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Abstract

Farming systems in Gokwe South District today are essentially the product of interactions between local indigenous cultivation systems and external interventions. Dryland crop production is the major income generating activity in the area. The major food crops are maize and groundnuts, while cotton and sunflower are the major cash crops. Through the years, changes in bio-physical conditions and population densities have led to a shift from traditional staples such as sorghum and millet to dominant grains, notably, maize. The introduction of a market economy and cash crops in local farming systems has also resulted in local crop production systems moving away from a purely subsistence activity to a partially commercialized industry. Livestock is an integral part of all smallholder farming systems, with cattle constituting the bulk of domesticated animals. Indigenous beef cattle constitute the bulk of cattle kept by individual households. However, farmers' current projections portray a trend of declining indigenous stock, accompanied by an increase in the commercial dairy herd size. The major identified constraints include unfavourable geo-physical conditions, an inadequate resource base, restricted access to inputs, labour bottlenecks, pests and diseases, inappropriate post-harvest technology, poor animal nutrition, poor animal health delivery systems, under-utilised genetic potential, insufficient infrastructure for disposal of marketable produce, and lack of institutional support.

Introduction

The Zimbabwean smallholder agricultural sector provides a home, employment and security to more than 70 percent of the country's population. This sector encompasses the small-scale commercial, resettlement and communal farming areas. While the land tenure systems in the three sub-sectors are different, the sub-sectors share common production problems in terms of the type of crop or animal in production, and a general poor resource base and technologies used. However, due to the large number of current and potential producers, the smallholder agricultural sector has the greatest potential and thus provides the best basis for enhancing national agricultural production and boosting economic development.

This paper presents results of a three-year study of farming systems in Gokwe South District. The study population comprised smallholder farmers from the district's Njelele 1, Njelele 2, Ndhlalambi, Nemangwe and Jahana wards. Farmer selection for the study was based on a stratified random sampling method aimed at making the selected farmers a representative sample of the larger population of smallholder farmers in the district. The study was carried out with the use of an informal survey, a formal questionnaire survey and continuous monitoring and data collection. The major objective of the informal survey was to gain an understanding of local farming systems, through system analysis, description, and the identification of system constraints and potentials. The formal questionnaire survey set to quantify informal survey data, while continuous monitoring and data collection was aimed at providing time-series data. Informal discussions and participant observations were used as techniques of verifying collected data. The study also benefited immensely from information from desk studies of available literature.

Historical Background

Original Settlements

The original settlers of Gokwe South District were the Shangwe and Tonga group of peoples. During these early years the population densities were very low and settlements were concentrated along the district's major rivers. The district was largely undeveloped, infested by tsetse-fly *(glossina)* and general living conditions were harsh. Living conditions improved and population densities started to increase with the arrival of newcomers to the district between 1950 and 1954. These newcomers, *dheruka* in the local vernacular, were mainly Shona and Ndebele speaking natives who were victims of the then colonial government's Land Apportionment Act (1931) which witnessed the removal of scores of natives from land designated for white settlement.

Traditional Farming Systems

For a larger part of the period of human occupation, Southern Africa's inhabitants have made their living solely by gathering wild food plants and hunting wild animals (Wright, 1977). In common with this way of life, indigenous Shangwe and Tonga peoples were mainly hunters and gatherers. Later there was a transition to a stock-keeping way of life, with a preoccupation in cattle rearing. The Shangwe and the Tonga had few cattle for beef and milk production only, with no utilisation of manure and draught power. In a review of early agricultural practices in Matebeleland and Mashonaland, Reid (1977) acknowledges that cattle were accorded many values, both agricultural and non-agricultural, of which the non-agricultural values were by far the most important. There was very little agricultural activity *vis a vis* crop production. Much of these agricultural activities were in the form of cereal production. The most common of these activities was the cultivation of millet and sorghum along major rivers, in which the only economic inputs were labour and seed. Although there were indications of trade in tools in the 1880s, this was not widespread, and the first recorded use of a plough by a native farmer was after European settlement (Reid, 1977).

The transition of the local economy from foraging to production of food especially became apparent with the arrival of the newcomers. This change in local farming systems also saw the introduction of diversified crop production. Crop production then became the most important single economic activity of all the people and attracted a greater input of sustained effort than any other activity. Major crops then included maize, sorghum and millet as the staples, and rice, groundnuts, bambara nuts and beans as important food crops providing variety. Sweet potatoes, melons and various vegetables were supplements to the main diet. Livestock numbers also swelled tremendously, but later declined due to tick infestation and poor animal health practices. Crop and livestock production was mainly for subsistence purposes, with little or no

marketed output. Cash cropping and sales of livestock were elements introduced by external interventions. According to Whitlow (1979), this and inflows of cash and goods largely derived from migrant workers (external factors) and population pressure, both human and livestock (internal influences) have led to modifications in subsistence agriculture in Zimbabwean smallholder farming areas.

Early Agricultural Interventions

Early agricultural extension efforts were concentrated on Master Farmer Training and demonstrations based on field activities of interested and cooperating farmers. The first major introduced cash crop was tobacco. This cash crop, though promising, proved to be a failure and was later abandoned. Sunflower and castor beans, which were not only new but also virtually unknown in the district, were introduced later and were relative success stories. However, a much more resounding success was struck with cotton, a crop that the district became associated with up to this day. Cotton was first introduced in the district's Chisina area in 1964. With regard to livestock, the extension thrust was to encourage farmers to sell off stock and fatten their cattle, but most farmers had few cattle because of tsetse-fly problems in the area.

The Geo-physical Context

Location

The specific research site is set within a communal area context in Gokwe South District, which is located about 200 kilometres north-west of the Midlands provincial capital of Gweru. The district itself is made up of Chemagora small-scale commercial area, Gokwe and Kana communal areas, Chirisa Safari Area and Mapfungautsi Forest Area. The district is bordered by Gokwe North District in the north, Nkayi District in the south, Lupane and Manjolo districts in the west and Kadoma district in the east. Within the district, the study area consisted of five wards. These were Njelele 1, Njelele 2, Ndhlalambi, Nemangwe and Jahana wards.

Topography and Drainage

The area's topography is basically of undulating terrain. The altitude ranges from 600m in the north, rising to 1 200m in the south, where Charama and Mapfungautsi plateaus are located. The Gokwe milkshed, which forms the research site, is situated on a watershed. The major rivers in the area include *Chemumvuri*, which dissects the milkshed into equal halves, *Svisvi*, which forms part of the milkshed's northern-western border, and *Sasame* and *Sengwa* further north.

