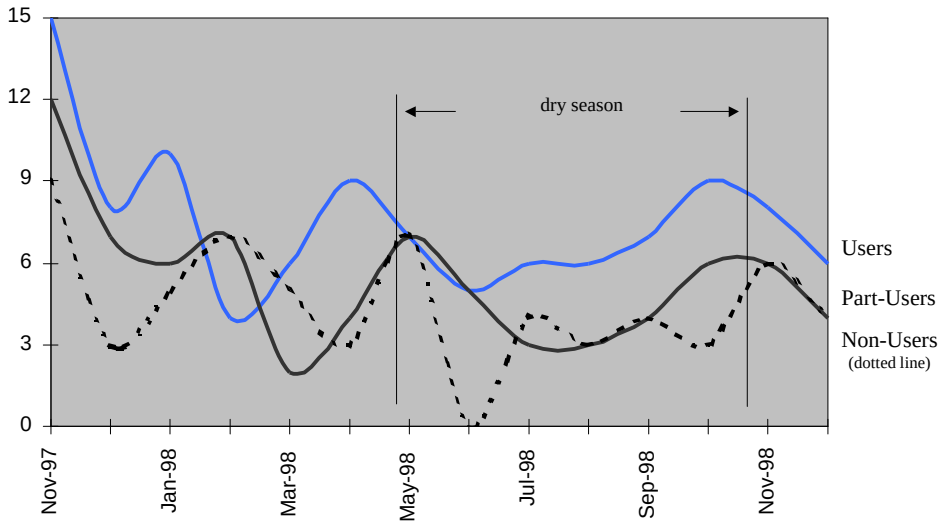


Figure V-6: Temporal pattern of cattle-kraal-repairs as monthly totals between 11/1997 and 12/1998 stratified by farm-status (n=276)

Most repair work happened around the onset and during the wet season with a peak during November for all farmer-groups.

Figure V-7 shows the frequency of nest-provision for brooding hens in villages.

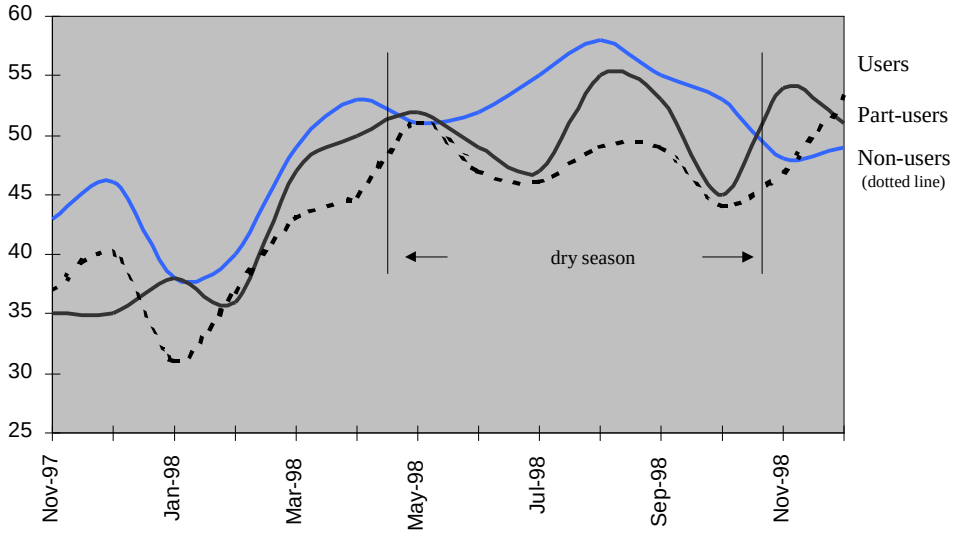


Figure V-7: Temporal pattern of nest provision for brooding hens as monthly totals between 11/1997 and 12/1998 stratified by farm-status (n=288)

The proportion of farmers providing nests was comparably high. Fourty-four non-users (SD 6.1), 46 part-users (SD 7.2) and 49 BAHS-users (SD 5.8) on average applied this measure. It means that about half of all selected farmers monitored their brooding hens regularly. All curves show a similar shape over time with a decline during January and the highest levels between May and September 1998, except for non-users, who had the highest level during the last visit.

Figure V-8 shows the monthly number of farms providing drinkers to their flocks stratified by farm-status.

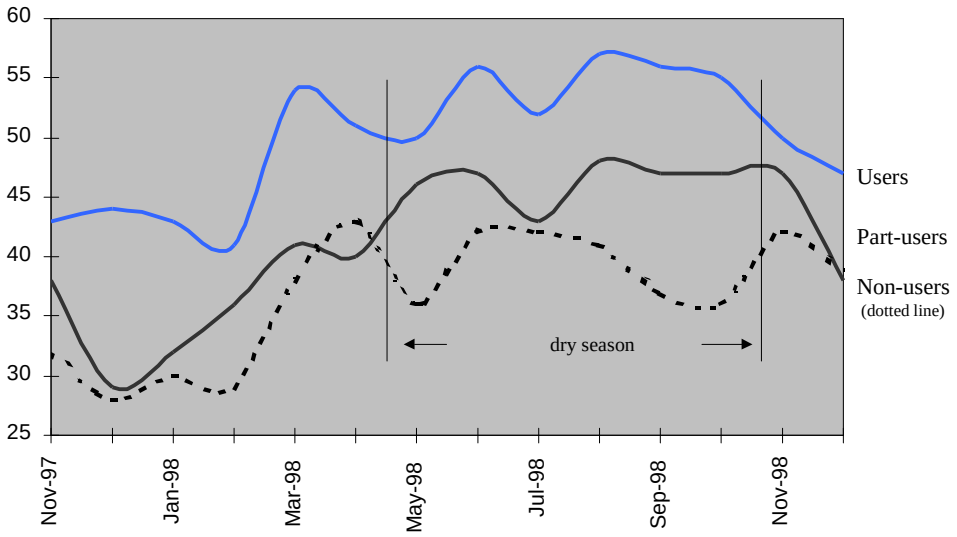


Figure V-8: Temporal distribution of drinker-provision for chicken-flocks as monthly totals between 11/1997 and 12/1998 stratified by farm-status (n=288)

