AN ECONOMIC STUDY OF MAIZE PRODUCTION ON IRRIGATION SCHEMES IN LEBOWA

by

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I declare that the dissertation for the degree Master of Science in Agriculture at the University of the North hereby submitted, has not previously been submitted by me for a degree at this or any other university, that it is my own work in design and in execution and that all material contained therein has been duly acknowledged.

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ABSTRACT

The African continent is faced with acute food shortages. Most African countries, including Lebowa national state, do not produce enough food to feed their own people. The study attempts to devise possible ways of increasing maize production in the less developed areas of South Africa (homelands).

There exist large differences between the maize output levels of the irrigation schemes covered in the study. Therefore, the study aims to determine the possible causes of these differences. It is suggested that the differences in output levels may largely be attributed to the existing differences in the input levels applied. Inputs which might affect maize production are isolated. The relationship which exist among these inputs and between the inputs and output is analyzed for all irrigation schemes combined and for the top and bottom farmers.

The results of the study indicate that differences in the maize output levels may be attributable to the differences in the levels of the following inputs which are applied : 2.3.2 superphosphate fertilizer, extension contact and course attendance. Factors such as durable capital, age of farmers, farmwork experience and family labour do not appear to explain the existing differences in output levels. Therefore, no appreciable increases in output levels may be expected to result from the adjustment in the levels of these factors. It has also been found that bottom farmers use more seed than top farmers. Furthermore, radio media which has been shown to have a positive effect on production in certain parts of Africa does not appear to have any impact on the per= formance of farmers in the areas covered. Contrary to expectations, having worked for a white farmer does not show any significant relation to output.

Farmers have singled out shortage of water as the most important obstacle to increased production. Some farmers also indicated that their land units are too small.

SAMEVATTING

Die Afrika kontinent word gekenmerk deur knellende voedseltekorte. Die meeste Afrika state, insluitende die nasionale staat Lebowa, se produksie is huidiglik onvoldoende om hul eie mense te kan voed. Hierdie studie poog om verskillende metodes te oorweeg waarvolgens mielieproduksie in die minder ontwikkelde gebiede soos die Suid-Afrikaanse tuislande, verhoog kan word.

Die studie het bevind dat relatief groot verskille in die opbrengspeile van mielieproduksie by die verskillende besproeiingskemas bestaan. Die studie het dus gepoog om die oorsake van hierdie verskille vir opbrengspeile te identifiseer. Dit blyk dat die verskil vir opbrengs= peile grootliks toegeskryf kan word aan die huidige verskil in die vlakke van insette wat aangewend is. Die spesifieke insette wat opbrengste affekteer is apart geïdentifiseer. Die spesifieke verhoudings wat tussen verskillende insette, en tussen insette en uitset bestaan word vir die verskillende besproeïingskemas gesamentlik en vir die boonste en onderste vlak boere ontleed.

Die resultate van die studie toon dat die verskil in opbrengspeile van mielies toegeskryf kan word aan die volgende faktore, naamlik, 2.3.2 Superfosfaat kunsmis, kontak met voorligtingsdienste en die bywoning van kursusse. Ander faktore soos vaste kapitaal, ouderdom van die boere, ondervinding van plaaswerk, en die beskikbaarheid van familie-arbeid, blyk nie 'n direkte invloed op die opbrengspeile te hê nie. Dit kan dus afgelei word dat opbrengspeile nie spesifiek deur verandering in die faktore verklaar kan word nie. Dit is ook bevind dat die onderste vlak boere relatief meer saad as die boonste vlak boere gebruik. Verder is bevind dat radio uitsendings wat oor die algemeen positiewe resultate op landbouproduksie in sommige Afrika state het, geen spesifieke invloed op die resultate van die boere in die steekproef getoon het nie. Teenstrydig met wat verwag sou kon word, het werksondervinding by Blanke boere, geen spesifieke invloed op opbrengste getoon nie.

Die faktor wat deur die grootste getal boere as beperkend vir die verkryging van hoër opbrengspeile uitgewys is, is die tekort aan besproeïingswater. Enkele boere het aangetoon dat hul grondeenhede te klein is.

This thesis is dedicated to my parents, Samson and Azania, without whom I might never have gone to school; to my wife, Thandi, and our children, Thabo and Phomolo, for their love and understanding.

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF MAPS

CHAPTER 1

INTRODUCTION

1.1 PROBLEM STATEMENT

Agriculture occupies an important place in the economy of less developed countries (LDCs). It serves as the main source of income for close to two-thirds of the population of LDCs (World Bank, 1982 : 39). In recognizing the dominant role of agriculture in LDCs, Metcalf (1969 : 74) states that "... agriculture is the most dominant industry in nearly all underdeveloped countries with typically 40 - 60 percent of the G.N.P. from agriculture and 50 - 80 percent of the labour force employed in agriculture".

Many LDCs tend to place more emphasis on the development of the industrial sector, neglecting agriculture (Clute, 1982; Reynolds, 1975 :1; Arnon, 1981 : 4-5; Iniodu, 1981 : 1). This is largely due to the association of agriculture with backwardness and underdevelopment (Iniodu, 1981 : 1). This exploitative view has led to the allocation of the limited resources available to the industrial sector. As long as LDCs view agriculture as a subservient sector which must be exploited for urban industrialization, development will be frustrated. What is needed for economic growth is the achievement of a proper balance between agricultural and industrial development (Meier, 1976; Johnston and Southworth, 1967 : 1 - 19; Mosher, 1971 : 12 - 13). Agriculture should be seen as a more or less equal partner with industry and other sectors of the economy. This is the approach which was followed in some developed countries in Europe, Japan and the United States. In these countries, a modern agriculture accompanied - and in some cases led - the development of the process of industrialization and growth (World Bank, 1982 : 39). Arnon (1981 : 5) states that "... development is not likely to occur if agricultural productivity is not increased as a prelude to industrial growth".

One of the most important functions which the agricultural sector must perform is the provision of adequate food supplies. An adequate food base is usually an essential prerequisite for economic development. The extent to which a country is able to feed its own people out of its domestic resources is an important measure of the degree of economic progress (Iniodu, 1981 : 2). If one takes into account that the majority of the population of LDCs reside in the rural areas where income sources other than agriculture are limited, the performance of this function will continue to play an essential role in the future. Many countries which are dependent on imports for their food supplies can make substantial foreign exchange savings by increasing their domestic food production.

It is known that in several LDCs, particularly in Africa, growth in food production has not succeeded in keeping pace with increases in population. The amount of food production in Africa has increased by two percent per annum since 1960 and this growth rate is showing a decline. Over the same period, population has increased by well over two percent per annum and this rate is increasing (Economist, 1983 : 52). In fact, Priebe and Hankel (1981 : 31) state that Africa is the only continent in the world where per capita food production has declined over the past two decades. Per capita food production in Sub-Saharan Africa was 86 percent of its 1969-71 level in 1981 (Christensen and Witucki, 1982 : 889). In some countries like Angola, Ethiopia, Ghana, Mozambique and Uganda, per capita food production was less than 75 percent of the 1969 - 71 level (Christensen and Witucki, 1982 : 889). Hartmans (1983 : 165) mentions that per capita food production declined in 30 out of 35 tropical African countries and in 1980 food imports liquidated 32 percent of their export earnings.