Climatic Conditions

The district lies in agro-ecological zones III and IV. Areas in the southern parts of the district lie mainly in Agro-Ecological Zone III, while the northern areas fall mainly in Agro-Ecological Zone IV. Agro-ecological zones are classified according to climate and the potential of agricultural production, with Agro-Ecological Zone I having the highest potential and Agro-Ecological Zone V the least. Rainfall ranges from 650 to 800mm in the southern part and falls to between 450 and 650mm in the north. The district experiences two major seasons viz: summer, which stretches from September to April, and winter, stretching from May to August. The average temperature in summer is 30 - 31°C, while the mean daily temperature in winter is 22°C. The moderate rainfall amounts in the district, accompanied by generally high temperatures, have meant a reduction in effective rainfall. The area is also subject to fairly severe mid-season dry spells and is, therefore, marginal for most crop based enterprises. Most smallholder farming contexts are situated in complex, marginal and risk-prone environments.

Geology and Soils

The area is predominantly a Kalahari sand escarpment but soils differ within specific locations. The southern area has soils of the amorphi order, regosol group. These are deep sands with very little silt. Further north, dominant soils belong to the kaolinite order, fersiallitic group. These soils are moderately shallow to deep, greyish brown in colour, formed mainly on sandstones. The soils in Ndhlalambi and Njelele (located centrally) are mainly basaltic and shallow. Soils in Jahana, in the east, are mainly vertisols that are formed on basalt and are black in colour. The farmers classify the soils into three major groups, viz: *Juche* (sands), *Chiomvu* or *Mhukutu* (red clays and loams) and *Chidhaka* (vertisols).

Vegetation

Physiognomic vegetation types range from Tree Savannah to Tree Bush Savannah, on high ground around Njelele, to Grassland in the low-lying areas around Jahana. Dominant tree species are *Brachystegias*, *Parinaria* and *Combretum*. The grass species are predominantly *Hypharrhenia* species mixed with *Pogonarthria* and *Brachiaria*.

Socio-Economic Characteristics of Sample Households

Household Composition

Local households tend to be of small to large sizes, within mono- and polygamous marriages. The number of family members within individual households range from as few as 1 to as many as 21, with an average of 7 members per household. The standard deviation is 4 (where n = 75). See Table 1. Males made up 64 % of household members, while females made up the other 36 %.

Table 1: Household characteristics of farming families in Gokwe South District, Zimbabwe (n = 75)

Characteristic	Mean	Standard Deviation
Number of resident family members	7.2	4.0
Number of non-resident family members	2.3	2.4
Number of family members under 10 years	1.4	1.5
Number of family members between 10 and 60 years	5.2	3.2
Number of family members above 60 years	0.6	0.6
Number of workers on farm	2.0	2.0

Source: Survey Results, August 1995.

Most households are male-headed (93.3 %), while a few exceptions are female-headed. Where the *de jure* male household heads are absent, *de facto* female household heads have emerged. Age characteristics of most household heads portray an ageing decision making fraternity (See Table 2). This is a positive attribute in terms of great wealth in farming experience, but also a threat *vis a vis* the continuity of the present generation management.

Table 2: Household headship by sex and age group

Sex		Percent of Total in Age Groups (%)			
		< 35	35 - 50	51 - 65	>65 (years)
Male	93.33	6.67	17.33	29.33	40.00
Female	6.67	1.33	0.00	4.00	1.33

Source: Survey Results, August 1995.

Labour

Reliance on family labour is a characteristic of smallholder farming systems. The "family labour" basis of smallholder farming systems distinguishes them from commercial farming enterprises which employ wage labour. Family labour is used to meet most of on-farm labour requirements. However, this feature does not rule out the use of hired labour, in say, periods of labour bottlenecks, nor the sale, by members of the farm household, of their own labour outside the farm on an *ad hoc* basis. Labour as a resource, is usually the main input in smallholder production systems.

Despite relatively large families in the district, available and effective family labour remain constraints to farm production in most households. Mean available family labour (determined by the number of family members resident on the farm) is 7.2, while effective family labour (number of active household members aged between 10 and 60) is 5.2. Labour shortages have long been established as the most limiting factor in smallholder agricultural production (Ruthernberg, 1980). Where available and effective family labour are inadequate, employed permanent workers supplement on-farm labour. Additional casual labour is usually contracted during periods of critical labour bottlenecks such as during planting, weeding and harvesting times. Where cash availability is a constraint, particularly in resource-poor households, traditional coping strategies are used. These include mainly the *jangano* (individual reciprocal labour exchanges), *nhimbe* (communal beer work parties) and,

occasionally, hired labour in the form of *maricho* (where payment can be in cash or in kind - grain, soap, etc.). Detailed case studies have also shown labour division in most enterprises as gender-specific. Research studies elsewhere have established that livestock production activities such as dairying tend to facilitate a more equal sexual division of labour than some other forms of agriculture (DANIDA, 1995).

Management

Men, who comprise the majority of farm household heads, often do the day-to-day management of farming activities. Such cases represented 61.3 % of the total responses. Management by *de facto* female household heads was prevalent in 29.3 % of the 75 cases. In very few or rare cases were farming activities co-managed by husband-wife teams, sons, cousins, grandchildren or worker-managers.

Land Ownership and Utilisation

Land is not privately owned, which makes it inalienable, but all members have access and rights to control and use of the land. The major form of land transfer is through inheritance, which is patrilineal in the district, and a common feature throughout Zimbabwe. For outsiders, access to such rights is obtained through the granting of permission, illegal financial transactions or by joining the land holding group through marriage. The majority of farmers in the district have access to relatively large arable lands. This can be attributed to the area's relatively short settlement history *vis a vis* new settlements and the then government's resettlement policy. The average arable land holding is 7.3 hectares, with a lower and upper limit of 2.4 ha and 20.8 ha, respectively (where n=75). A point worth noting here is that this average arable hectareage is far in excess of the national communal area average of 2 ha.

Nearly 90% of the total arable land is utilised during a normal agricultural season. A precise 81.7% of the total arable land was under cultivation during the 1994/95 agricultural season. A further 13% was under short-term fallow, while the remaining 5% was under long-term fallow. However, the total arable land under utilisation is still below 30% of the total potential arable land in the district. In some circumstances, the size of individual land holdings does not match the amount of land required for production purposes. In such cases additional land is either rented or leased from fellow farmers. See Table 3.

Table 3: Land ownership and land utilization (1994/95)

Land Characterization	Percentage of Total (%)	Average per Household [ha]	Standard Deviation
Total Arable Land	100.0	7.3	3.6
Cultivated Land	81.7	6.0	2.9
Short-term Fallow	13.2	1.6	2.6
Long-term Fallow	5.1	1.2	3.0
Total Cultivated Land	100.0	6.0	2.9
Cultivated Area Owned	95.7	6.0	2.9
Cultivated Area Rented	4.3	0.3	1.9
Cultivated Area Leased	0.0	0.0	0.0

Source: Survey Results, August 1995.