There were on average 37 non-users (SD 5.2), 41 part-users (SD 6.1) and 50 BAHS-users ensuring that chickens-flock had access to proper drinkers during respective months. The graph shows, that during the peak of the rains (December to February) drinkers were less frequently used, which applied to all farmer-groups.

Farmer's perception about the observation period

As part of the concluding visits in January/February 1990, farmers were asked about their perception towards the past 14 months in terms of livestock health and production. BAHS-users had a significantly more positive view compared to part-and non-users (Table V-7).

Table V-7: Farmers judgment about their livestock production during the study period in comparison with previous years (n=288)

(χ^2 167.6, df 6, p = .000)

status	bad	normal	better
non-users	42	26	28
part-users	38	27	31
BAHS-user	31	17	48

Discussion & Conclusions

All livestock species monitored during this study showed a decline in total numbers overall. However, chicken flock-sizes as a rule show large variations within the traditional farming system in Malawi (Ahlers, 1999) and developing countries in general (Ajuyah, 1999; Kitalyi, 1999; Mallia, 1999). For this reason, the current level of decline is not likely to lead to major concerns about the chicken population in the study area. Nonetheless, losses in village chickens are largely reducible by applying better management practices and also through improved uptake of vaccine against Newcastle Disease (Ahlers et al., 1999).

The issue of a shrinking ruminant-population particularly in cattle, however, has a different background compared to chickens. Cattle herds are traditionally held very stable. Moreover, the natural conditions in the study area, including pasture availability still allow an extension of cattle herds, which is different in the central- and more so southern region of Malawi. In addition, the exceptional population growth in Malawi has led to a strong demand for livestock and livestock products, which is currently only met by rising imports from neighboring countries (The World Bank Group, 1999). A Danish appraisal mission noted a decline in national cattle numbers, which commenced already during the late eighties (Malawi Report, 1999). This decline apparently accelerated since 1992. Possible reasons cited in the same report included the repatriation of almost 1 Mio refugees (including their livestock) to Mozambique, and also an alarming rate of cattle thefts during the nineties. Whole herds were (and still are) stolen and moved across borders. The latter, however, was not an issue on our study farms. The Danish report mentioned stagnant productivity under traditional livestock management as another contributing factor for a decline in the national livestock population.

Our results show, that annual cattle off-takes (adjusted and non-adjusted) are comparably high for all user-groups (Table V-1). Ngategize (1989) estimated the annual off-take of smallholder cattle farmers in northern Tanzania at 5 %. Perry et al. (1984) studied traditionally managed cattle herds in Zambia and found a mean off-take of 10 %. Rodgers and Homewood (1986) investigated cattle herds in northwestern areas in Tanzania and reported a mean annual off-take of 8 %. It is likely, that the issue of cattle movements in and out of kraals for reasons other than off-takes explains the decline in cattle numbers on one hand and the seemingly high off-take rates on the other. A possible explanation of much larger removals than returns of cattle is likely to be the strong demand for livestock and livestock products and/or higher requirements for cash by people that own these animals. The largest relative percentage of animals is moved during May and around November. During May, maize as the main staple food is harvested and dried. Grazing of animals on communal land is less restrictive in terms of potential crop damage. We know, for instance, that people at the Lakeshores return large numbers of cattle from uninhabited mountainous bush areas during May because of the latter. During this time loans are also commonly repaid in either cash or alternatives such as agricultural products. April/May also mark the beginning of the main calving season. During November, which is the planting season, demand for cash and loans is very strong, mainly because of need for fertilizer and seeds. Controlled grazing becomes essential during this time.

These are factors, which possibly had an impact on cattle movements and off-takes that might have led to a bias towards the actual cattle herd-size of the kraal-owners during the observation period. It would be important for future BAHS-expansion to assess, whether kraal-owners direct the same degree of attention to animals, other than their own.

Our results suggest that BAHS-users not only had the highest cattle off-takes but also managed more stable cattle herd-dynamics as compared to either of the other groups. Lower mortalities in young and adult stock by BAHS-users are highly likely to have contributed to that. Data retrieved earlier from the initial questionnaire defined BAHS-users as farmers that were already better educated and better motivated and that owned significantly more livestock compared to part- and non-users (Hüttner et al., 2000b). Ownership of more livestock, therefore, is certainly a driving force for a strong interest in the BAHS-program. Nonetheless, the level of livestock mortality is influenced by various other factors. Visit number, equivalent to months and thus an expression of season is significantly associated with mortality for all species under investigation. Calf mortality is highest between March and May. The calving season commences in April/May and earlier findings (Wanda, 1994) showed that 30 % of all newborn calves died within the first four weeks of life, confirming the seasonal pattern of death in young calves (Norman et al., 1997). For small ruminants, mortalities during the cooler months between April and June are significantly higher compared to November, which is irrespective of the BAHS-user status. Helminthiasis, particularly infections caused by *Haemonchus spp*., respiratory diseases but also management constraints are major contributors to death in sheep and goats in Malawi, whereby little is known about seasonal patterns (Edelsten, 1992). In addition, ecological zone was significantly associated with small ruminant mortality. Sheep and goats kept in the Highlands have a higher odds of death than those kept in the Plains or at the Lakeshores. It is possible that religion attributes to the degree of attention to these animals, with predominantly Islamic influence at the Lakeshores.

