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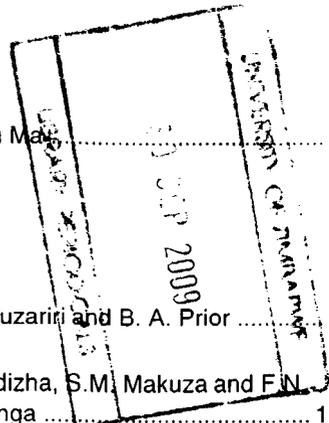
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A survey on land use and usage of cattle for draught in a semi-arid environment

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A diagnostic survey was conducted to examine land use and the extent to which cows were used for draught in January 1998 in Sanyati Communal Area. This communal area is situated in a semi-arid area of Mashonaland West Province of Zimbabwe. Data were collected from a total sample of 100 households using the farmer participatory approach, rapid rural appraisal (RRA) methodology and a formal survey. The households were selected at random from five adjacent villages. Land use was categorised into arable, grazing or residential. Arable land holding per household averaged 5.4 hectares and ranged from 4 to 35 hectares. Seventy-nine percent of the farmers owned cattle and herd sizes ranged from one to 26. Every household possessed small ruminants and poultry. Land preparation was done mainly through use of cattle draught power. The main crops cultivated were maize and cotton, averaging $2.57 \pm 0.15\text{ha}$ and $1.77 \pm 0.12\text{ha}$, respectively. Households possessing large cattle herd sizes cultivated larger hectares compared with those with fewer cattle. The survey showed that there was an acute shortage of oxen and farmers were forced to use cows in the provision of draught power. Eighty-five percent of the cows were utilised for draught purposes to enable timely cultivation. In conclusion, the survey indicated that farmers in Sanyati cultivate maize and cotton and are dependent on cattle for provision of draught power. In addition, there is a shortage of sufficient draught oxen which has resulted in the use of cows for draught power.

Keywords: Survey, Land use, Cattle, Draught, Semi-arid.

Introduction

The smallholder agricultural sector of Zimbabwe is composed of the communal, resettlement and small-scale commercial farming sectors. Seventy-four percent of the communal areas are in semi-arid and arid ecological regions (International Service for National Agricultural Research, 1997). Typically, communal areas have poor infrastructure and the soils are generally sandy and infertile. Land is under communal tenure, and individual farmers only have usufruct rights to arable land

whilst grazing land is shared (Scoones, 1992). In most cases, communal grazing land is dwindling due to expansion of the cropping area (Kjaer, 1994) to feed the ever-increasing human population. Consequently, there is overgrazing but farmers still insist on having large numbers of livestock, which aggravates the shortage of grazing land. In resettlement and small-scale commercial farming sectors, land is leased to farmers for up to 99 years. There is better extension, credit and marketing support in the small-scale commercial sector than in the communal areas.

In communal areas, cattle are utilised for ploughing, planting, weeding, transportation of goods and the provision of meat and milk, among other by-products (Ndlovu and Francis, 1997). Donkeys are also used as draught animals (for example, for cultivation) in some communal areas, however, they have been reported to be slow, and hence, cultivate limited areas per unit time (Christopher, 1998). Communal farmers who own and use animal draught power cultivate larger areas and achieve better crop yields than those without animal draught power (Shumba, 1984). This is attributed to timely and better land preparation and access to organic manure. Delays in the completion of primary tillage has been reported to cause losses of up to three percent of potential maize yield per day (Shumba, 1984). Such observations dictate that communal farmers have adequate healthy draught animals or alternative sources of draught power prior to the beginning of the rainy season to ensure that crop yields are not compromised.