Grazing land is communally owned. Traditionally, this has been an abundant resource. Further settlements and extension of arables is, however, cutting back on grazing land. A number of up-coming smallholder dairy producers have also fenced-off part of the arable land and reserved it for dairy cattle paddocks under natural and/or established pastures. Established pastures are, however, still scanty and form only 4.2 % of total arable land.

Capital and Income

A major source of enterprise funding has been in the form of farmers' own capital injection from both on- and off-farm income generating activities. In all, 94.7 % of the interviewed farmers depend on this source of capital. Crop production emerged as the major income generating activity in the area, with livestock enterprises playing a

complementary or supportive role. Income is generated directly from crop and livestock sales and indirectly through savings from household consumed crop and livestock products. The recently introduced dairy enterprise has greatly increased farmers' solvency, given the enterprise's more constant cash in-flows. This is a welcome departure from traditional major income generating activities whose returns are only occasional or seasonal. The farm is not the only source of income or capital and various other sources of capital are used as alternatives. In addition to crop and livestock enterprises, farmers are also engaged in formal and informal wage employment, local merchandise trade and exchange, home crafts sales, and market gardening. This, the farmers said, supplements their incomes. See Table 4.

Table 4: Major capital and income sources

Major Capital and Income Sources	Percentage of Farmers (%)
Crop Production Activities	74.7
Off-farm Wage Employment	12.0
Livestock Production Enterprises	5.3
Market Gardening	4.0
Remittances	2.7
Commercial Business Operations	1.3

Source: Survey Results, August 1995.

The Agricultural Finance Corporation (AFC) emerged as a major lender for smallholder farmers in Zimbabwe's post-independence era. However, most farmers are now reluctant to acquire individual loans, mainly due to punitive interest rates. Farmers also seldom make use of group loan facilities because of what respondents referred to as a high incidence of defaults amongst group members. Due to declining productivity and real producer prices, the ability to payback has also greatly declined. However, farmers still resort to loans in times of hardships such as periods after a drought season. The AFC provided loans to 5.7 % of the interviewed farmers in the 1994/95 agricultural season. From time to time, farmers also rely on local traders, fellow farmers *(sahwiras)* and utilise their membership in rotating credit groups, all of which are used as informal sources of credit.

Crop Production Systems

Prelude

Crop and livestock production in Zimbabwe is greatly influenced by the amount and variability of rainfall. Commercial dryland cropping is not considered a feasible proposition in Agro-Ecological Zones IV and V, where rainfall is low and variable. These areas are considered marginal for agricultural production and are largely utilized for livestock and game ranching in the commercial sector. However, the smallholder farmer is forced by circumstances to attempt to grow crops in these marginal and risky environments.

Major Food and Cash Crops

The major food crops grown in the area are maize and groundnuts, while cotton and sunflower are the major cash crops in the district. During the 1994/95 agricultural season, 53.6 % of the cultivated hectareage was planted to maize, 14.9 % was planted to cotton, 14.4% was allocated to the sunflower crop, about 5 % was reserved for groundnuts, while the remaining 12.1 % was planted to various other crops. The individual farming system is driven strongly by social goals, such as ensuring food security, although the economic goal (income generation) is also of importance. Smallholder farming systems have always had a high dependence on social aspects of the family and community (Dent, McGregor and Edwards-Jones, 1993). Sorghum, millet, bambara nuts, cowpeas, sweet potatoes and beans constitute the less dominant crops. Greater attention is also shifting towards emerging major "crops", such as, pastures. The major varieties, hectareages and average yields of all the major crops are shown in Table 5. The commonly planted varieties are those recommended by extension agents, while additional varieties are experimented with as a form of risk management.

Table 5: Major crop varieties, cultivated areas and average yields

Major Crops	Major Varieties	Average Cultivated Areas [ha]	Average Yield [ha]
Maize	R201, R215, SC501	3.5	3.9
Cotton	K502	1.4	2.2
Sunflower	Pannar 7225, Peredovic	1.2	1.2
Groundnuts	Valencia, Natal Common	0.4	1.8
PasturesGiant Rhodes		0.2	14.4*
	Bana Grass	0.1	15.5*
	Star Grass	0.1	8.4*

Source: Survey Results, August 1995.

* Average green fodder yield figures based on 1 cutting.

Maize, which accounts for most of the land under cultivation, is the staple food for the indigenous people. It is largely regarded as a subsistence crop, although the bulk of the produce is marketed. According to results of the survey, 74.8 % of the harvested maize crop finds its way into commercial and informal markets, while only 13.5 % and 11.6 % are retained for household consumption and livestock feed respectively. The major setbacks in maize production include the maize streak virus disease, the witch weed *(Striga hermantheca)* and pests such as the armyworm, cutworm and maize stock borer.

Cotton remains the main cash crop. However, discussions with interviewed farmers revealed that a number of them have stopped growing the crop. The main constraints associated with growing cotton are that it is labour intensive and producers are experiencing diminishing marginal returns. This has been due to escalating input costs in the face of meagre increases in producer prices. The crop is also very susceptible to a number of pests such as the red ball worm, American ball worm, red spider mite and aphids.

Sunflower is another cash crop that is widely grown by the farmers, although it is largely regarded as a "widow's crop" in local circles. Only 5.3 % of the interviewed farmers did not grow sunflower during the 1994/95 agricultural season. The positive attributes of the crop given by the farmers are that it is easy to grow and is sold early in the season, providing greatly sought-after cash for immediate needs such as the payment of school fees. Like cotton, sunflower is strictly a cash crop. Part of the harvested crop is, however, retained on the farms for use as animal feed, although the quantities are still insignificant. The early harvesting and marketing of the sunflower crop and the financial relief it provides to most households could be the reason for the crop's limited use as livestock feed. The only production constraint is the drooping head disease.

Groundnut, which is mainly regarded as a "woman's crop", is both meant for home consumption and marketing purposes. Unlike the case for maize, the bulk of the groundnut crop (52.9 %) is reserved for home consumption, 30.2 % is sold, while the remainder of the crop (16.9 %) is retained as seed. Use of bought-in commercial groundnut seed is rare. Most of the marketed crop is sold locally, while the rest is marketed through the Grain Marketing Board. Dried groundnut tops are fed to cattle as stover. Leaf spot, cercospora, rosette and aphids and golden mole are the major diseases and pests in groundnuts.

Cropping Practices

There are two main practices carried out by farmers in preparing land for agricultural production. Land is either winter ploughed (between May and July), followed by harrowing or shallow ploughing in September and October. Where applicable, row marking is done in late October. Alternatively, a single operation of ploughing followed by planting is done after the first effective rains.