Our mean monthly mortality rates in adult chickens between 2 % and 4.4 % are well below of what Ahlers (1999) found on study farms within Mzuzu ADD. Her mean monthly mortality rate came to 9.2 % in hens and 9.9 % in cocks. It is likely that the different study design with the explicit focus on village chicken flocks involving daily visits has lead to more realistic results. This was one of the reasons not to attempt the evaluation of chick's mortality because this figure changes daily. The seasonal pattern of adult chicken mortality as shown in Figure V-5 matches those identified by Ahlers (1999).

Livestock husbandry

Results of the initial questionnaire already provided some indications as to the disparities of husbandry measures applied through groups of study-farmers (Hüttner et al., 2000b). These finding are complemented by the outcome of the current longitudinal study results.
BAHS-users apply better husbandry and management practices more frequently than either of the other groups (Table V-6). Measures such as repair of calf-pens or complete overhaul of chicken-houses occurred significantly more frequent amongst BAHS-users than in either of the other groups. Farmers of all groups, though in varying proportions, clearly followed a seasonal calendar while being engaged in all sorts of management activities.
Addressing the issue of improved husbandry, however, may not just be based on intensified extension efforts and education. In the context of the Aids epidemic in Sub-Saharan Africa, lack of labour becomes more and more important in these production systems (Anon., 1999). In addition, natural building material already is difficult to obtain in certain parts within the Project-area, because forests and natural bush are rapidly disappearing due to deforestation and land degrading. This all has to be considered when further planning is undertaken by the BAHS-program.

Despite these constraints, the results of our study show the benefits, which can be obtained by utilizing BAHS. Losses in young and adult stock can be reduced and higher cattle off-take in conjunction with more stable cattle herds appears likely through usage of BAHS. This is supported by the judgment of study-farmers made at the end of the observation period, whereby significantly more BAHS-users were satisfied with health and productivity of their livestock compared to part- and non-users. However, our study farms represent households with larger livestock and thus better income compared with the general population. Involvement of all livestock holders in the Project area is one of the goals to be achieved by the BAHS-Project. It is therefore crucial to address the special needs of the majority of poorer families that own chickens, ducks or rabbits only.

References

1. Ahlers, C. 1999. Characteristics and constraints of the traditional poultry keeping system in northern Malawi; Doctorate Thesis, Free University Berlin, Germany, 175 pp.

2. Ajuyah, A. O, 1999. Rural family poultry production in the South Pacific Region. The First INFPD/FAO Electronic Conference on Family Poultry Http://www.Fao.Org/Waicent/Faoinfo/Agricult/Aga/Agap/Lps/Fampo/Leadpap4.Htm

3. Anon., 1999. Aids in Africa, http://www.unaids.org/highband/fact/saepap98.html Globale Aids-Situation: http://www.rki.de/INFEKT/AIDS_STD/GLOBAL/GLB_SEL.HTM

4. De Jode, A., Reynolds, L. and Matthewman, R. W., 1992. Cattle production systems in the derived savannah and southern guinea savannah regions of Oyo State, Southern Nigeria; Tropical Animal Health & Production, 24, 90-96

5. Edelsten, R.M., 1992. Health and husbandry of sheep and goats in Malawi. Proceedings of a Workshop on Small Ruminants Activities in Malawi. 5th - 8th October 1992, Capital Hotel, Lilongwe, Malawi, pp. 149-155

6. Hüttner, K., Leidl, K., Jere, F.B.D. and Pfeiffer, D.U., 2000a. Characteristics and Performance of Village Animal Health Workers and Veterinary Assistants in northern Malawi, Journal of the South African Veterinary Association, in press

7. Hüttner, K., Leidl, K., Pfeiffer, D.U., Jere, F.B.D. and Kasambara, D., 2000b. Farm and Personal Characteristics of the Clientele of a Community-based Animal Health Service Program in northern Malawi. Tropical Animal Health & Production, in press

8. Jemal, A., Justic, D. and Hugh-Jones M.E., 1995. The estimated long-term impact of Tsetse control on the size of the population of cattle in the Didessa Valley, Western Ethiopia. Veterinary Research Communication 19, 479-485

9. Jones, B.A., Deemer, B., Leyland, T.J., Mogga, W. and Sterm, E. 1998. Community-based animal health services in Southern Sudan; The experience and future. In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe (in press)

10. Kitalyi, A.J. 1999. Family poultry management systems in Africa. The First INFPD/FAO Electronic Conference on Family Poultry Http://www.Fao.Org/Waicent/Faoinfo/Agricult/Aga/Agap/Lps/Fampo/Leadpap3.Htm

11. Kudi,A.C., Umoh, J.U., Eduvie, L.O. and Gefu, J., 1998. Relative survival of calves in 16 traditionally managed herds in Bauchi, Nigeria. Preventive Veterinary Medicine, 36: 307-312.