Although mechanisation may be appropriate in some communal areas, it is expensive and most of the time not available. Recurrent droughts have decimated the livestock population across the whole agricultural sector of Zimbabwe (Central Statistical Office (CSO), 1997). After the droughts in the 1991 to 1992 and 1994 to 1995 seasons, animal draught power became limiting in many communal areas due to livestock deaths. As a result, many farmers turned to practising zero tillage (Francis, 1993; Ulrich and Kjaer, 1994). Although zero tillage is environmentally friendly, it may not be the most appropriate method of farming under semi-arid conditions where soils are often compacted and shallow. To improve water penetration, farmers continue to cultivate the land and have resorted to using cows as draught animals. However, farmers are reluctant to utilise cows as draught animals as this is reportedly associated with reduced reproductive performance. However, little is known regarding the extent to which cows are used as draught animals in communal areas. Therefore, this study was undertaken to determine land use and the contribution of cattle to draught power provision in the semi-arid Sanyati Communal Area.

Materials and Methods

Site description

Diagnostic surveys were undertaken in Mudzimba, Ngwenya, Majoni, Masocha and Mugariri villages of Sanyati District, Kadoma, Zimbabwe, which is approximately 250 km west of Harare and approximately 100 km north of Kadoma. The site is 900 to 1200 metres above sea level and is located in Natural Region IV.

Sanyati is a smallscale cotton producing area and one of Zimbabwe's cotton ginneries is located in Sanyati. Mean diurnal temperatures experienced in Sanyati are 32°C in the hot wet season, and 24°C during the cool dry season. Sanyati receives low to moderate annual rainfall (450 to 600 mm) during the rainy season extending from November to March. The area is prone to periodic droughts (Kjaer, 1994).

The vegetation in Sanyati is mainly woodland savanna, dominated by *Acacia* spp. and *Colophospermum mopane* tree species. Some of the trees and bushes provide browse for livestock when grazing is scarce. Natural pastures' abundance and quality vary with season. The quantity and quality of grazing decline from the wet to the dry season. Animals are forced to forage riverine vegetation along Munyati River in addition to foraging crop residues left in the fields.

Data collection

A farming systems research approach using rapid rural appraisal (RRA) and the farmer participatory approach were used as a tool to generate preliminary data which were subsequently used in designing a formal survey. The formal survey was conducted in 100 households between 1997 and 1998. Although participating households were selected at random from five villages, one of the criteria used in selection was accessibility of the villages. Demographic data (sex, age, size, decision making), crop production (types of crops grown, hectareage) and livestock production (herd structures and sizes, animal feeding management and use) were collected during the survey. Secondary data were also provided from an earlier survey (Mutisi *et al.*, 1998).

Statistical analysis

Results are presented as means and frequencies, where appropriate. The effects of household size and gender (sex of head of household) on hectareages cultivated and differences in hectareages allocated to the various crops were analysed using the GLM procedures of SAS (SAS, 1994). Correlations between household size, number of draught animals and area cultivated were computed using the PROC CORR procedure of SAS.

Results

Household demography

Figure 1 shows that 29 percent of the farmers were above 50 years of age and 59 percent being 30 to 50 years of age; the remainder (12 percent) were lower than 30 years of age. The average household size was 7.6 ± 0.4 and ranged from one to 22 members with the majority of the households (52 percent) having 5 to 8 members (Figure 2). Only 16 percent of the households were headed by females.

Crop production

Land preparation for crop production was done using animal drawn implements.