A possible reason for the decline in per capita food production in Africa over the past two decades is the discrimination in resource allocation between commercial crops and food crops in favour of the former. (Iniodu, 1981 :2; Clute, 1982). Agricultural development programmes were designed to put more emphasis on the production of cash crops at the

expense of food crops. Clute (1982) mentions that this came about when colonial powers introduced cash crops for the purpose of gaining raw materials from the African colonies. This resulted in a reduction of the amount of land devoted to crop production.

Due to the increased demand for tropical agricultural products during the post-World War II period, colonial powers and the newly independent states encouraged farmers to grow even more cash crops. Prices of food crops were very low whilst those for cash crops were guaranteed by the marketing boards (Clute, 1982).

These events resulted in a serious decline in per capita food production. The effect of this decline was, however, mitigated by foreign food aid as countries like the United States had food surpluses (Clute, 1982). The food situation became critical during the late 1960's and food prices soared. Food imports became expensive for African countries. Mosher (1971 : 79) criticises the action whereby farmers are forced or encouraged to produce specific commodities. Instead, farmers should be free to select their own pattern of production.

LDCs should give the highest priority to self-sufficiency in food production. The food production situation in the less developed areas of South Africa does not differ from that in other African countries. It is known that these areas do not produce enough food to feed their people. Thus, it is necessary to devise ways and means of improving the food situation in these areas.

1.2 OBJECTIVES AND HYPOTHESIS OF THE STUDY

The research covers eight irrigation schemes in Lebowa.

The hypothesis advanced in this study is that there exist significant differences in maize output levels between irrigation schemes and between groups of farmers across the schemes. The causes of these differences are not clearly understood. The specific hypothesis to be tested is that differences in output levels between groups of farmers and between schemes may be due to the differences which exist in input levels used by the different farmer groups and irrigation schemes.

The objective of the study is to determine the possible causes of differences in the production performance of (a) groups of farmers, and (b) irrigation schemes. The specific objectives will, therefore, be to :

(a) isolate factors which affect maize production;
(b) determine the resource base of groups of farmers and irrigation schemes and how these resources are utilised in the production process with a view to establishing constraints to increased maize production; and
(c) make policy proposals which may help uplift output levels of bottom farmers and irrigation schemes.

1.3 METHOD OF DATA COLLECTION

The survey method was used to collect the data. A random sample of farmers in each of the eight irrigation schemes which produce maize and wheat was taken. The reason for selecting irrigation schemes which produce both maize and wheat was to have factors such as climate and land use vary as little as possible (Wilkening, 1953). The entire sample included 117 farmers : 17 in Coetzeesdraai, 9 in Mapela, 11 in Wonderboom, 16 in Haak=doorndraai, 25 in Krokodilheuwel, 12 in Success, 15 in Platklip and 12 in Apiesboom. These samples represent an average of 18 percent of the total population per scheme. The planned sizes were 18 percent of the total population but due to the drought which adversely affected agricultural production during the time of conducting the survey, several completed questionnaires had to be excluded as farmers could not harvest anything and,thus,could not provide relevant information.

Visits were undertaken to all the irrigation schemes selected in order to familiarize the author with some of the production conditions and to make contact with the key people who turned out to be of much help during the conducting of the survey. The actual interviews were conducted at the beginning of 1982 and the information gathered relate to the crop year of 1981. Each farmer was asked by means of a questionnaire to supply information about his/her social characteristics, educational and literacy levels, exposure to sources of innovative information, labour supply and

utilisation, inventory of farming implements and equipment, availability and utilisation of variable inputs, credit availability, output levels and attitude towards certain issues (See appendix 1). It took two weeks to complete the questionnaires at an average time of 1,5 hours per questionnaire. Some of the information gathered was readily available from the local extension officers.

1.4 OUTLINE OF SUBSEQUENT CHAPTERS

Literature on the concept of economic efficiency and its measurement is reviewed in Chapter 2. Chapter 3 describes the geographical location of Lebowa and, thus, of the irrigation schemes; Lebowa's policy guidelines on rural development; the role of the Lebowa Department of Agriculture and Environmental Affairs and the setting within which the irrigation schemes operate. In Chapter 4 the factors which may affect maize production are described and relevant literature is reviewed. Chapter 5 quantifies the resources which are used on the irrigation schemes. A summary of opinions of farmers regarding certain production aspects is also given. Finally, irrigation schemes are ranked according to their output levels and the performance of farmers. In Chapter 6 the data collected are analysed and the results presented. Correlation analysis is employed in order to determine the relationship which may exist among the inputs and between inputs and output. The t-test is used to determine if there is any difference between output and input levels of farmers and irrigation schemes. Chapter 7 gives a summary of the results and their implications for policy.

CHAPTER 2

ECONOMIC EFFICIENCY AND ITS MEASUREMENT - LITERATURE REVIEW

Although the measurement of economic efficiency would have probably provided the best answer to the inquiry of this study, it was not possible to employ any of the techniques used in the measurement of economic efficiency due, mainly, to the paucity of data. It is, however, important to understand the meaning of economic efficiency in order to explain the causes of differences in the performance of farmers.

2.1 MEANING OF ECONOMIC EFFICIENCY

Economic efficiency has long been a subject of concern for economists. Schultz (1964 : 37) has argued that traditional agriculture represents an economic equilibrium and "there are comparatively few significant inefficiencies in the allocation of the factors of production..." Thus, the "efficient but poor hypothesis" implies that any reallocation of factors of production at the disposal of farmers will not yield any appreciable increases in production. Thus, each input is allocated such that its marginal factor cost (its price) equals its imputed value of marginal product. Given this situation, the only way in which agricultural progress can take place is through the use of modern inputs.

Since Schultz' book was published (1964), several studies - the results of which lend support to his hypothesis - have been undertaken (Welsch, 1965; Chennarreddy, 1967; Yotopoulus, 1967; Sahota, 1968; Sidhu, 1974; Wise and Yotopoulos, 1969; Saini, 1979; Srivastava and Nagadevara, 1972; Acheson, 1972; Dey and Rudra, 1973; Hati and Rudra, 1973; Helleiner, 1975; Norman, 1975; El-Shagi, 1978; Yotopoulos and Nugent, 1976; and Herdt and Mandac, 1981). Although the number of researchers whose results support Schultz' hypothesis is significant, it has not escaped criticisms. Ghatak and Ingersent (1984 : 127) outline these criticisms as concerning :

(a) the choice of the neo-classical model to represent the behaviour of peasant farmers; and

(b) the distinction between allocative and economic efficiency

Ghatak and Ingersent (1984 : 127) note that the restrictive assumptions underlying the neo-classical model are not applicable to traditional agriculture. Traditional farmers operate within an uncertain environment and are confronted by institutional and cultural constraints. In addition, because traditional farmers are poor, they tend to be more risk-averse (cf. Cleave, 1974 : 202; Heady, 1981 : 37-38 for similar criticisms). In the neo-classical model, it is assumed that profit maximization is the objective of the farmer. This assumption is not applicable to traditional agriculture as "adequate stability of output and income, and the avoidance of major short-run losses, take precedence over profit maximization" (Lipton, 1968). The results of a study by Schulter and Mount (1974) provide further evidence that traditional farmers maximize utility and not profit. Ghatak and Ingersent (1984 : 135) conclude that the implication for a farmer whose objective is not profit maximization is that he cannot achieve economic efficiency although he may be either technically or allocatively efficient.