Planting dates are not fixed but usually occur from the end of November till mid-January. Staggered plantings of the maize crop are common. This practice is carried out to reduce risk and spread labour requirements. More and more farmers are also practising dry planting as a form of risk management. The practices are that of dry planting winter ploughed lands in early November, followed by another planting with the first rains and other plantings which may end in January. The seed is drilled by hand within furrows opened up by ox-drawn ploughs.

Cotton is dry planted in rows by hand and seeds are covered by harrows or by the use of tree branches. Groundnut seed is usually planted using hands and hoes, while seed for small grains is normally broadcast. With the exception of groundnuts and small grains, hybrid seed is generally used. However, some farmers still use second and third generation hybrid seed, while others make use of open-pollinated seed varieties.

Weeding is done using an ox-drawn plough with the mould board removed, ox-drawn cultivator or simply weeding by hand. The actual weeding task is carried out when weeds start to be a menace or as soon as weeds emerge. The weeding frequency depends on the type of crop in question. This frequency is as low as once in maize, which is regarded as a weed tolerant crop, and as high as five to six times in cotton and sunflower respectively.

Maize harvesting occurs during April and May. The most common practice is cutting and stocking the crop in the field. Thereafter, the cobs are harvested, de-husked and carted to a drying crib at the homestead. The crop dries in the crib until July or August when it is shelled and stored in a granary or bagged for sale. Cotton picking is done by hand using family or hired labour, beginning in late April. Once harvested, the crop is carted to the homestead for grading and later marketed. The groundnut crop is harvested in March when it is lifted and dried. It is windrowed or put on stacks and finally plucked after April. For sunflower and small grains, harvesting is done by hand with the heads being cut and transported home for drying and threshing.

The Fertilizer Economy

Local farming systems portray a very varied use of both organic and inorganic fertilizers. Kraal manure is the most important organic fertilizer used. The manure is dug out of the pens and left to decompose further for some time. The manure is then either broadcast or applied in rows, depending on availability of supplies. A wide range of application rates have been observed, ranging from 5 to 30 tonnes per hectare for the maize crop (Goto, 1995). Manure is mainly applied in areas in Agro-Ecological Region III. Farmers in Agro-Ecological Region IV hardly apply it.

Bought-in inorganic fertilizers are mainly applied to maize and cotton. Basal fertilizer is used in some areas and the method of application is either at planting or after emergence. Compounds D (8% N, 14% P and 7% K) is used as basal application for most crops. Where manure is used, the farmers do not apply basal fertilizer. Ammonium nitrate (34.5% N) is mainly used for top dressing both crops. Details of fertilizer use are shown in Table 6.

Table 6: Inorganic fertilizer use and application rates

Crop	Point of Application	Percentage of Farmers Making The Application (%)	Average Application Rates [kg/ha]	Recommended Application Rates [kg/ha]
Maize	Basal	65.3	204.3	300.0
	Top Dressing	70.7	136.8	200.0
Cotton	Basal	37.3	159.0	300.0
	Top Dressing	98.7	113.9	200.0
Sunflower	Basal	54.7	50.5	200.0
	Top Dressing	50.7	32.6	100.0
Groundnuts	Basal	4.5	27.8	200.0
	Top Dressing	21.3	25.4	100.0

Source: Survey Results, August 1995.

Whereas, general crop manuring is quite high for the area, Table 6 shows that the fertilizer economy is still very rudimentary. In some areas, the application of chemical fertilizers, in general, is rare. In cases where fertilizer is used, the amounts applied are usually much lower than the recommended rates. A local "re-invention of the innovation" is the single application of a mixture of basal and top-dressing fertilizers after crop emergence. The

risk posed by erratic rains, critical shortages of cash and labour bottlenecks are factors that militate against more moderate and recommended fertilizer applications by farmers in the district. Inorganic fertilizers are also not economically priced in relation to the sale value of most crops.

Crop rotations are not strictly followed. In some instances, crop rotation is not practiced, whilst a simple rotation, consisting of continuous cultivation of the same grain crop over a 3 – 4 year period and a single year's cultivation of a legume, is followed. Very few farmers practice fallowing. In all noted cases the prevalent case was that of short-term fallow caused by specific circumstances such as illness or absence of the farmer and unfavourable weather conditions likely to make the planting of the field difficult.

Crop Protection

A number of interviewed farmers, mainly from Njelele 2 Ward, cited *Striga hermantheca* weed as a major problem in maize fields. The farmers control it by crop rotations and planting the maize crop early (late October and early November). The major pests for cotton are aphids, bollworms, and, sometimes, the red spider mite. For pest control, various pesticides are used. Some farmers spray after scouting and those not scouting spray on a weekly basis. Pesticide selection is not done according to pest problem where routine spraying is done. The method is usually to rotate the chemicals using conventional pesticides in the early stages, and then using synthetic pyrethoids continuously thereafter up to the end of the season. For groundnuts, Dimethoate is used to control aphids, while pest and disease control is not practised for sunflowers.

Irrigation

Despite the great potential of irrigation farming as an alternative to dryland cropping, less than 5 % of the total potential irrigable land is currently utilized for irrigation purposes. Where farmers are involved in irrigation schemes, the normal practice is the allocation of plot holdings averaging 0.1 ha in size to individual farmers. Scheme management and technical backstopping is provided by government extension agents, hence strict cropping practices and watering regimes are usually followed. The most commonly planted crop is green mealies for sale at the local growth point. Other crops are mainly horticultural and leguminous crops such as beans.

A more common form of irrigation farming is the management of small gardens usually located along rivers or near major water sources, a practice with its roots in local traditional farming systems. In these contexts, watering is done either from rivers using buckets or from high water tables in vleis. In some instances, water is drawn from boreholes. Watering is based on soil moisture loss, hence there is no watering regime.

Fodder Production

The introduction of commercial smallholder dairy production in the district has seen the establishment of pasture grasses and legumes solely meant for livestock feeding. These fodder crops include grasses such as Giant Rhodes *(Chloris gayana)*, Bana grass *(P. purpureum* cv.bana*)*, Star grass *(Cynodon nlemfuensis)* and Napier fodder *(Pennisetum purpureum)*. Established pastures also include legumes, which are essential for the provision of protein. The legumes include Lablab *(Lablab purpureum)*, fine-stem stylo *(Stylosanthes guianensis)*, silverleaf desmodium *(Desmodium uncinatum)* and siratro *(Macroptilium atropurpureum)*. Other occasionally grown species include multi-purpose trees such as Leucaena (*Leucaena leucocephala*) and Sesbania *(Sesbania sesban)*, and other legumes such as lucerne, cassava, cowpeas and velvet beans.