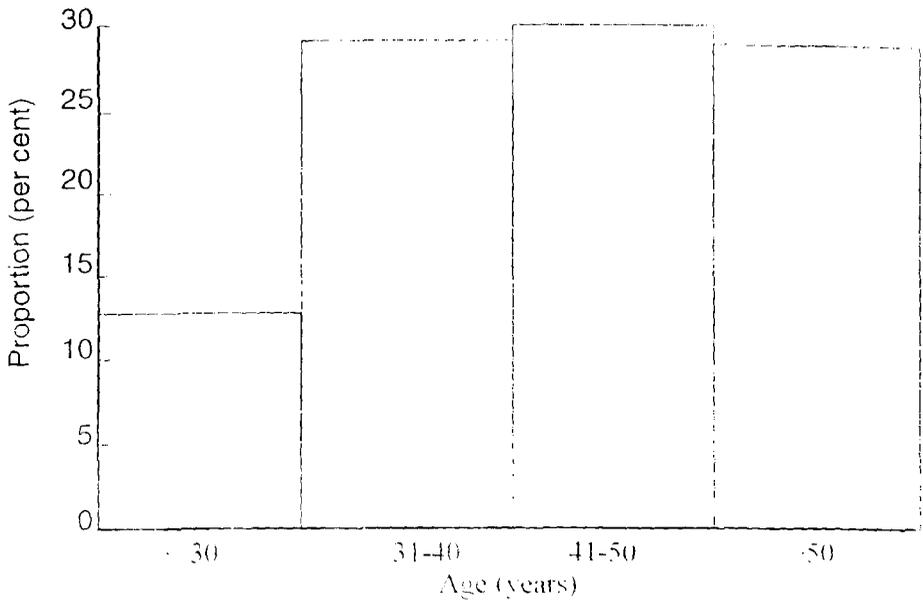


Figure 1: Age distribution of farmers in five villages of Sanyati Communal Area.

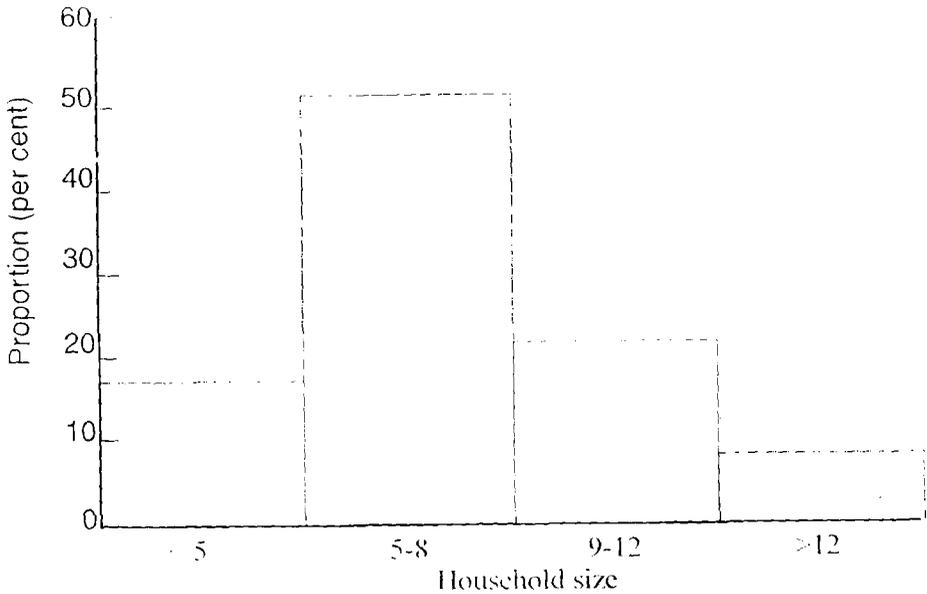


Figure 2: Proportions of household sizes in five villages of Sanyati Communal Area.

All farmers who had cattle had ox-drawn ploughs, as compared to only 30 percent of farmers who did not own cattle. A large proportion (90 percent) of those who owned cattle had adjustable-width inter-row cultivators. Only one farmer owned a planter. Eighty-four percent of the farmers who owned cattle had ox-drawn carts compared to five percent of those without cattle.

Arable land averaged 5.4 hectares ranging from four to 35 hectares per household. The major crops grown and hectares are shown in Table 1. Maize had the largest average hectareage, 2.57 ± 0.15 ha, followed by cotton, 1.77 ± 0.12 ha, which was the most important cash crop. Other crops grown included sunflower, groundnuts and bambara nuts (Table 1).

Table 1: Crops grown, percentage of households cultivating the crop and hectares (mean \pm SE) cultivated for various crops in five villages in Sanyati communal area during the 1997/1998 season.