The second major criticism of the poor but efficient hypothesis and its supporting evidence is that "by neglecting the distinction between allocative efficiency and economic efficiency; it takes technical efficiency for granted" (Ghatak and Ingersent, 1984 : 133). It is alleged that, in his study Schultz implied that a firm (or farmer) which is allocatively efficient is automatically technically efficient. This forms the main criticism of the "efficient but poor hypothesis".

Until Farrell's article (1957), allocative efficiency and economic efficiency were treated as practically synonymous. A clear-cut distinction should be made between technical and allocative efficiency as two components which make up economic efficiency. This distinction is important especially for policy purposes. By treating allocative and economic efficiency as synonymous one may overlook the fact that technical inefficiency may result in even greater wastage of resources than allocative inefficiency (Timmer, 1970).

Technical efficiency is concerned with the manner in which the inputs are used. It refers to the proper choice of production function among all those actively in use by the firms (farms) in the industry (agriculture) (Sampath, 1979 : 17). Technical inefficiency is said to result from firms not fully understanding their underlying production function (Pachico, 1980 : 66). Perfect technical efficiency means that all farmers operate on the outerbound production function. The more technically efficient firms tend to produce larger quantities of output from the same quantities of resources than other firms in the industry assuming constant technology across firms and simple maximizing behaviour. Thus, modern inputs have limited value without the knowledge of how they should be used. The more technically efficient farmer may produce more output from the same bundle of resources and constant technology because he has acquired more knowledge about the production process. This has been labelled by Welch (1970 : 42) as the "worker effect" of education to distinguish it from education's effect on allocative decision-making. According to Mijindadi (1980 : 190) four factors may be regarded as responsible for differentials in technical efficiency.

(a) differences in management ability;
(b) employment of different levels of technology;
(c) different environmental factors; and
(d) non-economic and non-technical factors which can prevent some farmers from working hard enough on their plots and, thus, failing to achieve the best level of output.

Allocative efficiency refers to the proper choice of input combinations. A firm is said to be allocatively efficient if it maximizes profits, i.e., if it allocates its inputs such that the value of marginal product of the input equals its marginal factor cost under conditions of competitive markets, certainty and no input constraints. An allocatively efficient firm will operate on that point on the boundary of its production possibility surface which is tangential to the ratio of input prices. A firm which has achieved overall economic efficiency will operate on that point on the outerbound production function which will maximize profits.

In his study based on Tanzanian cotton farmers, Shapiro (1977) distinguishes between the source of economic efficiency (allocative and technical). The results of his study do not lend support to the "efficient but poor hypothesis". His reanalysis of certain studies which support Schultz' hypothesis indicates that the value of marginal product of inputs differed by more than 40 percent from the marginal cost. He found that "output could be increased by 51 percent if all farmers achieved the same levels of technical efficiency that were achieved by the best farmers in the sample, with the same inputs and technologies" (Shapiro, 1977 : 95). This conclusion suggests that the "efficient but poor hypothesis" may not be applicable to all of traditional agriculture; and that there are areas where relatively inexpensive development policies can raise farmers closer to the more efficient levels achieved by better farmers. This conclusion is also supported by the World Bank (1978 : 39 - 40).

Sampath (1979) presents a modified approach to the description of economic efficiency. He criticises the conventional approach in that "it does not separate out the influence of the environment (or the system) from the influence (or contribution) of the individual upon 'total (in)efficiency' in the economy". According to Sampath a system or environment refers to "all those factors external to the farmer (or decision-maker) which influence his decisions but which are not under his control such as the infrastructure available (to the decision-maker) in the economy at any point of time, the nature and structure of commodity and factor markets, the institutional structure, etc..." A system is perfect if it satisfies all the conditions of a perfectly competitive market. The absence of any one or more of the conditions renders it imperfect. The individual refers to the decision-maker. The decision-maker is rational if he, given the charac= teristics of the system, maximizes his profit.

Taking into account the two components of economic efficiency perfect economic efficiency has been achieved if both the system and the individual are both technically and allocatively efficient. It follows therefore that if there is a failure in the achievement of perfect economic efficiency, it may be due to the failure in the achievement of technical and/or allocative efficiency which in turn may be due to inefficiency at the system and/or individual level. Previous studies have identified economic (in)efficiency with the (in)efficiency of the individual and this may

lead to wrong policy proposals and decisions. For example, the individual may be both technically and allocatively efficient while the system is technically and/or allocatively inefficient. In this case, to improve overall efficiency, system impediments will have to be removed but if (in)efficiency is identified solely with the individual, policy proposals (decisions) may not lead to any improvement.

2.2 AN OVERVIEW OF THE TECHNIQUES USED IN MEASURING ECONOMIC EFFICIENCY

Several approaches may be used to measure economic efficiency. An overview of the more important techniques follows below :

2.2.1 AVERAGE PRODUCTION FUNCTIONS

A production function describes the physical relationship between inputs and output assuming that durable inputs do not vary during the time period considered. The relationship can be expressed in mathematical form where output is a function of variable productive factors used.

There are various forms of production functions and the selection of the appropriate form will depend on the nature of the problem, type of relationship deemed to exist between inputs and output, and the constraints or assumptions implied by the particular function (Heady and Dillon, 1961). The Cobb-Douglas function is the most widely used production function. Researchers who have used it in the measurement of economic efficiency include Shapiro (1977); Chennareddy (1967); Hopper (1957); Sahota (1968); Saini (1979); Srivastava and Nagadevara (1972): Wise and Yotopoulos (1967); Dey and Rudra (1973); Sidhu (1974); and Welsch (1965). Reasons usually put forward for selecting the Cobb-Douglas function are that it provides a compromise

between adequate fit of the data, computational feasibility and sufficient degrees of freedom unused to allow for statistical testing (Heady and Dillon, 1961 : 228).

The production function approach involves the estimation of the production function, derivation of marginal value productivities from the production function and the comparison of the marginal value productivities and marginal factor costs. The production function may be estimated by single equation or simultaneous equation procedures (Marschak and Andrews, 1944; Heady and Dillon, 1961:109). In most studies where cross-sectional data have been used, the single equation approach and the ordinary least squares estimating procedures are used (Massel and Johnson, 1968; Youmans and Schuh, 1968). Most statistical problems encountered in the estimation of production functions are related to the basic assumptions of the ordinary least squares model. These include simultaneous equation bias and specification error (Mijindadi, 1980).

The production function is probably the oldest tool for measuring economic efficiency. Just as any other tool it has not escaped criticism. Sampath (1979) criticises the Cobb-Douglas production function in particular in that it fails to distinguish between technical and allocative efficiency. Furthermore the technique cannot be used to measure allocative efficiency directly and does not allow for differences in endowments of fixed factors.