12. Malawi Report, 1999. Malawi National Livestock Development Masterplan. Final Report, Lilongwe, Malawi, 114 pp

13. Meemark, N., 1988. The Development and Evaluation of a Village-Based Parasite Control Program for Swamp Buffalo and Cattle in Northeast Thailand; Masters Thesis, Massey University. Palmerston North, New Zealand. 169 pp

14. Mallia, J.G., 1999. Observations on family poultry units in parts of Central America and sustainable development opportunities. The First INFPD/FAO Electronic Conference on Family Poultry, Http://www.Fao.Org/Waicent/Faoinfo/Agricult/Aga/Agap/Lps/Fampo/Freeco13.Htm

15. Ngategize, P.K., 1989. Economic Evaluation of Improved Management for Zebu Cattle in Northern Tanzania. Agricultural Systems 31 (1989) 305-314

16. Norman, N.; Claes, L., Soldan, N., Banda, M., 1997. Observations on undipped Malawi Zebu cattle. In: Zimmermann, W., Pfeiffer, D.U., Zessin, K.H. (Eds.): Primary Animal Health Care Activities in Southern Africa, Proceedings of an International Seminar held in Mzuzu, Malawi, February 26 to March 8 1996, pp. 90-107

17. Perry, B. D., Mwanaumo, B.; Schels, H. F.; Eicher, E. and Zaman, M. R., 1984. A study of health and productivity of traditionally managed cattle in Zambia. Preventive Veterinary Medicine, 2: 633-653

18. Rodgers, W. A. and Homewood K. M., 1986. Cattle dynamics in a pastoral community in Ngorongoro, Tanzania, during the 1982-3 drought. Agricultural Systems, 22: 33-51.

19. Safalaoh, A. C. L Characteristics of indigenous chickens of Malawi. Animal Genetic Resources Information. 1997. No. 22, pp. 61-69

20. Soereth-Böntgen, D., 1999. Karonga ADD Livestock Statistics between 1993 and 1997 (personal communication)

21. Schreuder, B. E. C., Noorman, N., Halimi, M. and Wassink, G., 1996. Livestock mortality in Afghanistan in districts with and without a veterinary program. Tropical Animal Health & Production, 28, 129-136

22. Sulistiyo, U., Wahyuni, D. and Leksmono, C.S., 1998. Village Animal Health Workers in Minahasa District North Sulawesi Indonesia. . In: Proceedings of the 9th International Conference of the Association of Institutions of Tropical Veterinary Medicine (AITVM), 14-18 September 1998, Harare, Zimbabwe (in press).

23. Tuah, K. and Yaa Nyamaa, D., 1985. Preliminary studies on the performance and productivity indices of N'dama and West African Shorthorn cattle in Ghana. Tropical Animal Health & Production, 17, 114-120

24. Zeger, S.L. and Liang, K.Y., 1986. Longitudinal data analysis for discrete and continuous outcomes. Biometrics 42, 121-30

VI. CHAPTER

Economic Evaluation of the BAHS-Program

Abstract

Partial budget analysis was used to evaluate the economic benefits farmers at different levels can obtain by using BAHS. The spreadsheet model was based on figures derived from the longitudinal study (V.Chapter) but also on findings from other studies. Full users achieved higher net returns from livestock production compared to part- and non-users. Annual returns were in the range of US$ 19-22, US$ 625-650 and US$ 2915-3014 according to farming level, classified as subsistence, small or larger farms.

A cost benefit analysis was done to assess the economic merits of implementing the BAHS-program at the regional level. Assuming a total of 5,500 full-user households for the study area and about 55,000 part-user households out of a total number of about 145,000 households with livestock, the total regional gross benefit from livestock production amounted to US$ 45,195,915 Mio with BAHS and US$ 44,279,895 Mio without.

Thus an investment of US$ 57,000 produced a benefit/cost ratio of 16.1:1.

Different models were applied to assess the impact of increased intensity of BAHS-usage. One of the challenges for the BAHS-team lies in achieving a significant increase of BAHS-usage among rural households.

Introduction

Only a few studies have been published that assessed the economic benefits farmers can obtain by making use of community-based livestock service programs and by improving livestock health and marketing in developing countries (Holtzman, 1984; Meemark, 1988). Although there is no doubt about the merits of the many PAHA schemes for the rural people in developing countries, sound data evaluating the effectiveness of these schemes are not commonly available. It would certainly be easier to propagate community-based programs if this information would be accessible. Mlangwa and Kisauzi (1994a, 1994b) stressed that principles of livestock economics are essential to undertake planning of any animal health strategy.

For the economic evaluation of specific interventions such as the BAHS-scheme at the individual owner level, the preferred analytical approach is partial farm budgeting, which has been used in this study. Partial budgeting is used to good advantage, where specification of opportunity costs for land and labour is not crucial (no serious competition with other farm activities).

The results of the various part of the BAHS-impact assessment, particularly the longitudinal study (V. Chapter) made important parameters such as off-take and mortality across species and farm-categories available. Additional results of BAHS-field research as outlined in the II. Chapter, were also utilized which is specified in the respective Tables. The objective of this study was to determine the economic benefits of livestock production at the regional level for each of the three farm-categories by quantifying the economic consequences of a specific change in farm procedure, in our case the adoption of BAHS.

Materials & Methods

Partial Budget Analysis

A spreadsheet model was built using functions in Microsoft Excel 2000. Four sections were considered for the analysis: (1) *additional returns*: a list of income items from the alternate plan that will be not received from the base plan; (2) *reduced costs*: a list of cost items for the base plan that will be avoided with the alternate plan; (3) *returns foregone*: a list of income items from the base plan that will not be received from the alternate plan, and (4) *extra costs*: a list of costs of the alternate plan that are not required with the base plan. Full BAHS-usage should be adopted if the net return of BAHS-users exceeds those of non-users and part-user, and if this net return is better than from alternative investments (Morris, 1988; Gittinger, 1994; Dijkhuizen. and Morris, 1997).