Crop cultivated	Percent of farmewrs with crop*	Mean area (ha)
Maize	100	2.57 ± 0.15^a
Cotton	84	1.77 ± 0.12^b
Groundnuts	80	0.40 ± 0.06^c
Bambara nuts	56	0.25 ± 0.07^d
Sunflower	22	0.64 ± 0.24^c

a,b,c,d Means with different superscripts within column are significantly different ($P < 0.05$); SE — standard error

* Total number of households = 10

There was a high positive correlation between household size and hectares cultivated ($r = 0.72$; $P < 0.05$) with large household sizes cultivating more land (Table 2) than smaller household sizes. Further, the area under cultivation was positively correlated ($r = 0.64$; $P < 0.05$) with the number of draught cattle available to the household. Also, farmers who owned cattle cultivated larger areas of land ($P < 0.05$) than non-cattle owners (7.06 ± 0.33 versus 5.2 ± 0.39 ha).

Cotton was grown by 90 percent of farmers who had cattle compared to 62 percent of those farmers without cattle. Gender affected area under cultivation, with households headed by males cultivating more land ($P < 0.05$) than households headed by females (Table 3). Male-headed households also owned larger ($P < 0.05$) cattle herds than their female counterparts.

Ninety percent of the farmers in Sanyati left some of their land fallow. Householders who had draught cattle left smaller ($P < 0.05$) pieces of land fallow (1.79 ± 0.23 ha) compared to those who did not own draught cattle (2.39 ± 0.39 ha). Also, households with large numbers of people left smaller hectares fallow ($P < 0.05$) than small households.

Table 2: Household size (number of members dwelling within household) and distribution of households according to size in a total surveyed population of 100 households; and mean (\pm SE) hectares cultivated by different household sizes during the 1997/1998 season.

Household size	Number of households	Mean area (ha)
<5	18	5.58 \pm 0.38 ^a
5-8	52	6.48 \pm 0.38 ^b
9-12	22	6.75 \pm 0.52 ^b
>12	8	8.48 \pm 1.32 ^c

a, b, c Means with different superscripts within column are significantly different ($P < 0.05$); SE — standard error.

Table 3: Gender distribution within households and the relationship between gender (sex of head of household) with area cultivated (mean \pm SE: hectares) and cattle herd size during the 1997/1998 season.

Gender (sex of farmer)	Number of households	Mean area (ha)	Mean cattle herd size
Male	84	6.91 \pm 0.34 ^a	6.74 \pm 1.01 ^a
Female	16	5.57 \pm 0.21 ^b	4.68 \pm 0.93 ^b

a, b Means with different superscripts within column are significantly different ($P < 0.05$); SE — standard error.

Livestock production and use

Seventy-nine percent of the farmers owned cattle ranging from one to 26 heads per household. Nearly forty-five percent of the households owned one to four head of cattle (Figure 3). A small proportion of households (10 percent) owned donkeys. Oxen were the preferred source of draught power, followed by cows and bulls, and lastly heifers.

Although most farmers owned draught cattle, only eight percent had adequate oxen for draught power. The remainder used cows and/or heifers as draught animals. Apparently, some farmers who had adequate oxen also used their female cattle for light work such as fetching water from boreholes and carrying crop residues. Overall, 85 percent of the cows including lactating and pregnant cows were utilised for some form of traction. However, farmers indicated that cows which were at an advanced stage of pregnancy or had recently calved were not preferred for draught.

Animal feeding management

Animals were let out to graze on natural vegetation during the rainy season. In the dry season, they were allowed to roam in the fields and natural grazing areas in search of food and water. The animals usually grazed along the Munyati River during this period. Seventy percent of the households gave supplementary feed to their cattle in the form of maize stover and groundnut tops during the dry season. The animals were usually fed as a group. During the ploughing period, draught cattle were preferentially fed compared to other classes of livestock. Some farmers gave supplementary feeds to milking cows, especially those that calved during the dry season.