2.2.2 LINEAR PROGRAMMING

A modified approach to economic efficiency has been put forward by Sampath (1979). This approach makes use of linear programming to measure economic efficiency. It overcomes the drawbacks of the conventional production function approach.

The major drawback of the conventional production function is that the influence of the environment or the system on total economic efficiency is not taken into consideration. Thus economic efficiency is associated solely with the individual. The linear programming technique is superior to the conventional production function approach because system rigidities and imperfections can be incorporated into the model.

Linear programming with all its advantages is however not suitable as a measuring device in situations where one is concerned with a single crop or farming systems where one crop dominates all cropping patterns during a particular season (Kalirajan and Flinn, 1982 : 16).

2.2.3 PROFIT FUNCTION

The profit function approach was developed by Lau and Yotopoulos (1971). It offers advantages over linear programming in comparing economic efficiency of single-product farms.

The technique is based on the assumption that the firms seek to maximize profit, and make use of normalised prices of variable inputs and quantities of fixed inputs. It depends upon the theoretical duality between production functions and profit functions. Thus, for each production function there is a profit function where profit is a function of variable inputs and quantities of fixed inputs (Lau and Yotopoulos, 1971; Pachico, 1980).

Since the technique is relatively new, a brief explanation may be essential.

Consider a firm with a production function.

$$Y = F\ (X_1, \ldots X_m; Z_1, \ldots Z_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y = output

X_i = variable inputs

Z_i = fixed inputs.

Per farm profit is defined as current revenues less current total costs and can be written as

$$\Pi' = P\ [F\ (X_1, \ldots Xm;\ Z_1, \ldots Z_n)] \ - \ \sum_{i=1}^{m} c_i' X_i \quad \ldots\ldots\ldots (2)$$

where Π' = profit

P = unit price of output

c_i' = unit price of the ith variable input.

In order to derive a "unit-output-price" equation, (2) is divided by the price of output, P.

$$\Pi'/_P = \Pi = F\left[X_1, \ldots X_m;\ Z_1, \ldots Z_n\right] - \sum_{i=1}^{m} c_i X_i \quad \ldots\ldots (3)$$

Equation (1) may be solved for the optimal quantities of variable inputs X_i^{*}'s. This can be expressed as a function of the normalised prices of variable inputs and the quantities of fixed inputs.

$$X_i^{*} = F_i\ (c, Z\ ,\ \ i = 1, \ldots m \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

By substituting (4) into (2) the profit function is obtained.

$$\Pi = P\left[F\ (X_1^{*}, \ldots\ldots X_m^{*};\ Z_1, \ldots\ldots Z_n) - \sum_{i=1}^{m} c_i X_i^{*}\right] \quad \ldots\ldots\ldots (5)$$

Equation (5) gives a maximized value of the profit for each set of values $(P;\ c_1, \ldots c_m;\ Z_1 \ldots Z_n)$

Since the term within the square brackets in (5) is a function of c and Z, it can be rewritten as

$$\Pi = PG^{*}\ (c_1, \ldots c_m;\ Z_1, \ldots Zn) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The profit function is therefore given by

$$\Pi^{*} = \Pi/_P = G^{*}\ (c_1, \ldots c_m;\ Z_1, \ldots Z_n) \quad \ldots\ldots\ldots\ldots\ldots (7)$$

The demand functions for the variable factors may be obtained by differentiating (7) with respect to the respective normalised factor prices.

The profit function is also vulnerable to criticisms. Pachico (1980) questions the use of this technique in a multi-product situation. He also states that the technique only permits the examination of relative technical efficiency between groups and can only be used where there are differences in the prices of resources and output among farmers.

2.2.4 FRONTIER PRODUCTION FUNCTIONS

This technique was first used by Farrel (1957). He rejected the conventional production function approach because its results represent only average levels of efficiency.

The technique involves the plotting of input per unit of output observations as points in a space of suitable dimension. This is followed by fitting an envelope to the scatter points. The "best practice" firms will operate on this curve and all other firms are compared to those on the frontier to measure economic efficiency (Farrel, 1957). Linear programming is generally used to estimate frontier production functions (Pachico, 1980; Aigner and Chu, 1968; Boles, 1966; Timmer, 1970). Herdt and Mandac (1981) have used the engineering approach.

Although the frontier production function has been used in several studies (e.g. Farrel, 1957; Seitz, 1970, Boles, 1966; Kelly, 1977) Lau and Yotopoulos (1972) state that it is not suited to examine questions related to allocative efficiency. Aigner and Chu (1968) find it not general enough since the assumptions made in this technique imply that it is not possible to use it in estimating a production function that conforms to the law of variable proportions. Farrel and Fieldhouse (1962) have presented some methods for applying the Farrel method to conditions involving increasing returns to scale. Nerlove (1965) criticises the technique on the grounds that it does not allow comparison of firms in an imperfectly competitive industry and does not take into account the environmental differences of the firms. This latter criticism has since been shown to be less crucial by Seitz (1970) because firms could be grouped on locational basis prior to estimation.

2.3 SUMMARY

An understanding of economic efficiency is essential in the formulation of correct policy proposals. Economic inefficiency is not always the result of inefficiency on the part of the farmer but may also be due to the contribution of the system within which the farmer operates. It is, therefore, important to determine the source of economic inefficiency accurately if policy proposals are to contribute positively to the process of agricultural development. Several techniques may be used to measure economic efficiency. The researcher should in each case select the most appropriate technique.

CHAPTER 3

BACKGROUND TO THE STUDY

3.1 GEOGRAPHICAL BACKGROUND

Lebowa is a self-governing state within the Republic of South Africa (RSA). It has been set aside for the Northern-sotho speaking people in terms of South Africa's policy of separate development. It is a state with fragmented units of land which are spread over a large part of the central, northern-eastern and eastern Transvaal between 22°30' and 25°30' southern latitudes and between longitudes 28°30'E and 31°39'E. Lebowa shares common boundaries with the RSA, Venda in the North, Gazankulu in the north-east and east, and Kwandebele in the South (University of Pretoria, 1983 : 33).