Additional returns were composed of the annual increase in capital value of the herd that was received by study farms at the different farming levels through livestock production. Reduced costs were not quantifiable in the model since previous state services were free of charge. The only returns foregone in the traditional production system in northern Malawi consist of animal skins that are being utilized when the animal dies rather than being available for meat consumption. No other items in this section were measurable. Extra costs were calculated in accordance with BAHS accounting data. Non-users are assumed to purchase drugs occasionally from sources other than BAHS. Extra fees apply to part-users as non-members of BAHS. Table VI-1 explains the costs of this section.

Table VI-1: Input variables concerning annual extra costs per farm status and farming level (US$[*])

	non-user		**part-user**		**user**	
farming level	extra fee	drugs	extra fee	drugs	membership	drugs
subsistence	none	0.5	0,5	1.0	0.5	1.0
small	none	1.0	1.0	3.0	0.5	4.0
larger	none	2.0	1.0	4.0	0.5	7.0

[*] Exchange rate US$: Malawi Kwacha = 1 : 45 as of March 2000

Only cattle, small ruminants and village chickens were included. Three farming levels were applied: subsistence, small and larger farms, as shown in Table VI-2. All three levels are part of the traditional smallholder farming system in Malawi and thus have nothing in common with commercial farming.

Table VI-2: Input variables of annual average livestock numbers kept

farming level	no. cattle	no. sheep/goats	no. adult chickens
subsistence	none	< 2	< 15
small	< 4	< 5	< 26
larger	≥ 20	≥ 15	≥ 40

According to our survey results (II. Chapter) the 'large farming' level applies to not more than 4 % of smallholder farms, whereas 28 % manage small farms and 68 % of farms are at subsistence level. Table VI-3 shows prices for livestock and livestock products that were applied in the model.

Table VI-3: Input variables concerning average prices for livestock and animal skins (US$)

	calf (<1 yr.)	heifer	cow	bull (breedg)	oxen (traction)
cattle	33.3	100.0	110.5	180.0	220.0
	adult	kid (<4 mths)			
sheep/goats	15.0	9.0			
	cock	hen	pullet	chicks	
chickens	2.9	2.4	1.1	0.22	
	calf	cattle	sheep/goat		
skins	1.5	2.5	1.1		

Input variables within farming levels were applied according to the status of non-users, part-users and users of the BAHS-scheme as shown in Table VI-4.

Table VI-4: Input variables concerning annual mortality, reproduction and off-take according to farm-status*

variable	**non-users**	**part-users**	**BAHS-users**	**source**
mortality				
calf (<1 yr.)	.38	.18	.16	study results
adult cattle/female	.031	.029	.024	study results
adult cattle/male	.016	.014	.012	study results
sheep/goats young	.20	.17	.10	study results
sheep/goat female	.13	.07	.03	study results
sheep/goat male	.06	.03	.01	study results
hens + cocks each	.07	.05	.03	study results
pullets	.29	.19	.10	study results
chicks (per clutch)	.58	.50	.44	Ahlers, 1999
reproduction	(assumed equal, irrespective of farm-status)			
cattle parturition rate	.61	.61	.61	Zessin (1993)
sheep/goats no. birth/2 years	3	3	3	Nyrenda (1993)
sheep/goats no. kids raised/female/year	1.8	1.8	1.8	Nyirenda (1993)
chickens clutch/year	3	3	3	Ahlers (1999)
off-take				
cattle (male and female)	.035	.047	.055	study results
calves (<1 yr)	none	none	none	study results
sheep/goats (male and female)	.179	.139	.146	study results
kids (< 4 months)	.089	.069	.073	study results
chickens (adults and pullets combined)	.15	.20	.25	Ahlers (1999)

* Additional returns from use of manure, increase in milk production or sales of eggs have not been considered in the model

Cost Benefit Analysis

The cost benefit analysis was done for four districts within Mzuzu ADD. These are Mzimba South, Mzimba Central, Rumphi and Nkhata Bay (Figure II-1). Population figures and the percentage of households keeping livestock are shown in Table VI-5.

Table VI-5: Livestock keeping households and percent of farms at respective farming levels per districts
(Malawi 1998 housing and population Census)

estimates	Rumphi	C.Mzimba	S.Mzimba	Nkhata Bay	Mzuzu ADD
total no. HH's	25,459	69,368	29,355	53,382	**177,564**
mean HH size	5.0	5.3	5.3	4.8	**5.1**
total no. people	128,274	367,506	155,522	258,164	**909,466**
% HH with Livestock	0.75	0.82	0.82	0.85	**0.8**
no. HH with Livestock	19,094	56,882	24,071	45,375	**145,422**
4 % larger farms as no. HH	764	2,275	963	1,815	**5,817**
28 % small farms as no. HH	5,346	15,927	6,740	12,705	**40,718**
68 % subsistence f. as no. HH	12,984	38,680	16,368	30,855	**98,887**

Currently about 5500 households in Mzuzu ADD are paid-up members of BAHS. Table VI-6 presents estimates about numbers of households being non-users, part-users or users of BAHS per farming level. The estimates are based on findings discussed during the International Seminar on PAHA that took place recently (Hüttner et al., 2000).