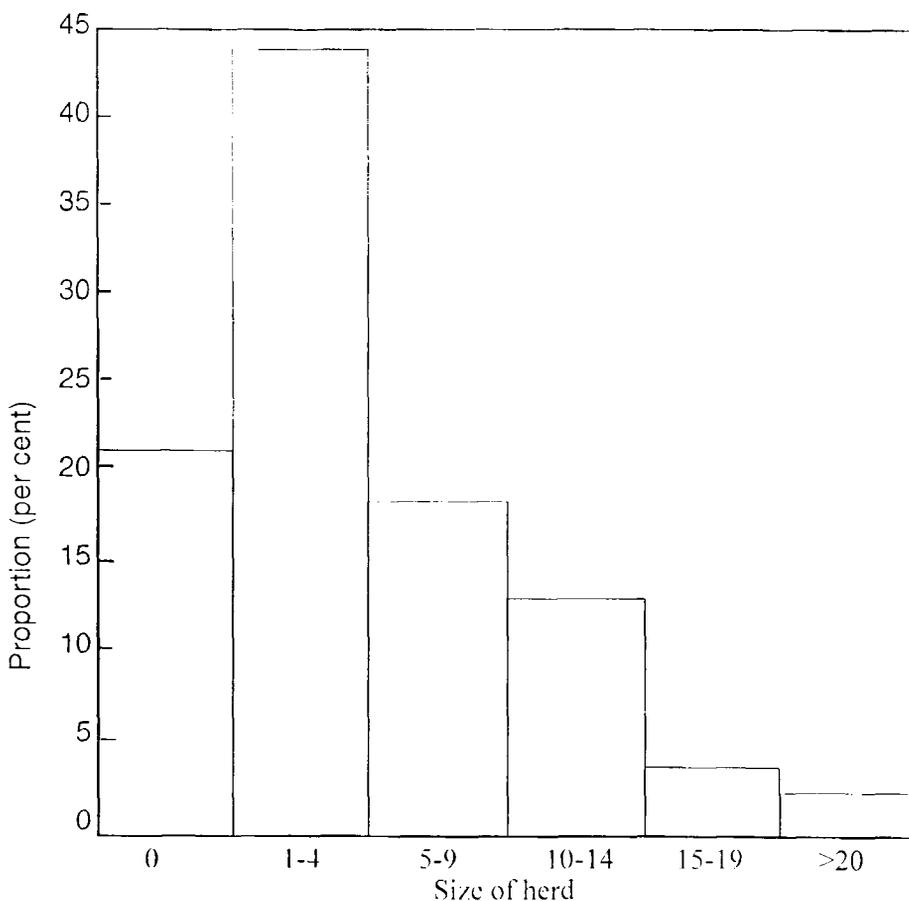


Figure 3: Percentage of households holding various herd sizes during the 1997/1988 season in five villages of Sanyati Communal Area.

Discussion

The survey showed that farmers in Sanyati cultivate mainly maize and cotton and are dependent on cattle for provision of draught. Manure from the animals is also an important organic fertilizer and aids in soil structure improvement. However, there is an acute shortage of sufficient draught oxen as reflected by the large proportion of cows (85 percent) being utilised for draught purposes. Sanyati is renowned for cotton production (Kjaer, 1994), as the microclimate is suitable for growth of cotton. Results of this survey confirm that observation. Compared to other communal areas in different agroecological regions, the high risks of lint spoilage of cotton which prevail in high rainfall areas are low in Sanyati. During the survey period, most farmers highlighted the desire to cultivate more land for cotton production. However, their main constraint was draught power availability.

The post independence era has seen an increased demand for arable land for expansion of crop production by communal farmers. In Sanyati, this increase has been mainly restricted to the expansion of cultivated hectarages under cotton and maize (CSO, 1997). However, livestock numbers have been fluctuating and are generally low as a direct result of droughts. The decline in cattle numbers has compounded the problem of animal draught power shortages as communal farmers primarily depend on livestock for primary tillage. Apart from provision of animal draught power for primary tillage, in Sanyati, cattle are also used for transportation of harvest, and ferrying cotton to the ginnery at Sanyati Growth Point (Kjaer, 1994; Mutisi *et al.*, 1997).