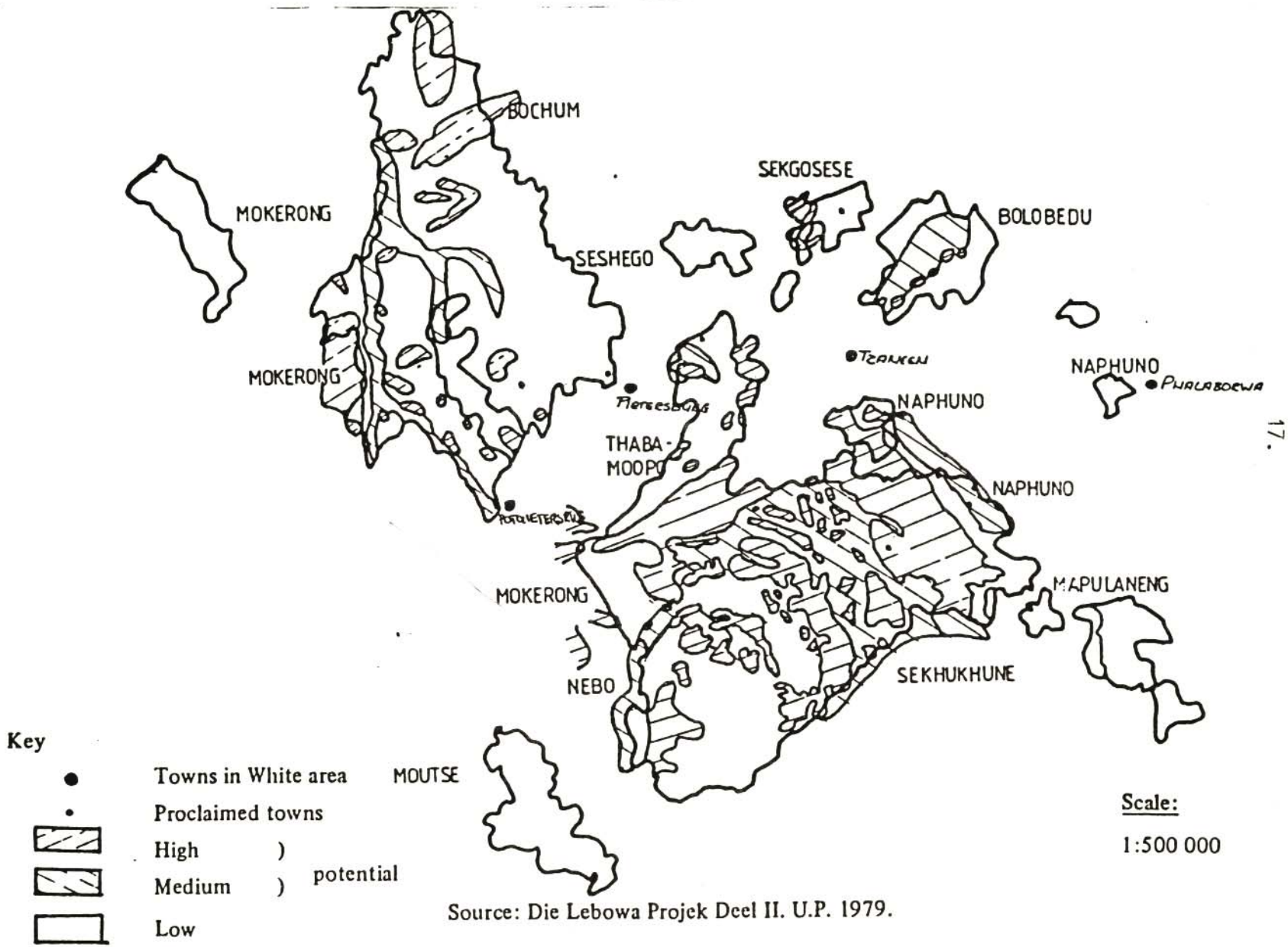
The irrigation schemes covered in the study are located in four districts (see Map 1). Coetzeesdraai, Wonderboom, Haakdoorndraai, Platklip and Krokodilheuwel are located in Nebo; Mapela in Mokerong; Success in Thabamoopo and Apiesboom in Sekhukhune.

3.2 CLIMATIC CONDITIONS

According to the University of Pretoria (1983) Lebowa is characterised by summers which include a warm to hot dry period and a warm to moist period. Winters are cold and dry. Lebowa is situated in the summer rainfall region of the Transvaal and the duration of the summer for the whole of Lebowa exceeds 228 days.

There are differences in the amount of rain which parts of Lebowa receive. There is a decreasing rainfall tendency from east to west. It decreases from about 600 mm in the east to less than 400 mm in the west. Rainfall on the escarpment can increase to 1600 mm and at some places 2000 mm per annum have been recorded. Northern Lebowa receives less than 500 mm of rainfall per annum and is classified as arid. More than 75 mm of rain is received during January and December.

MAP 1. LEBOWA NATIONAL STATE



Source: Die Lebowa Projek Deel II. U.P. 1979.

The southern-most part of Lebowa is characterised by two rainfall maxima, namely, one in November and the other in January. The central southern part has a maxima during December and January/February. Part of Lebowa which is in the Transvaal Lowveld has a maximum during February and northern Lebowa's maximum occurs in January.

It can be said that most parts of Lebowa, especially the northern part, experience a moisture deficit for the major part of the year. It is for this reason that this part of Lebowa is not suited to dryland crop production.

3.3 LAND/POPULATION RELATIONSHIPS

The de jure population of Lebowa was 2 613 040 and the de facto population, 1 746 500 in 1980 (Population Census, 1980). The Lebowa Department of Agriculture and Environmental Affairs (1980) gives the total area of Lebowa as 2 322 408 km². The resulting de facto average population density is 75 persons per km². This is 213 % higher than the density of the whole of RSA (Department of Economic Affairs and Planning, 1983 : 10). According to the standards of other parts of Africa, Lebowa may be said to be relatively underpopulated.

The position of Lebowa within the RSA and its level of economic development leads to a leakage of buying power into the "white" towns. An average of 62 % of the total purchasing power of Lebowa's urban residents is spent outside its borders. The leakage of buying power for rural areas is 52 % (Department of Economic Affairs and Planning, 1984).

3.4 LEBOWA'S POLICY GUIDELINES ON RURAL DEVELOPMENT

The great importance which the Lebowa government attaches to agricultural and rural development can be seen from its policy guidelines on rural development (Lebowa Government, 1979). A summary of these guidelines follows:

(a) Lebowa regards agriculture's role in economic development as essential and high priority shall be given to the optimal utilization of available agricultural resources.

(b) A large proportion of Lebowa's population resides in the rural areas. Thus, more attention should be given to agricultural development which will ultimately provide employment opportu= nities.

(c) An integrated rural development strategy should be followed. Target groups should be identified and their specific needs be met through the institution of specific development programmes.

(d) The following strategy principles for the application of the rural development strategy should be followed :

- Bona fide farmers should be identified and placed at agricultural growth points. These farmers should be provided with the necessary infrastructure so as to stimulate agricultural production. The Department of Agriculture and Environmental Affairs and development corporations should have complementary roles.

- High potential agricultural land should be made available at the growth points. Attention should be given to the question of land reform.

- Production targets should be set and a sufficient number of growth points be developed to achieve these targets.

- The next group to be identified includes people with land rights but not farming on full-time basis. Agricultural infrastructure should only be provided to this group after the requirements of farmers at growth points have been met.

- The third target group includes people without land rights but dependent for their livelihood on the rural sector. Employment creation should receive more attention, i.e. labour-intensive projects should be established.

3.5 THE LEBOWA DEPARTMENT OF AGRICULTURE AND ENVIRONMENTAL AFFAIRS

The Department of Agriculture and Environmental Affairs plays an important role in the development of agriculture. The objectives of this department are stated as the provision of assistance with the aim of safeguarding and promoting the agricultural industry and also the promoting of efficiency and productivity in agriculture (Lebowa Budget, 1979 : 51). Figure 1 illustrates the functioning of this department.