Table VI-6: Estimated numbers of non-users, part-users and users per farming level (in 1000)

Estimated BAHS-usage	Rumphi	C.Mzimba	S.Mzimba	Nkhata Bay	Mzuzu ADD
larger farms					
15% users	115	341	144	272	**873**
70% part-users	535	1,593	674	1,270	**4,072**
15% non-users	115	341	144	272	**873**
small farms					
5% users	267	796	337	635	**2,036**
60% part-users	3,208	9,556	4,044	7,623	**24,431**
35% non-users	1,871	5,574	2,359	4,447	**14,251**
subsistence farms					
3% users	390	1,160	491	926	**2,967**
27% part-users	3,506	10,443	4,419	8,331	**26,699**
70% non-users	9,089	27,076	11,458	21,598	**69,221**

Results

Partial Budget Analysis

Table VI-7 presents the net income according to livestock species

Table VI-7: Annual gross income per livestock species according to farm-status and farming level (US$)

	subsistence f.	small farming	larger farming
cattle	(no cattle owned)		
non-user	n/a	545.52	2730.58
part-user	n/a	554.79	2788.94
full-user	n/a	555.98	2799.92
sheep and goats			
non-user	10.26	66.22	159.47
part-user	9.87	72.46	165.49
full-user	9.49	77.41	172.28
chickens			
non-user	8.28	13.63	21.41
part-user	9.74	14.74	24.98
full-user	10.27	15.79	26.56

The livestock budgets present a higher net income for full users of BAHS across farming levels and for all species under investigation compared to part- and non-users. An exception is the sheep/goat budget at subsistence farms. This is caused by higher off-take rates for non-users compared to part- and full users (Table VI-4), which at this level (1 animal for subsistence farms) represent a higher value than the losses caused by mortalities. This effect does not apply where more than one sheep or goat is kept.

Table VI-8 presents the net income from livestock production at the individual farm level.

Table VI-8: Annual net income from livestock production per status and farming level (US$)

	subsistence farming	small farming	larger farming
non-users	19.02	624.70	2915.41
part-users	21.20	641.86	2989.66
full-users	22.32	649.30	3013.94

Subsistence farmers adopting BAHS clearly achieve a higher net return from their livestock compared to part-users and non-users. For instance, a BAHS-user at subsistence farm level obtains a net margin over a non-user of US$ 3.3 taking his/her additional costs of US$ 1.5 into account (equivalent to 220 % net return on invested funds).
Similarly, a part-user owning a small farm achieves a net margin over a comparable non-user of US$ 17.2 taking his/her additional costs of US$ into account (572 % net return).
The results of our analysis suggest that the adoption of BAHS is economically beneficial, which also includes the very poor families.

Figure VI-1 shows the percent net margin over non-users that users and part-users of BAHS obtain.

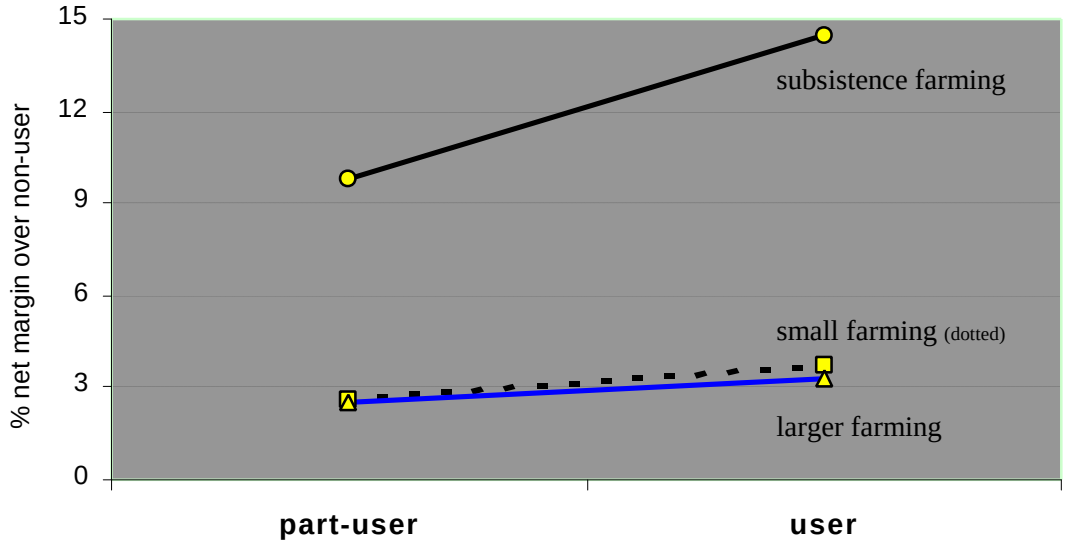


Figure VI-1: Annual percent net margin of users and part-users over non-users (US$)

The percent net margin of part-users over non-users at the subsistence, small and larger level came to 9.9 %, 2.6 % and 2.5 %. The percentages for users came to 14 %, 3.8 % and 3.3 %. It shows that households at the subsistence level obtain relatively higher benefits as compared to small and larger farms.

Cost Benefit Analysis

Multiplying the specified net income of farms with the proportion of farms at the various levels within Mzuzu ADD equals regional income through livestock production. This is presented in Table VI-9 for the district levels and according to farm-status.

Table VI-9: Regional gross income livestock production per farm-status for the study area

Regional Benefit (US$)	**Rumphi**	**C.Mzimba**	**S.Mzimba**	**Nkhata Bay**	**Mzuzu ADD**
non-user	1,676,120	4,993,162	2,112,995	3,983,056	12,765,333
part-user	3,730,736	11,113,861	4,703,139	8,865,550	28,413,286
user	527,481	1,571,365	664,967	1,253,481	4,017,294
total	5,934,337	17,678,387	7,481,102	14,102,087	**45,195,913**

Users being yet the minority of households in the study area overall produce less annually than both of the other groups. The highest income is generated in Central Mzimba, a relatively large district where also most of the cattle are kept (Table II-2).

Regional gross income

The annual gross income through livestock production currently comes to US$ 45.195,913 for the study area. The net-benefit for the region comes to US$ 44.279,894. This means, the additional income that the current proportion of part-users and users generate through usage of BAHS amounts to US$ 916,019 for the study area.