Similar to observations in other surveys in communal areas of Zimbabwe (Shumba, 1984; Scoones, 1992; Mutisi *et al.*, 1998) gender roles were very distinct. In this study, ownership of and access to land and cattle by female-headed households was limited. This resulted in larger areas of land being left fallow in female-headed households due to shortage of animal draught power. Francis (1993) also observed similar trends in Chinamhora Communal area of Zimbabwe.

In this study, a substantial number of the farmers (41 percent) were relatively young, that is, below 40 years of age. This may indicate a potential for future development of communal area agriculture. This is with the expectation that the young farmers are likely to learn and adopt new technologies for improving agriculture more easily than their aged counterparts. This is further supported by findings that, in Zimbabwe, aspiring young farmers view farming systems in smallholder areas as backward and old-fashioned (Starkey, 1996). Therefore there is a perceived need for technological enhancement and development in this sector.

The large hectareage which was allocated to maize is evidence of its popularity as the staple food in Zimbabwe. As mentioned earlier, Sanyati receives low rainfall and is subject to dry spells during the short rainy season. Despite the potential dangers of poor maize yields in a dry year, farmers continue to insist on maize production. The use of drought-tolerant small grain crops such as sorghum and millet which are suitable for the semi-arid environment, as recommended by

Agritex extension workers, was minimal. The farmers cited the lower yields of small grain crops as the main reason for not growing them.

Among the other crops grown was sunflower, which is also a cash crop as observed similarly in previous surveys in this area (Kjaer, 1994; Mutisi *et al.*, 1998). Residue from oil expression of sunflower is used as supplementary feed for animals during the dry season. Groundnuts and bambara nuts were mainly for subsistence.

The observation that households with large numbers of people cultivated larger hectares agrees with those obtained by Francis (1993) in Chinamhora communal area. These results confirm that labour availability is one of the major limitations to enhanced and intensified crop and livestock production in many smallholder farming systems (Shumba, 1984; Francis, 1993; Kusina and Kusina, 1998). In addition to labour constraints, availability and quality of draught animal power also determine hectareage under cultivation. In our survey, farmers who owned cattle had larger hectares under cultivation as reported previously (Starkey *et al.*, 1987). In other studies (Shumba, 1984), farmers who owned cattle realised higher crop yields than farmers without draught cattle. The high yields were attributed to timeliness of ploughing, planting and weeding. Such observations highlight the critical need for adequate draught power to ensure timely land preparation and cultivation in communal areas.

The ownership and availability of farm implements such as ploughs, cultivators and carts were important in the Sanyati crop-livestock farming system. However, the observation that a considerable proportion of farmers (30 percent) who did not own cattle had ox-drawn ploughs may be evidence that these farmers lost their draught animals during the recent drought seasons (1991/92 and 1994/95). This was supported by the farmers and confirms the draught power shortage in Sanyati.

Although donkeys can tolerate drought (Starkey, 1996), only ten percent of the farmers kept donkeys in the study area. The farmers reported that work rates for donkeys were low as stated earlier (Christopher, 1998) and that donkeys cause land degradation. Furthermore, no formal markets existed for donkeys since they have no salvage value. Farmers further alleged that donkeys have no sense of home and can thus be easily stolen. On the whole, donkeys were described as the 'poor man's ox'.

Farmers in communal areas prefer oxen for draught power (Kjaer, 1994; Mutisi *et al.*, 1998). The acute shortage of draught power in Sanyati has forced most farmers to use cows for traction purposes. Ndlovu and Francis (1997) reported that many farmers could be using cows for draught due to shortages of animal draught power. The farmers used both pregnant and milking cows as draught animals. The survey results also showed that farmers who had sufficient draught oxen often subjected their cows to some light work as training for future use in draught provision.

Cows were said to be less temperamental than bulls. Heifers were not commonly used as draught animals since farmers argued that the use of heifers for draught would delay attainment of puberty resulting in delayed breeding. However, the survey showed that, due to shortages of draught power, some farmers with inadequate draught animal power used all the classes of cattle available.