The department has already established a number of agricultural projects in Lebowa. After recognizing the need for a project in a specific area, the department approaches the local authority to discuss the establishment of such a project. After an agreement has been reached on the matter, the department proceeds with the establishment of the project.

According to Fourie (1984) three types of irrigation schemes can be identified :

(a) Schemes on which the department is involved on a small scale
The department gives farming advice to farmers with land rights (usually 1,25 ha). It sometimes supplies farmers with ploughing services.

(b) Departmental projects
The department provides farming advice, ploughing services, production inputs and credit services to farmers with land rights. These farmers are required to work according to a prescribed production programme by the department.

(c) Schemes managed by private firms
Certain schemes with high agricultural potential are managed by private firms. The firm responsible supplies production inputs, management and credit services to farmers with occupational land rights. The department seconds an agricultural extension officer to the scheme where necessary.

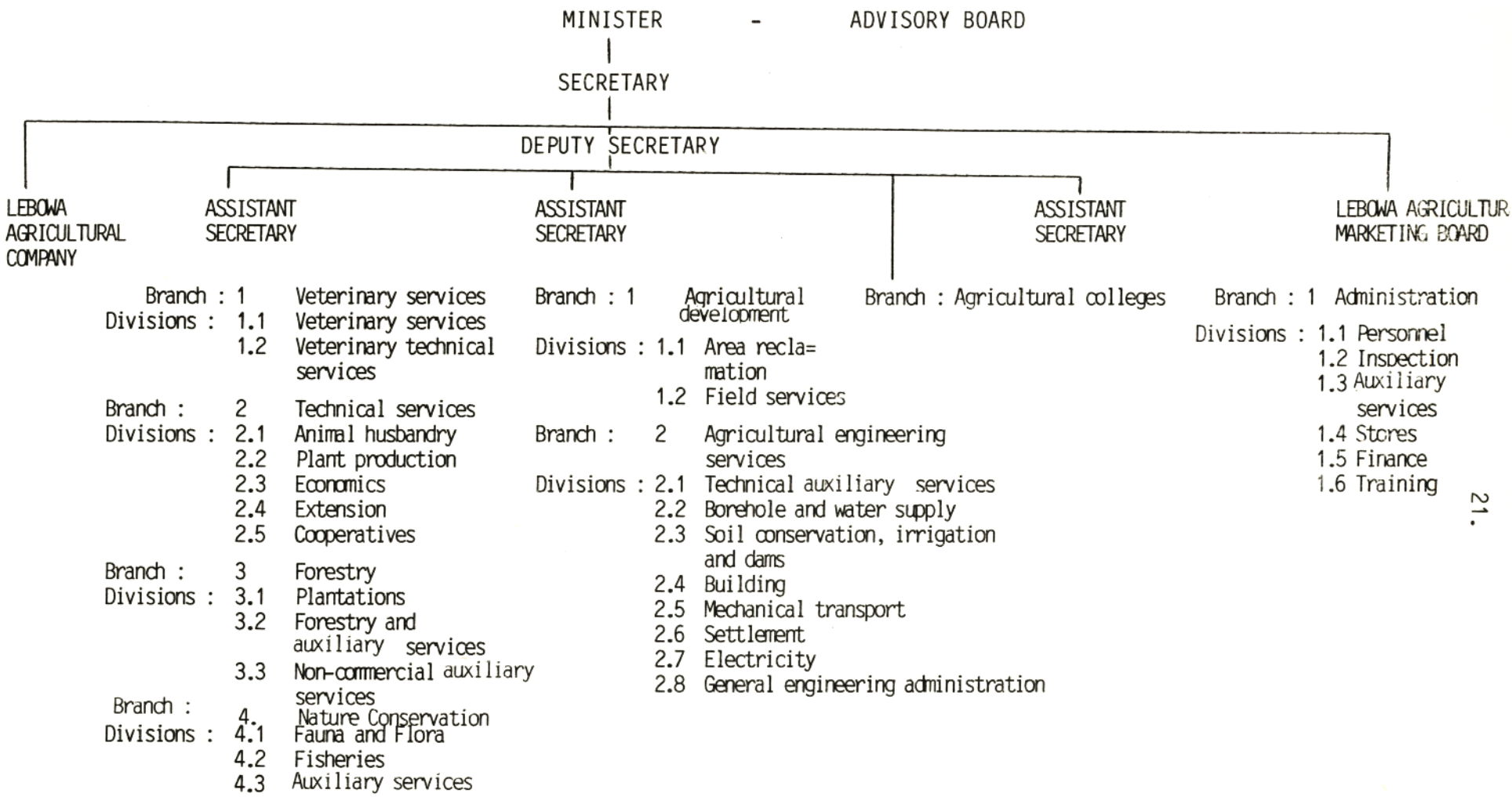


Figure 1. ORGANIZATIONAL STRUCTURE OF THE LEBOWA DEPARTMENT OF AGRICULTURE AND ENVIRONMENTAL AFFAIRS

SOURCE : LEBOWA DEPARTMENT OF AGRICULTURE AND ENVIRONMENTAL AFFAIRS, 1984.

3.6 REGULATIONS FOR THE CONTROL OF IRRIGATION SCHEMES

Irrigation schemes in Lebowa are controlled in terms of Proclamation No R.5. 1963. In terms of this proclamation :

(a) The Minister of Co-operation and Development may declare a piece of land to be an irrigation scheme.

(b) The granting of permission to occupy an irrigation and residential allotment rests with the magistrate in con= sultation with the regional authority concerned. The local project superintendent may only grant a temporary permission.

(c) Land rights cannot be transferred without the written permission of the magistrate.

(d) The project superintendent may give instructions to person(s) who have been granted permission to occupy land. Some of the instructions include :

- the manner of cultivation, manuring and irrigation
- the types of crops that may or may not be grown
- crop rotation
- the general farming system which is to be applied
- the control and eradication of noxious weeds and other undesirable plants
- the types of shrubs or trees which may or may not be planted
- the grazing of stock on the allotment
- the times of making application of water
- the prevention of the wasteful usage of water
- the dates on which any of the various kinds of crops or fodder should be planted

(e) No person who has been granted permission to occupy land shall without the permission, in writing, of the project superintendent, absent himself from the scheme for a continuous period exceeding fourteen days in any calendar year.

(f) Each person on the scheme is required to pay a rental in respect of a residential and irrigation allotment occupied.

(g) The magistrate may in consultation with the regional authority (if any) cancel any temporary permission granted provided that the project superintendent gives the occupier at least three months notice in writing.