Figure VI-2 illustrates the results of 4 different models representing a gradual increase in usage, which is explained below (all starting at the current level of regional gross income).

model I*: increase of BAHS-usage in 10 % intervals by non-users at subsistence level alone (US$ 32,000 per 10 % interval)*

model II*: increase of BAHS-usage in 10 % intervals equally by non- and part-users at subsistence level (US$ 95,000 per interval)*

model III*: increase of BAHS-usage as model II and additional 5 % intervals equally for non- and part-users at small farming level (US$ 117,000 per interval)*

model IV*: increase of BAHS-usage as in model III and additional 5 % intervals equally by non- and part-users at large farming level (US$ 153,000 per interval).*

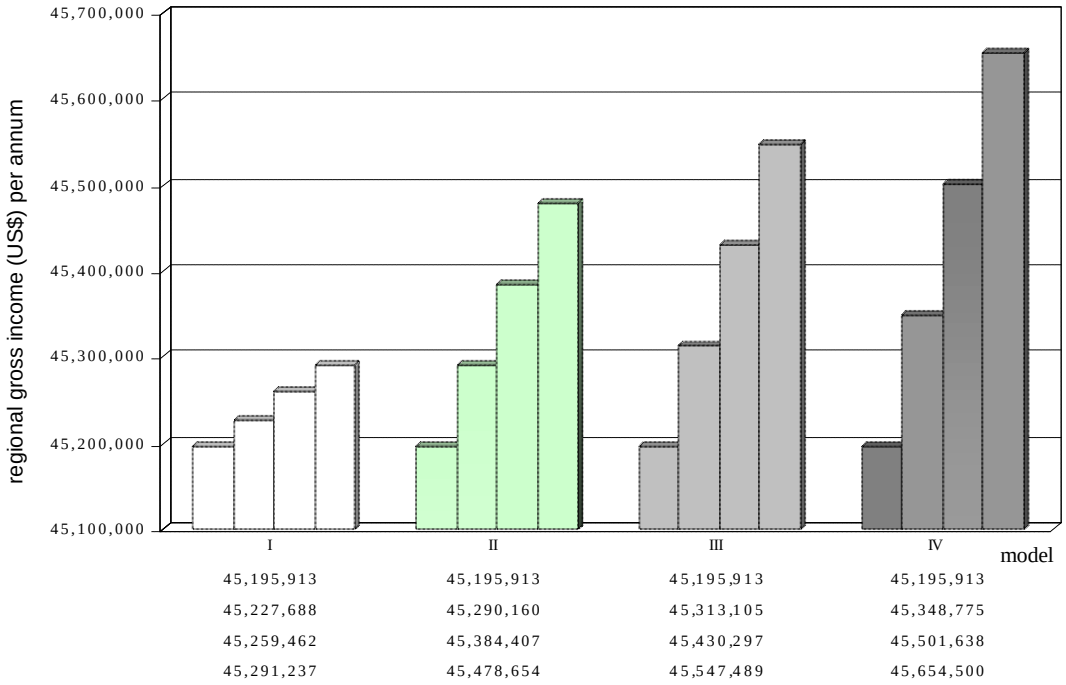


Figure VI-2: Results of modeling higher regional income (US$) by gradually reducing non-usage of BAHS at different levels

By concentrating on larger numbers of subsistence farms alone (model I), the additional gross income generated through livestock would be relatively small. For instance adoption of BAHS by additional 30 % non-users would generate less than US$ 100,000 annually. If the program would take the challenge of model IV an additional gross income of US$ 150,000 annually can be expected in the study area.

Regional net benefit

The total expenditures of the Foundation for the Improvement of Animal Health (FIAH) in 1998/99 were US$ 57,000 (Table I-3). This figure includes subsidies from GTZ and covers BAHS-operations for the whole of the northern region (Mzuzu ADD and Karonga ADD). The net benefit for the farming community in Mzuzu ADD, therefore, amounts to US$ 860,000. This is 1507 % return on invested funds or a benefit/cost ratio of 16.1:1.

Discussion

The results of this analysis suggest that users and part-users at all farming levels obtain higher net income compared to non-users of BAHS. For the reader, who is not familiar with the conditions prevailing in the study area, the rather modest increases such as those for subsistence farms could appear to be negligible. This is not the case considering an average annual income per capita in Malawi of less than US$ 40 (The World Bank Group, 2000). Moreover, the increase in available income particularly for this group in the short term can be significant through usage of Newcastle Disease vaccination alone (Ahlers, 1999; Ahlers et al., 1999).

Full-users at subsistence level obtain 14 % net margin over non-users, thus achieving the highest relative increase of net income by using BAHS compared to small and larger farms. The potential for a much higher regional benefit by encouraging many more households to join the BAHS-program seems to be obvious. On one hand these farms represent the vast majority of Malawi households. On the other, even users of BAHS have barely reached a satisfactory level in livestock mortality, particularly in young stock.

Small and larger farms using BAHS can increase their annual net income between US$ 17-24 and 74-98, respectively. Meemark (1988) analyzed the economic effect of a village parasite control program in northeast Thailand. The annual net benefit of study farms came to US$ 150 and thus is close to our 'larger' farms.

Modelling the regional economic benefit through improved livestock production at the subsistence farming level alone shows a relatively small increase in net income for the region. The example cited in the discussion leads to less than US$ 100,000 annually. The costs for effectively addressing these families would be difficult to define. There is, however, a balance to be found, to meet the project goal (involvement of the very poor families) and sustainable, hence efficient service delivery in the long term. It is therefore economically meaningful to further and actively propagate BAHS also among households at the larger farming level.