All pastures are grown under dryland conditions. Pastures are grazed while green, or conserved as silage or hay for dry season feeding. The Dairy Development Programme (DDP) recommendation is for all dairy producers to establish and maintain at least 0.5 ha of pastures. However, contrary to expectations, the reality *vis a vis* actual fodder production is somewhat different. Not all dairy producers have made the effort to establish pastures. At the time of this survey, 26 % of delivering and non-delivering dairy producers had no established pastures. The total established pasture hectareage was about 23 ha (representing only 4.2 % of total arable land), while the average pasture hectareage is 0.43 ha. Where fodder production has been attempted or is in progress, the situation is characterized by a great disparity between the herd size and fodder base. This is because normally farmers do not establish enough fodder to feed their animals throughout the production season.

Limited land, in its variant forms in equally variant production contexts, has been a major constraint to fodder production. Dairy farmers in the district face grave problems of limited availability of land to establish pastures due to the high population densities typical of most communal areas. The problem of limited land intensifies a long-time battle, that of stiff competition between dairy, other livestock, cash and subsistence crop enterprises, since the farmer has to allocate land to all these enterprises. These enterprises also compete for the farmer's capital, labour and management resources. Not surprisingly, the fodder production process has also been greatly hampered by labour bottlenecks. In addition, the more widespread constraint of draught power shortages has also set in, greatly hampering fodder production.

Major Production Constraints and Coping Strategies

The introduction of cash cropping provides great scope for commercial and intensive crop production in the district. The attainment of this potential is, however, hindered by unfavourable weather and geo-physical conditions, given that the district is located in a marginal agricultural zone. The lack of adequate resources necessary for such a scale of production is also further hampering prospects of more commercialized and intensified agricultural production. As a result, the cropping system in the district tends towards partially commercialized agriculture, with farmers' attitude towards risk being directed towards making sure that the family is fed.

Cropping is also practiced in contexts where the risk of drought is high due to a late start to the rainy season, mid-season droughts and/or an early end of the rainy season. Unlike production in the large-scale commercial agricultural sector, local cropping systems are characterized more by a complex and skilful adaptation to conditions of nature than manipulation of the environment. Where the risk of drought is high and land is scarce, mixed cropping is often practised as a yield optimizing, risk-reducing, moisture-saving and fertilizer-saving strategy. However, the cultivation of cash crops such as cotton and high-yielding staples (particularly maize) have led to a considerable number of sole crop stands. The introduction of field day competitions has perpetuated this later practice. Such competitions are usually sponsored by seed houses for plots where strict recommended agronomic practices are followed, while agricultural extension agents carry out regular inspection.

To allow for uncertainty, due to unreliable rainfall, farmers also distribute the planting of their crops over a long period. The practice of phased or staggered planting also spreads the demand for labour and harvests over several months. Arable cropping is usually supplemented by drought-tolerant crops such as sorghum and cotton, as well as animal production.

Trends in Crop Production Systems

Through the years, changes in bio-physical and socio-economic conditions have led to a shift in cultivated crops and general production patterns. There has been a considerable change in total agricultural production. However, increases in agricultural production over the years have been accomplished more by expanding the areas under cultivation than on land use intensification. Evidently, there has been a considerable extension in the area under cultivation since 1954. The hectareage under cultivation per farmer increased from an average of 2.9 ha in the 1959/60 season (Le Roux, 1969) to 7.3 ha in the 1994/95 season (Jingura and Hanyani-Mlambo, 1995).

In addition to the increase in population pressure, another factor, which has resulted in the extension of arables, is the introduction of cash crops such as cotton and groundnuts. The tendency has been to continue growing the staple food crops, with additional areas being used for cash crops. The introduction of a market economy and cash crops in local farming systems has also resulted in local crop production systems developing away from a purely subsistence economy to a partially commercialized industry.

From humble beginnings in the early 1950s, maize production has also grown from being an experimental crop with the local farming community to a dominant crop, not only in terms of cultivated land, but also in terms of quantities that are produced and marketed. There has also been a shift from the use of conventional maize varieties such as R201 and R215 to SC501, mainly due to the latter's higher yielding capacity. The introduction of the smallholder dairy programme has also seen the expansion of maize hectareages for silage making purposes

and the introduction of fodder crops in farmers' fields. Farmers could also have realized the complementarities between these two components.

Farm households have also reduced the land allocated to sorghum, millet, cowpeas and bambara nuts or stopped producing them completely due to lack of a lucrative market to absorb them. However, recurrent droughts in the area, in common with other parts of the region, have seen a resurgence in areas allocated to the more drought tolerant cereals such as sorghum and millet as a risk management measure.

An important finding from discussions with farmers during the informal survey was that maize and sunflower hectareages have increased, while that for cotton has declined over the years. The hectareage figures from the formal questionnaire survey are presented in Table 7.

Table 7:Trends in major crop production over a ten year period (1985 – 1995)

Crop	Average Crop Hectareages [ha]		
	1985	*1990*	*1995*
Maize	2.87	3.23	3.62
Cotton	1.02	1.14	0.83
Sunflower	0.88	1.08	0.94

Source: Survey Results, August 1995.

The 26 % increase in land allocated for maize production from 1985 to 1995 is highly significant ($P<0.001$). The increase in land allocated for cotton production (11.8 %) from 1985 to 1990 is not statistically significant ($P>0.05$). However, the decline in the cotton hectareage from 1990 to 1995 is significant ($P<0.05$). Land allocated for sunflower production increased, though not significantly ($P>0.05$), by 22.7 % from 1985 to 1990. The decline in sunflower hectareage from 1990 to 1995 by 13 percent is also not significant ($P>0.05$).

Maize has always been an important food crop since the take over from sorghum, millet and other small grains as the major staple food crop. Thus, the change in maize hectareages can be attributed to the increasing importance of maize as a staple food crop. An increase in human population has also meant a rise in demand of maize products. On the other hand, relative increases in the area cultivated to the sunflower crop have been as a direct result of the increasing importance of sunflower as a cash crop. The complementarity of these crops with the recently introduced smallholder dairy enterprise has added to this effect. On the other hand, relatively higher labour requirements and diminishing marginal returns in cotton have led to the decline in hectareages.

Livestock Production Systems

Common Livestock Species

Livestock is an integral part of almost all farming systems in Zimbabwe, with cattle constituting the bulk of domesticated animals in local farming systems. In Gokwe South District, cattle alone comprise 60 % of all animals kept by farmers. The less common species include goats (23.3 %) and pigs (10 %). Very few farmers have sheep (3.3 %) and donkeys (3.3 %). Indigenous poultry also form part of the livestock systems. The household livestock composition and distribution are shown in Table 8.

Table 8: Livestock holdings per household

Livestock Species	No. of Households	Average Numbers	Standard Deviation	Minimum Value	Maximum Value
Cattle	75	18	15	2	101
Donkeys	75	1	2	0	8
Goats	75	7	10	0	60
Sheep	75	1	2	0	15
Pigs	75	3	23	0	200

Source: Survey Results, August 1995.