(h) Permission to occupy an allotment may be terminated by the magistrate. Some of conditions under which permission may be terminated are :

- upon the surrender of the allotments by the occupier
- if the occupier is in arrears for more than six months
- if, without reasons deemed by the magistrate to be adequate, the occupier has failed to occupy the residential allotment or has failed to cultivate the irrigation allotment to the satisfaction of the project superintendent for a continuous period of two months
- if the occupier sublets his allotments or permits, without the permission of the project superintendent, in writing, any other person to cultivate the irrigation allotment
- upon proof to the satisfaction of the chief magistrate that the occupier is acting in any manner prejudicial to the interests of or inconsistent with a due allegiance of the state

2.7 SUMMARY

Lebowa is characterised by several fragmented units of land. The rainfall pattern is not the same in all areas. Lebowa is said to be relatively underpopulated although its population density is much higher than the whole of RSA. The geographical location of Lebowa is such that the major portion of its purchasing power is spent outside its borders. In order to foster agricultural and rural development, the Lebowa government has adopted certain policy guidelines. The Lebowa Department of Agriculture and Environmental Affairs is responsible for implementing policies aimed at agricultural develop= ment. This department fulfils a great need by inter alia establishing irri= gation projects which are controlled in terms of Proclamation No. R.5. 1963.

CHAPTER 4

THE INPUTS WHICH AFFECT MAIZE PRODUCTION AND THEIR MEASUREMENT

The aim of this chapter is to describe the resources which may affect maize production and how they have been measured in this study. Relevant literature will be reviewed.

In any attempt to measure the amount of input used in a production process it is essential to distinguish between the amount of an input which is available for use and the amount of that input which is actually being used for production. Wrong conclusions will obviously be made if this distinction is not clearly defined. It is appropriate, however, to mention that there are situations in which the amount of an input available serves as a good estimate of the amount which is used for production. A notable example would be labour in an area where there is no alternative employment. The nature of subsistence agriculture poses serious measurement and definitional problems. According to Mijindadi (1980 : 16) most of these problems may be attributed to :

- barriers of communications attributable in part to inexperienced enumerators or their lack of familiarity with local conditions;
- the practice of intercropping which makes the collection of information on individual crops difficult;
- the measurement of labour input and the need to use a weighting scheme which accounts for differences in age and sex; and
- the lack of standard weight measures for farm products as opposed to volume measures (Yang, 1965; Hunt, 1969; Norman, 1973).

4.1 LABOUR

Labour together with land form the major inputs in the production processes of traditional agriculture (Mellor, 1966 : 156). Although much of the literature on economic development assumes abundance of labour in agriculture with a marginal product of zero it has also been observed that the withdrawal of labour from agriculture during certain times would lead

to a decline in production (Mellor, 1966 : 156 - 157).

The measurement of labour input presents some problems in traditional agriculture. In order to obtain reliable data on labour, it is desirable to make frequent visits to the farmer and observe him and other workers as they perform certain tasks on the farm. A major limitation of this "direct observation" method is that the mere presence of the researcher may cause the farmer and his workers to alter his usual pattern of behaviour (Dillon and Hardaker, 1980 : 22). This method may also turn out to be too costly in certain cases. It is for these and other reasons that questionnaires are used to collect data on labour.

Another aspect of importance in the measurement of labour input is its quality or efficiency. Farrington (1975 : 36 - 43) identifies two factors which may explain variations in the efficiency of workers. These are physical strength and the degree of motivation of the worker. To these, a third factor, education, may be added (See Moock, 1981 : 723 - 739).

4.1.1 PHYSICAL STRENGTH

Sex and age are regarded as the underlying characteristics of physical strength. In operations where physical strength is required, it may be the main source of differences in efficiency between workers. In lighter operations, however, strength is unlikely to be the source of differences in worker performance.

The physical strength of workers varies according to their age and sex. It increases through childhood to early manhood and then decreases gradually from middle age. It is doubtful, however, if differences in age among children (boys and girls) does lead to significant variations in their performance. Men are expected to perform better than women in operations which require physical strength as they are physically stronger (Farrington, 1975 : 39).

4.1.2 DEGREE OF MOTIVATION

Workers may be expected to differ in their degree of motivation. The head of the household might be expected to be more strongly motivated in his work than any other member of the household or any of the workers. This may be due to his position as a decision-maker and his responsibility for supporting other members of the household. Other members of the household may in turn be expected to have a higher degree of motivation than hired workers, visitors and distant relatives (Farrington, 1975 : 39 - 40).

Hired workers may differ in their motivation according to the method of payment for their labour. It has been shown that workers in traditional agriculture who receive piece-rates achieve a higher performance than those working on time-rates (Farrington, 1975 : 37).

4.1.3 EDUCATION

The role of education in enhancing worker's productivity is well documented in literature (Welch, 1970; Schultz, 1975; Pudasaini, 1983; Moock, 1981; Lockheed et al, 1980; See also Lockheed et al, 1980 : 60 - 61). There is a general concensus among all the researchers cited above on the positive effect of education on productivity. Moock (1981 : 738 - 739) states that "any form of education which imparts knowledge about the production process directly, or which enhances the capacity to acquire knowledge about the production process from other sources, should raise the individual producer's surface of production possibilities".

Education in this study is understood to include both formal and informal schooling. Formal schooling of less than four years is not expected to cause any difference in the performance of labour. It is generally accepted that "a minimum of 4 years of schooling is necessary for the average individual to achieve and retain functional literacy" (Moock, 1981 : 730). In his study, Moock (1981 : 739) could not find any significant difference in the productivity of labour that achieved 1 - 3 years of schooling and that which had no schooling at all. However, a significant difference was found to exist between those who attended four years or more of schooling and those who had less than four years of schooling (Moock, 1981 : 739; Lockheed et al, 1980 : 61). Pudasaini (1983) and Lockheed et al (1980) have in addition found that education has a greater impact on productivity in a modern agriculture than in a traditional one.

Informal schooling includes factors such as experience on and off the farm (i.e. age and years spent away) and extension service contact. Moock (1981 : 724) has found that extension has a positive effect on the productivity of the worker. The effect was greater for workers who had four years or more of schooling. It was also noted that the difference in productivity between the latter category and the other farmers decreased as exposure to extension increased suggesting that extension contact and four years or more of schooling may act as substitutes. Unfortunately, due to the crude nature of the data collected, Moock (1981) could not determine the effect of migration on labour productivity.

In calculating the amount of labour input actually used in the production process, physical strength and, to a lesser extent, the degree of motivation have been taken into account in the classification of labour into different categories. The selection of an appropriate dividing line between children, adults and the elderly is bound to be arbitrary. Various classifications have been adopted in several studies (cf. Heyer, 1971; Norman, 1972; Forbes-Watt, 1966; Luning, 1964; Collinson, 1962; Johnson, 1968; Massel and Johnson, 1968). The selection of appropriate conversion ratios is also arbitrary. The following ratios as used by Fényes (1982 : 114) have been adopted for the various labour categories in this study :

(a)	Females :	10-14 years	=	0,25
		15-19 years	=	0,50
		20-50 years	=	0,67
		Over 50 years	=	0,50
(b)	Males :	10-14 years	=	0,25
		15-19 years	=	0,67
		20-50 years	=	1,00
		Over 50 years	=	0,50

Farmers were asked by means of a questionnaire, the number of days it took them and other workers to complete certain tasks. Due to the nature of the information obtained, it was not possible to establish with certainty the number of hours spent per day by each category of labour. The following assumptions about the time spent per day, expressed in hours, are, therefore, made :

