CHAPTER 1

INTRODUCTION

1.1 Draught animal power use by smallholder farmers in Zimbabwe

Smallholder farmers in Zimbabwe depend on livestock as the main source of draught power for farm operations (Ministry of Lands and Agriculture, 1995). Draught animals are an important component of smallholder farming systems in most developing countries and cattle are most used for draught (Ndlovu and Francis, 1997, Ellis-Jones, 2000). Generally, livestock, particularly cattle are an important component to the communal farming system, providing farm inputs such as draught power, transport and manure (Shumba, 1984; Francis, 1996; Ndlovu and Francis, *op cit*; Ellis-Jones, *op cit*). Draught animal power (DAP) is used primarily for tillage operations and transport. The main tillage operations are land preparation and mechanical weed control (O'Neill, 1999).

Shortage of DAP is one of the major constraints to increased crop production in communal areas of Zimbabwe (Tembo and Elliot, 1988; Elliot, 1989). This constraint generally also affects other countries in the Sub-Saharan African region (ODA, 1992). Shortage of DAP is second to land shortage as a constraint to agricultural production (Muchena, 1989 cited by Ndlovu and Francis, 1997). The effects of droughts have reduced the number of draught animals and a considerable number of smallholder farmers have inadequate draught power. Due to large numbers of cattle that were lost as a result of droughts, donkeys are now being used more for draught than as pack animals for transportation (Francis, 1996).

According to Barrett, O'Neill and Pearson (1992), 90% of smallholder farmers in communal areas of Zimbabwe are located in natural regions (NR) III, IV and V and own arable land ranging from about 2 to 5 hectares (ha). Farming systems in Zimbabwe are based on the NRs map drawn by the Government of Zimbabwe (1984) and are described in Appendix 1. Earlier findings by Goe (1989),

cited by Francis (1993), estimated that over 80% of households in communal areas of Zimbabwe used DAP provided by about 800 000 cattle. About 60% of the national cattle herd is found in communal areas and up to 65% of communal farmers own cattle (Mudimu, 1983; Bratton, 1984; Shumba, 1984; Rusike, 1988; CSO, 1997). Farmers with inadequate draught animals rely on making hiring or sharing arrangements in order to form draught teams for field operations (Shumba, *op cit*; Muchena, 1989; Francis, 1993; Zindi, 1999).

Smallholder farmers own a range of animal-drawn tillage implements and equipment that include ploughs, cultivators, harrows, planters, ridgers and scotchcarts. Conventional ploughing using the mouldboard plough is the basic primary tillage operation carried out by smallholder farmers. About 80% of smallholder farmers own a plough (Tembo and Elliot, *op cit*). This trend in implement ownership has generally remained stable (Francis, 1993; 1996).

Previous studies have indicated that smallholder farmers lacked skills and knowledge in correct use, repair and maintenance of animal-drawn implements. Chatizwa and Khumalo (1996), Chatizwa and Ellis-Jones (1997) and Mujuru (1998), found out that many smallholder farmers could not set ploughs properly. Ploughs are usually used without drawbar assemblies, width and depth regulators and other components resulting in poor quality of tillage. Some farmers complain that ploughs are heavy and difficult to use and so remove parts with the aim of reducing the weight of ploughs. Some of the available draught energy can be wasted due to the use of improperly set implements. Both operators and draught animals may be subjected to unnecessary stress as implements become unstable and difficult to control during work.

In order to improve the performance of DAP, smallholder farmers need to have a good understanding of the main components of the tillage system. The draught animal, harness,

implement, operator and the soil are the five components in an animal draught tillage system (Inns, 1994). Each of these components has its characteristics and the performance of the system depends on how these five components interact. At smallholder level, these components vary considerably from farmer to farmer.

1.2 Purpose of study

A number of factors affect the efficiency of animal draught tillage systems and these depend on specific farmer-situation. This study was part of the United Kingdom's Department for International Development (DFID) project, Draught Power Performance and Production Management, that was implemented under the Livestock Production Programme (Project R7352).

The aim of the project was to enhance the performance of available draught animals in semi-arid crop/livestock and livestock production systems. Investigations into the interaction of implement condition and draught animal performance were undertaken to identify both feasible and appropriate management options for smallholder farmers. Previous DAP work in Zimbabwe had identified a wastage in limited draught power resource available, as well as human energy, through inefficient use of ploughs.

There is some information on implement ownership as well as their condition but there is very limited information on the performance and the effect of implements on crop productivity at smallholder level. This study sought to evaluate the performance of implements using available farm resources (draught animals, implements and labour) in a typical draught animal tillage system at smallholder level and identify options for the allocation and efficient use of these resources in cropping systems. The study focused on the implement, draught animal and the operator, and their

interactions, whilst important characteristics of the soil and harnessing systems were observed, so that their impact on overall crop productivity could be assessed.

1.3 Objectives of the study

Overall objective

The main objective of the study was to investigate the effect of renovating animal-drawn ploughs and cultivators on field performance, soil physical properties and on crop yields at smallholder level in Masvingo province. The study also investigated farmers' attitudes and constraints in using DAP and the operation, repair and maintenance of implements.

Specific objectives

a) To assess the capital resource base of smallholder farmers as related to use of DAP in Masvingo province
b) To investigate the state of animal-drawn tillage implements (ploughs and cultivators) used by smallholder farmers in Masvingo province
c) To evaluate the effect of renovating ploughs and cultivators used by smallholder farmers in Masvingo province on:
    i) field performance in terms of depth and width of cut, draught, specific draught, field capacity, weeding efficiency, field efficiency, quality of work and implement handling
    ii) three soil physical properties (soil bulk density, soil shear stress and soil moisture) and crop yield
d) To carry out an assessment of the residual effects and benefits of farmer training in implement operation, repair and maintenance in Masvingo province

1.4 Hypotheses of study

a) Well-resourced households own implements in better condition than resource-poor farmers.

b) Smallholder farmers are able to correctly set, operate and maintain animal-drawn ploughs and cultivators.

c) Renovated ploughs and cultivators produce better field efficiency, field capacity and improve weeding efficiency leading to improved crop yields than implements that are not renovated.

d) Training improves farmers' attitudes and skills in correct implement setting, use, repair and maintenance.

1.5 Structure of thesis

There are seven chapters in this thesis. The problem statement, objectives and hypothesis are given in Chapter 1. Chapter 2 is a review of literature related to utilisation of DAP technology. An overview of DAP systems and some of the constraints faced by smallholder farmers in the use of DAP are highlighted. General materials and research methods used in the study are explained in Chapter 3. Chapter 4 gives a synthesis of data on the resource base of smallholder farmers. Details of household characterisation based on physical capital as related to the use of DAP and information on the condition of implements owned and farmers' knowledge in the use of implements is given in this chapter. Chapter 5 describes studies conducted to evaluate the effect of implement renovation on field performance, soil properties and crop yields. Chapter 6 contains findings from an assessment of implements that were renovated during implement performance trials to determine the impact of the trials on the attitudes and skills of farmers in implement use and maintenance. General discussions, conclusions and recommendations on the utilisation of DAP are given in Chapter 7. References of cited literature and appendices are at the end of the thesis.