Main Cattle Breeds

Indigenous or beef-type cattle are predominantly of the Mashona breed, but other genotypes are also present in the herds. Notable genotypes in the herds are the Nkone and Brahman breeds. On the other hand, the dairy herd is mainly composed of pure *Bos taurus* breeds and *Bos taurus* by *Bos indicus* crosses. These include Friesians, Jerseys and Red Dane cattle bought-in from surrounding commercial dairy farms. The less common dairy breeds include the Ayrshire and Guernsey.

Herd Composition and Herd Dynamics

Indigenous cattle constitute the bulk of cattle kept by individual households, representing 62.6 % of all ruminants found on farms. The current indigenous herd size stands at an average of 16 animals, of which 5 are cows. The situation within individual farm households differs markedly. These data are summarized in Table 9.

The breeding stock (cows and heifers) comprises 42.4 % of the indigenous herd, bulls (2.6 %) and bullocks (2.3 %), giving 47.2 % of the herd directed to breeding. Draught power animals (oxen and steers) comprise 33 % of the herd, while follower stock (calves) comprise 19.6 % of the total indigenous herd. The male to female ratio of breeding animals is 1:8.6, while the cow to calf ratio is 1:0.7.

Table 9: Composition of indigenous cattle herds per household

Cattle Types	Number of Households	Average Number	Standard Deviation	Min. Value	Max. Value
Total Numbers	75	16	15	0	101
Oxen	75	4	3	0	17
Bulls	75	**	**	0	3
Steers	75	2	2	0	9
Bullocks	75	**	1	0	7
Cows	75	5	4	0	27
Heifers	75	2	3	0	16
Calves	75	3	4	0	31

Source: Survey Results, August 1995.

** represents statistics where $x < 1$.

In comparison, the average dairy herd size is 4 animals, comprising 2 cows (1 of which is a cow in milk producing 10 litres a day). Both indigenous and dairy cattle numbers are characterized by great variability between individual households. Indigenous cattle populations have dwindled over the years due to recurrent droughts, persistent diseases, poor dipping facilities and, to a limited extent, sales. According to Goto (1995) the highest numbers were recorded in 1989/90 when the indigenous cattle population stood at 254 000. The lowest figures were recorded in 1993/94, with 127 600 animals. However, the average of 16 head of cattle per household is quite high by smallholder standards. This reflects the importance of cattle in local farming systems.

Upsurges in cattle numbers can be attributed to inward movement of new settlers, purchases and quality grazing during normal rainfall seasons.

The production system of indigenous cattle in the district is typical of production systems in smallholder farming areas, where cattle have multi-purposes and socio-economic roles. The higher proportion of oxen and cows than the other classes could be an indicator of an emphasis on rearing cattle for draught power and breeding. In addition, the high proportion of the breeding stock (47.2 %) indicates a great potential for the expansion of the herd. The smallholder dairy project is picking up, and so are the dairy cattle numbers. However, the average dairy cattle per farmer are still below the targeted levels. The major reasons why this is the case includes the 1994/95 drought, which resulted in the death of many cattle countrywide, poor animal health management practices and lack of capital to purchase additional dairy animals. Lack of collateral excludes most smallholder farmers from taking advantage of several loan facilities. However, farmers' current projections portray a trend of declining indigenous stock, accompanied by an increase in the dairy herd size.

Breeding and Reproduction

For most indigenous cattle, mating takes place naturally in the grazing fields where there is very little control and there is not much choice of breeding bulls. Some farmers do not even have their own bulls. In addition, farmers do not keep any breeding records. The only records kept are those of cattle numbers and herd composition required for dipping purposes by the veterinary department. Breeding information such as the age at first calving, calving interval and weaning age is hardly monitored. The prevalence of uncontrolled breeding in the indigenous herd, not only affects herd improvement, but also results in some cows calving down during winter periods when pastures are at their worst. According to results of the survey, the average age at first mating for indigenous heifers is 2.8 years, while the average calving interval is 1.6 years.

The introduction of the smallholder targeted and market oriented dairy enterprise has seen the start of a higher intensity and better managed livestock production system. This general improvement has been in the form of restricted cattle movements, closer monitoring of herds, improved calf management and proper breeding record management and use. Closer monitoring of dairy herds has already started paying dividends, with the average age at first mating for the dairy herd pegged at 1.8 years, while the average calving interval is 1 year.

Farmers are also encouraged to cross their indigenous cows with the exotic dairy bulls and use the progeny as dairy animals. Although this innovation has been fairly adopted, results are not as widespread as originally anticipated. This problem arises from the fact that most farmers are of the perception that the high producing, but disease prone, fragile and attention demanding, exotic dairy animal is the best. This problem is compounded by the mismatch between this affinity for exotic dairy breeds and farmers' management capabilities. Most of the pure breeds are still sustained on a mediocre management basis.

Calf Rearing

Controlled weaning of indigenous calves is practiced by 53.3 % of the farmers, with the remainder relying on natural weaning. Natural weaning of indigenous calves takes place at an average age of 1.3 years. Castration of male calves takes place at an average age of 16 months. The main method used is the burdizzo method (84.3 %) and some farmers use the elastrator ring (15.1 %).

Smallholder dairy farmers basically follow calf rearing recommendations given by the DDP. These recommendations are based on a modification of the Henderson Calf Rearing System (Oliver, 1987). This is basically a restrictive feeding system and recommends that a new born calf is fed on colostrum indirectly or directly from the dam for 5 days. The feeding frequency for the rest of the first week and the entire second week is twice a day, during which the calf is fed 1.5 litres of milk in the morning and another 1.5 litres in the afternoon (a total of 3 litres a day). This is reduced to 1 litre per feeding (2 litres a day) in the third week and 0.5 litres per feeding (1 litre per day) in the fourth and fifth weeks. Water is introduced *ad lib* at 3 days.

Calf starter meal is introduced to the calf on day 7, while growers' meal is introduced at one month's age. This is normally given in addition to provision of good quality hay or any other roughage source. Weaning is at day 35.

Recent research in Tanzania has also demonstrated that calves grow better on less milk and restricted suckling increases milk available for sale by 10 - 30 %, while the incidence of mastitis is reduced (van Sanh, 1994; Mejia, 1994). It is worth noting, though, that the actual individual farmer calf rearing practice is usually a re-invention of the innovation since most farmers follow practically different schedules in practice. In other words, very few farmers adhere to recommendations. These calf rearing system adaptations include feeding schedules where on average 2 litres of milk is fed to the calf per day for 3 to 4 months. Weaning is then set at 3 - 4 months. Those who let the calf suckle from the dam usually let this happen until the calf grazes on it's own. Once weaned, all female calves are kept as replacement heifers, while almost all male calves are exchanged or sold to neighbouring smallholder dairy farmers as a way of curbing inbreeding. Calf mortalities are relatively high, which acts as a drawback to individual dairy herd development. Calf death and removal have also been found to shorten the lactation length and depress milk yield in *Bos Indicus* breeds (van Sanh, 1994).