Many options to increase BAHS-uptake in northern Malawi are practicable. Part-users for

instance make up a pool of farmers that already know about BAHS but yet have significant higher mortalities compared to users. It should be repeated that the calculations in this Chapter exclude all livestock other than cattle, small ruminants and chickens. Also livestock products such as eggs or milk sales that can make a substantial contribution to household income in the traditional production system have not been included in the model. In addition, there is certainly a bias by applying various estimates in the calculation. The results, however, have produced a realistic reflection of the current situation in the field. Moreover, these figures provide sound indications towards possible alternatives to achieve more focused BAHS activities in the future.

Overall, the BAHS-scheme has built a solid regional coverage but as yet reaches a minority of potential customers. Here lies the challenge for more efficient livestock production at the regional but potentially also at the national level.

References

1. Ahlers, C. 1999. Characteristics and constraints of the traditional poultry keeping system in northern Malawi; Doctorate Thesis, Free University Berlin, Germany, 175 pp.

2. Ahlers, C., Hüttner, K., Pfeiffer, D.U. (1999). Comparison between a live and an inactivated vaccine against Newcastle disease in village chickens. A field study in northern Malawi. Tropical Animal Health & Production 31, 3, 167-174

3. Dijkhuizen, A.A. and R.S.Morris, 1997. Animal Health Economics - Principles and Applications. Published by the Post Graduate Foundation in Veterinary Science, University of Sydney, 305 p.

4. Gittinger, J.P., 1994. Economic Analysis of Agricultural Projects. Published by the Economic Development Institute of the World Bank. Johns Hopkins University Press, Baltimore, second edition, 505 pp.

5. Holtzman, J. S, 1984. Economics of improving animal health and livestock marketing in Somalia. AIDS Research & Development Abstracts. 1984. 12: 1, 21-22

6. Hüttner, K., Leidl, K., Jere, F.B.D. (Eds.) 2000. Primary Animal Health Activities - Topic Day. Proceedings of an International Seminar, 15th to 17 th February 2000, Mzuzu, Malawi. http://epicentre.massey.ac.nz/

7. Malawi Housing and Population Census, 1998. National Statitics Office, Zomba, Malawi

8. Meemark, N.., 1988. The Development and Evaluation of a Village-Based Parasite Control Program for Swamp Buffalo and Cattle in Northeast Thailand; Masters Thesis, Massey University. Palmerston North, New Zealand, 169 pp.

9. Mlangwa, J. E. D., Kisauzi, D. N., 1994a. Systems approach to animal health services delivery in sub-Saharan Africa: the case of privatisation. Revue Scientifique et Technique Office International des Epizooties. 13: 3, 673-685. 19

10. Mlangwa, J. E. D., Kisauzi, D. N., 1994b. Systems approach to animal health services delivery in sub-Saharan Africa: concept development. Revue Scientifique et Technique Office International des Epizooties. 13: 3, 665-672

11. Morris, R.S., 1988. The effects of diseases on productivity and profitability of livestock: how should be assessed? Proceedings of the New Zealand Society of An. Prod., 48, 117-125

12. Naipospos-Hutabarat, T.S.P., 1995. The Development of an Animal Health Information System for Indonesia. PhD Thesis, IVABS, Massey University, Palmerston North, New Zealand, 525 pp.

13. Nyirenda, K.F.D., 1992. The Prospects of integrating small ruminants within the farming system of Salima ADD. In Proceedings of a Workshop on Small Ruminants Activities in Malawi. 5th to 8th October 1992, Capital Hotel, Lilongwe, pp. 169-196

14. The World Bank Group, 2000. Country at-a-glance. Website http://www.worldbank.org/data/countrydata/aag/mwi_aag.pdf.

15. Zessin, K.H., 1993. Consultants' report on the short-term assignment for the Basic Animal Health Service Project, Mzuzu/Malawi. Berlin + Eschborn, Germany, 42 pp.

Summary Remarks

The BAHS-program has continued to progress since the field implementation first commenced in 1993. There have been times where we have had to modify the program for unbalanced decisions or unpredictable developments. This is a normal process for a project of this scale and in this environment. The BAHS-team has also been challenged to rethink the role of farmers and professionals in agricultural research and extension. This included questioning of prevailing theories, challenging power-laden relationships between scientist, extensionists and poor farmers and also confronting bureaucratic structures, as Scoones and Thompson (1994)[*] have reported.

BAHS is no exception. The learning curve was steep throughout the years, not only for our clientele in the BAHS area of operation but also for us, the BAHS team. In response, we continuously kept in touch with many projects and institutions worldwide, and we implemented this impact assessment, a comprehensive research project driven by two questions: what are the characteristics of the different parties involved in the BAHS-scheme and what are its merits for the rural livestock farmers in northern Malawi?

The experience of this research has been very satisfying by delivering sound results for the traditional production system, which for outsiders is not easy to comprehend and scientifically difficult to assess.

In my view, the BAHS team has to consider some key points to effectively utilize the final phase of the program:

(1) Having demonstrated proof about the benefits for the target population, this does not automatically ensure their continuous or future involvement in the program

(2) Good extension and service delivery is crucial and truly a team issue, whereby those who are most involved have to receive the best possible and continuous support

(3) Actively addressing the very poor people requires much more skills and input in all respects than that needed to serve the people, whom we defined as 'better'

While working on this assessment it again became clear that communication amongst those involved in such work is not a given thing, despite networks and mailing lists. It remains a personal and thus emotional matter to actively exchange views and findings. I would be most grateful to see the results of this assessment being critically used.

[*] Scoones, I. and Thompson, J. "Beyond Farmers First. Rural people's knowledge, agricultural research and extension practice. IT Publications Ltd., London, UK, 1994, 301 pp.