In terms of animal feeding management, the farmers believed that natural pastures provided adequate feed to the animals during the rainy season. However, due to scarcity of grass and other forms of forage during the dry season, supplementary feeding with maize stover was common. Some farmers also provided animals with sunflower cake when available. Similar practices of cattle management have been reported in a number of communal areas (Scoones, 1992; Francis, 1993) (Kjaer, 1994).

Conclusion

In Sanyati communal area, land size under crop production was influenced by ownership of draught cattle and the size of households. Larger households or those with adequate draught animal power cultivated greater area than smaller households or those with inadequate draught animal power. Cotton was the major source of farm income while maize was the major staple crop. Other crops such as sunflower, groundnuts and bambara nuts were for subsistence. Only eight percent of the farmers had adequate draught oxen, indicating an acute shortage of the traditional draught power source. As a result, 85 percent of cows and heifers were used to supplement oxen in the provision of draught power. In general, our study shows that, in Sanyati communal area, crop production is heavily dependent on animal draught power availability. Other factors affecting area under crop cultivation include gender and labour availability.

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REFERENCES

- CENTRAL STATISTICAL OFFICE (CSO). 1997 Livestock populations in smallscale commercial and communal farms in Zimbabwe. Ministry of Lands and Agriculture, Zimbabwe.
- CHRISTOPHER, J. K. 1998 Cultivation by donkeys in Andra Pradesh. *Draught Animal News* 29: 2-6.
- FRANCIS J. 1993 Effects of strategic supplementation on work performance and physiological parameters of Mashona oxen. MPhil Thesis, University of Zimbabwe, Harare, Zimbabwe.
- INTERNATIONAL SERVICE FOR NATIONAL AGRICULTURAL RESEARCH (ISNAR), 1997 Strengthening the role of Universities in the National Agricultural Research System in Zimbabwe, Harare, Zimbabwe. 5.

- KJAEER S, 1994 Possible changes in communal cattle production based on the situation and the view of the individual farmer. In: *Proceeding of the Workshop on Intergrated Livestock/Crop Production systems in the Small scale and Communal Farming Systems in Zimbabwe*. Mutisi C., Gomez M., Madsen J. and Hvelplund T. (eds). Harare, Zimbabwe. 162-177.
- KUSINA, N.T. AND KUSINA, J. 1998 Goat productivity in Zimbabwe: opportunities and constraints: A Review. Proceedings of a Conference of Association of Institutions of Tropical Veterinary Medicine (AITVM) held at Sheraton Hotel, 14-18 September, 1998: 17-18.
- MUTISI, C., YOUNGER C., ILLIUS A., GUNDRY S. AND KUSINA N. 1998 Perception of production and service values for livestock in semi-arid subsistence farming systems. *Foods, Lands and Livelihood: Setting research agendas for Animal Science*, KARI Conference Centre, Nairobi, Kenya. 163-164.
- NDLOVU, L. R. AND FRANCIS, J. 1997 Performance and nutritional management of draught cattle in smallholder farming in Zimbabwe. University of Zimbabwe Publications. Harare, Zimbabwe.
- SAS (STATISTICAL ANALYSIS SYSTEMS) INSTITUTE, 1994 SAS Guide for Personal Computers. SAS Institute, Cary, North Carolina, USA.
- SUCONES I, 1992 The economic value of livestock in a communal area in southern Zimbabwe. *Agricultural Systems* **39**: 339-359.
- SHUMBA E. 1984 Reduced tillage in communal areas. *Zimbabwe Agricultural Journal* **81** (vi): 235-239
- STARKEY P, 1996. Animal power in South Africa: a summary of some key issues. *Draught Animal News*. **24**: 2-6.
- STARKEY, P., ALLAGMAT, P. AND BANGWA A. B. 1987 Animal traction for agricultural development in West Africa: production, impacts, profitability and constraints. Technology Centre for Agricultural and Rural Cooperation: 8-12.
- ULRICH, P. AND KJAEER, S. S. 1994 A systems approach to communal crop-livestock farming. A case study from Zimbabwe. *MSc Thesis*. Royal Veterinary and Agricultural University, Copenhagen, Denmark.



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