Milk Production

Commercial smallholder dairying in Gokwe is a fairly recent phenomenon, having only started in earnest in January 1994. The local smallholder dairy production system is manually operated, where milking is done by hand, often twice a day. Production on most smallholder farms heavily relies on family labour (Hanyani-Mlambo, Sibanda and Ostergaard, 1997). Milk production levels vary between different farm household herds, and within the herds this varies between different dairy breeds. According to the results of the survey, the average milk production per cow per day in Gokwe is 10 litres. On average, pure breed cows produce 13 litres per cow per day. The respective figures for crossbreds and indigenous cows are 8 and 4 litres. The lowest production per cow per day is 2 litres, which is usually from the indigenous cows.

Production figures also vary greatly depending on an individual farmer's feeding levels and management capacity. Milk production is also greatly influenced by season, with more milk being produced in the wet season. The average lactation length is 313 $\pm$ 20 days. Data on lactational performance and feeding regimes are shown in Table 10.

Table 10: Lactational performance and feeding systems of dairy cows in Gokwe South District*

Parameter	Number of Farmers(kg/day)	Wet Season (kg/day)	Dry Season
Concentrate Quantity	32	3.5 $\pm$ 1.8	4.5 $\pm$ 2.1
Milk output per cow	20	15.1 $\pm$ 5.4	8.1 $\pm$ 3.4

* mean $\pm$ standard deviation

Milk production per farm household has been rising steadily. However, these increases have been achieved on the basis of increased dairy cattle numbers rather than improved milk yields. As already highlighted, a major constraint to increasing smallholder dairy production has been the lack of capital to acquire more dairy animals. Even when cash is available, a lot of farmers face difficulties in sourcing suitable breeds and end up using any that come their way. Most heifers or cows also tend to be rejects which the commercial farmers will be trying to get rid of. Therefore, bought-in heifers and cows tend to be condemned or culled animals, making smallholder dairy projects dumping grounds.

Other factors hampering milk production in the district include shortage of liquid cash, high interest rates on loans, an inadequate feed base and high costs of bought-in animal feeds, high prevalence of cattle diseases and limited knowledge of animal health, inadequate knowledge on general livestock management and problems of milk transport to the Milk Collection Centre. Farmers have also been failing to cope and adjust to the heavy labour demands of a dairy enterprise. Labour shortages have long been established as the most limiting factor in smallholder agricultural production (Ruthernberg, 1980). Record keeping at the farm level, which is essential for performance evaluation and improvements, is also very poor.

The main constraints for improving production and human welfare in the livestock sector in developing countries have been identified as: poor animal nutrition due to an underdeveloped feed resource base, poor health delivery systems, inadequate post-harvest technology, under-utilised genetic potential, restricted access to inputs, insufficient infrastructure for disposal of marketable produce, and lack of institutional support (Ostergaard, Dalsgaard, Kyvsgaard and Dolberg, 1997). Similar factors have been identified as constraints to improved smallholder dairying in Zimbabwe (DDP, 1994; Hale, 1994; Mugwagwa, 1994).

However, according to Dube (1995), Zimbabwe's smallholder dairy projects have great potential because traditionally, smallholder farmers have always kept cattle, demand for milk in the rural communities is quite high, overhead costs for setting up smallholder dairies are lower compared to sophisticated commercial dairy set ups and donor support in the development of this sub-sector is still forthcoming.

Nutrition

The management of indigenous cattle has continued to follow traditional systems of common pasture grazing with little dietary control. Indigenous cattle herds are herded from November to June to avoid damage to crops. Herds are then allowed to graze freely during winter. However, land reserved for grazing purposes is dwindling fast as people are settling in grazing areas and converting large tracts of grazing land into arable land. Most areas are thus moderately grazed, very overgrazed or bare. Though some areas may be predominantly bare or overgrazed there are localized areas of better grazing. For example, grazing land is still adequate in Jahana ward which is still relatively sparsely populated. In most other wards grazing is limited to very marginal areas where there is very poor sward growth and species composition. Supplementary feeding for indigenous cattle is based on the use of crop residues such as maize stover, groundnut stalks, sunflower heads and salt licks. Occasionally, farmers buy high energy feeds, mostly for fattening animals for sale. Draft animals and pregnant animals have a preference over other animals on supplementary feeding. Currently, however, most crop residues are inefficiently used. Crop residues meant for cattle feed are rarely treated and are given in abundance, leading to wastage.

On the other hand, bought-in feeds are widely used for dairy animals. Purchased dairy concentrates are mixed with crushed maize grain as basic or supplementary feed. Crushed whole sunflower seed is also used by some farmers in mixture with crushed maize. Feeding is usually done twice a day where lactating cows are fed during milking. The recommendation is that farmers should feed one kilogramme of dairy meal per cow per day for body maintenance purposes, while an additional 0.5 kg of dairy meal is fed for every litre of milk produced. Dry cows are usually fed for body condition maintenance purposes only. Lactating dairy cows are usually fed on a flat rate of 2kg per feeding. However, the actual feeding regimes vary from farm to farm. The feeding regime can also be according to production and/or season. Twenty-eight percent of the farmers gave concentrates to their lactating cows according to production and 20 % according to season. Fifty-two percent of the farmers did not have defined feeding regimes. In the season related feeding programme, the cows were offered 3.5 and 4.5 kg of concentrate per day in the wet and dry season respectively.

Dry season feeding is a problem throughout the tropical world and Zimbabwe is no exception. In the wet season, animals have access to lush and abundant grass, and readily available water. Pastures deteriorate, both quantitatively and qualitatively, in the dry season. This severely limits nutrient supply to meet the demand for lactation. Pasture production by farmers indicates an attempt to ensure improved fodder availability in the dry season. This still has to attain sustainable levels. Cattle are also fed stover during the period May to December when fodder and veld stocks are low. Maize stover is fed mixed with groundnut stover, with molasses or salt, or fed without additives. Fibrous crop residues, normally available in at least a 1:1 ratio to grain, constitute a large potential ruminant feed resource in most smallholder farming areas.

The high cost of supplements, a problem intensified by recurrent droughts, has led some dairy producers to develop the tendency of following the false economy of restrictive cow feeding in the hope of saving cash on feed purchases. Feed shortages and related high feed costs have also forced some farmers into the practice of using non-conventional feedstuffs whose rations are arrived at without a proper basis. An example is the feeding of bovines on *Mupangara* (Acacia albida), *Mutsangu* (Acacia spp.), *Musekesa* (Piliostigma

thorningii), *Mukonashanhu* and *Mugogoro* pods, and the leaves of *Musasa* (Brachystegia spiciformis), *Mupfuti* (Brachystegia spp.) and *Munhondo* (Julbernadia globiflora). The pods are crushed and mixed with concentrates, maize grain or simply crushed and fed without additives. Leaves are fed whilst still green.

Herd Health

The major cattle health problems in the district are tick-borne diseases. Common tick-borne diseases are gall sickness, red-water and heart-water. These diseases, which are common in both indigenous and dairy cattle, are greatly intensified by infrequent dipping due to shortages of dipping chemicals and breakdown in dip boreholes or dip refilling schedules. Low rainfall and the unavailability of water has always been perceived as the major constraint to agricultural production, a crisis worsened by the 1994/95 drought. In extreme cases and usually along the hardest hit belts of the district, water sources are up to 11 kilometres away, resulting in water problems for local dip-tanks and an upsurge in tick-borne diseases.

Other common cattle diseases are skin or viral diseases such as lumpy skin and *senkobo* and bacterial diseases such as mastitis, anthrax and quarter evil or black leg. This list also includes calf scours, foot and mouth, foot rot, blot, orf and ophthalmia, pneumonia which is a problem especially during the rainy season, and the occassional stiff sickness disease. Other common diseases include babesiosis, cowdriosis, anaplasmosis and brucellosis. Common reproductive problems are abortions, retained placenta, metritis and dystocia. These, however, do not present major dairy animal health problems.

Indigenous cattle casualties averaged one (1) per herd and a maximum figure of 31 deaths per herd, per year (where n = 73). Dipping for the dairy animals is home-based where individually purchased pour-ons such as Drastic Deadline (used by 60.4 % of households) and spray acaricides (10.3 %) are used. 29.3 % of the interviewed farmers used both. Casualties within the dairy herd are also relatively high with a statistical average of 0.49 head per household herd, representing an average herd mortality of 11.6 %. This is especially so given that the accepted mortality rate under commercial systems is 2 %.

The Department of Veterinary Services (DVS) helps farmers with cattle vaccinations. There is very little vaccination done by farmers. A more common herd health management practice among farmers is the deworming of animals. This is normally done twice a year at the onset of rains and when animals are put on crop residues at the end of the rainy season.

Conclusion

This diagnostic study was carried out with a Farming Systems perspective. Land use patterns, system trends, enterprise compatibility, constraints, potentials and socio-economic issues were explored. Farming systems in Gokwe South District presents a host of production constraints but at the same time also indicate a great potential for improvement. Highlighted crop and livestock enterprises show great potential for the integration of smallholder farmers into the mainstream of the national economy. Although crop production constraints were identified as the major setbacks in agricultural production, issues concerning livestock production were also highly prioritized by the farmers. Low productivity, which is characteristic of most tropical smallholder farming systems, is also evidence of weak institutional support within local crop and livestock production systems. Such problems should not be put down as imponderables, but investigated, while appropriate and sustainable solutions can be developed together with the intended beneficiaries. Although this study was done at district level, it has a much wider application, given similarities in environments and practices in tropical farming systems. The study is also vital in its quest to provide information useful in facilitating the running of current and the planning of future rural development programmes.

References

DANIDA, 1995. "Evaluation of Danida's Support to the Dairy Industry in Thailand". DANIDA Evaluation Report. pp. 71.

DDP, 1994. Proceedings of the Dairy Development Programme Ngezi National Parks Workshop.

Dent, J. B., McGregor, M. J. and Edwards-Jones, G. 1993. "Integrating Livestock and Socio-Economic Systems into Complex Models". Agricultural Resource Management, University of Edinburgh, Scotland. pp. 15.

Dube, L. 1995. "An Economic Analysis of Smallholder Dairy Farming in Zimbabwe: A Case Study of Rusitu Small Scale Dairy Settlement Scheme". Unpublished MSc. Thesis, University of Zimbabwe.

Goto, E. P. 1995. "Farming Systems in Gokwe South District". A Paper Presented at a Workshop on Livestock Systems Research Methodologies, Gokwe Hotel, Zimbabwe, 26 – 30 June 1995.

Hale, D. H. 1994. "Dairy Manpower Development Survey for Zimbabwe". In Mann, E.J. and Brookes, B. (eds), Seminar Proceedings on Dairy Development Policy and Implementation: Sharing of Experiences Between Africa and Asia; FAO,Rome.

Hanyani-Mlambo, B. T., Sibanda, S. and Ostergaard, V. 1997. "Socio-Economic Aspects of Smallholder Dairying in Zimbabwe". Unpublished Paper. Department of Agricultural Economics and Extension. University of Zimbabwe.

Jingura, R. M. and Hanyani-Mlambo, B. T. 1995. Diagnostic Report on the Informal Survey on Gokwe South District's Farming Systems.

Le Roux, A. A. 1969. "African Agriculture in Rhodesia". *Rhodesia Agricultural Journal.* 66(4): 83 – 89.

Mejia, C. E. 1994. "Effects of Restricted Suckling Versus Artificial Rearing on Milk Production, Calf Performance and Reproductive Efficiency on Dual Purpose Mpwapwa Cattle in a Semi-Arid Climate". Unpublished MSc. Dissertation. Swedish University of Agricultural Sciences.

Mugwagwa, M. 1994. "Progress in Smallholder Dairying in Zimbabwe". In Mann, E.J. and Brookes, B. (eds), Seminar Proceedings on Dairy Development Policy and Implementation: Sharing of Experiences Between Africa and Asia; FAO, Rome.

Oliver, J. (ed) 1987. NADFZ (National Association of Dairy Farmers of Zimbabwe) Dairy Farmers' Handbook. NADFZ, Commercial Farmers' Union, Harare, Zimbabwe.

Ostergaard, V., Dalsgaard, J., Kyvsgaard, N. and Dolberg, F. 1997. "Livestock Systems Research In Uganda". Internal Report No. 100. Danish Institute of Agricultural Sciences.

Reid, M. G. 1977. "The Early Agriculture of Matebeleland and Mashonaland". *Rhodesia Agricultural Journal.* 74(4): 97 – 102.

Ruthernberg, H. 1980. *Farming Systems in the Tropics.* 3rd Edition. Oxford: Oxford University Press. pp.

van Sanh, M. 1994. "Effects of Restricted Suckling Versus Artificial Rearing on Performance and Fertility of *Bos Taurus* and *Bos Indicus* Cows and Calves". Unpublished MSc. Dissertation. Swedish University of Agricultural Sciences.

Whitlow, J. 1979. "A Scenario of Changes in Subsistence Land Use and its Relevance to the Tribal Areas of Zimbabwe". *Zambezia.* 7(2): 171 – 190.

Wright, J. 1977. "Hunters, Herders and Early Farmers in Southern Africa". *Theoria.* 49: 20 – 36.