Male and female between 10-14 years	= 4
Male and female between 15-19 years	= 4
Male and female $\geq$ 20 years	= 8
Hired temporary labour	= 8

The time spent is then converted to Adult Male Equivalent (AME) by using the following formula :

$$AME = 0{,}25\ T_{MF\ (10-14)} + 0{,}67\ T_{M\ (15-19)} + 0{,}5\ T_{F(15-19)} + T_{M\ (20-50)} + T_{M(20-50)} + 0{,}67\ T_{F(20-50)} + 0{,}67\ T_{M(>50)} + 0{,}5\ T_{F\ (>50)}$$

where

$T_{MF\ (10-14)}$ = Total time in hours spent by male and female labour between 10-14 years old

$T_{M\ (15-19)}$ = Total time in hours spent by males between 15-19 years old

$T_{F\ (15-19)}$ = Total time in hours spent by females between 15-19 years old

$T_{M\ (20-50)}$, $T_{F(20-50)}$, $T_{M\ (>50)}$ and $T_{F\ (>50)}$ are defined as above

4.2 LAND

Land is also one of the most significant inputs in traditional agriculture. Although land shortage may be a serious problem in certain countries, it does not appear to be so in some African countries. There is evidence to suggest that there is undercultivation of cultivable land in the South African homelands (Lipton, 1977). In Transkei, Westcott (1977) indicates that more than half of the rural farm-households which were surveyed failed to cultivate some of their land. Knight and Lenta (1980 : 191) observe that land shortage does not appear to be a problem in KwaZulu since only 73 percent of dry arable land and 78 percent of irrigated land was cultivated in 1972.

In Lesotho there has been a reduction in the area of land cultivated from 340 000 hectares during 1974 - 76 to 230 000 hectares in 1977 - 78 (IRBD, 1980 b, Annex. 7 : 11). Evidence from Malawi indicates that 50 percent of arable land was not cropped during 1982 (cf. Low, 1984 : 9). According to the Lebowa Department of Agriculture and Environmental Affairs (1983 : 4- 5), only 29,07 percent of dry arable land and 44,42 percent of irrigated land was cultivated in 1982.

4.2.1 Land tenure

Land tenure, would, however, appear to pose a problem. The subject of land tenure has received much attention over the past and a vast amount of literature which singles out land tenure as one of the most important obstacles to agricultural development is available (cf. Hodder, 1968 : 120; Brenner, 1971 : 104; Ng'andwe, 1976 : 51; Podedworny, 1974 : 95; Van Zyl, 1980 : 11). Having realized this, governments of several countries, especially in Africa, have embarked on a process of land reform. Land reform has been recognized as a strategic policy instrument for increasing agricultural output since Adam Smith suggested that land tenure systems differ in allocative efficiency (Bettis, 1979 :2). It should, however, be recognized that an "efficient" land tenure system per se cannot increase agricultural productivity although it may be a necessary condition.

Although the question of what constitutes an "efficient" land tenure arrangement is a very difficult one to answer as there is no single optimum tenurial system for all circumstances, it has become evident that the communal system of land tenure is an obstacle to agricultural development. Podedworny (1974 : 105 - 106) states that "... the merits of customary land tenure do not change the fact that it is an anachronism hampering agricultural development". It is not surprising, therefore, that most efforts aimed at improving land tenure systems have the owner-operator pattern as the objective (Hayami and Ruttan, 1971 : 259). It is believed that the latter system ensures optimal resource allocation.

In the major part of Lebowa and other homelands, the communal system is in operation. The other part is the property of the Trust which holds it in trust for African occupation and use (Fényes, 1982 : 237). The conditions under which a farmer may occupy a residential or arable plot on the irrigation schemes covered in this study are contained in Proclamation No. R.5 1963, the relevant parts of which have been described in Chapter 2.

4.2.2 Measurement

Land input may be measured in terms of acreage or market value (Heady and Dillon, 1961 : 223). As with all other factors, the amount of land which is actually used for production should be included. Land quality should as far as is possible be taken into consideration in the measurement of land input.

Land input was measured as the amount of land which was used for maize production. Land quality could not be taken into consideration as no soil classification was available at the time of conducting the survey.

4.3 CAPITAL

Capital, human or physical, in traditional agriculture is normally thought of as a scarce resource. Mellor (1967) indicates that savings and investment are a function of the attitudes toward saving,investment, and consumption and the marginal returns available to further investment. Low capital formation in traditional agriculture is not necessarily due to low capacity for saving but because of low returns on investment. Mellor (1967 : 45 - 46) puts forward two reasons for the low rates of return on investment. Firstly, many forms of capital goods are directly formed from labour, e.g. simple tools, so that returns are low because of the low returns to labour. Secondly, the low level of technology greatly reduces the productivity of capital, e.g. investment in fertilizer, compared with the returns in agriculture practised at a higher level of technology.

Capital in this study has been defined to include investment in production items which last longer than one production period such as tools and equipment. Tools and equipment have been valued at their replacement values.

4.4 OTHER PRODUCTIVITY-ENHANCING INPUTS

The role of education, formal and informal, in enhancing labour productivity, has already been outlined in the previous section. Each irrigation scheme covered in this study is supplied with an extension officer by the Department of Agriculture and Environmental Affairs of Lebowa. The extension officer

is supposed to provide farmers on the scheme with knowledge of better farming practices. In addition to the provision of an extension officer, lectures on farming are organized by the department. Farmers were asked whether they had any contact with the extension officer recently and whether they attended any lectures organized by the department. A point was allocated if the answer was positive and no point if the answer was "no". Household heads were also requested to supply information about the number of years they spent attending formal schools. It was also found necessary to request farmers to indicate whether they have ever worked for a white farmer. A point was allocated if the answer was "yes" and none if it was "no".

It is believed that exposure to radio media leads to some "beneficial consequences such as readiness to innovate, high aspirations and hence impatience with the status quo..." (Akenda-Ondoga, 1980 : 115). However, Akenda-Ondoga (1980 : 197) found a negative correlation between listening to the radio and the value of output. Farmers were asked whether they possessed any radio or television and whether they do listen to or watch any of them. A point was allocated if the answer was "yes" and none if it was "no".

4.5 SUMMARY

The nature of traditional agriculture presents some problems as regards the measurement of inputs used in production. In particular, labour input is one of the most difficult inputs to measure. It is necessary to use a weighting scheme which will account for differences in age and sex. Until now, no concensus has been reached on the weighting scheme which is most appropriate. As with all the other factors of production, care should be taken to include the quality of the labour input in its measurement. Land is regarded as an abundant resource in the literature on agricultural development. It has been observed that in several African countries, there is undercultivation of cultivable land. One of the major problems in these countries is the communal land tenure system. Investment in capital in traditional agriculture is usually low and this could serve as an obstacle to agricultural development. It is also important to measure levels of inputs which may raise the productivity of labour such as extension contact, attendance of lectures on farming and the farming experience acquired by the farmer.

CHAPTER 5

RESOURCE UTILIZATION AND SOME OPINIONS REGARDING CERTAIN ASPECTS WHICH AFFECT PRODUCTION

The objective of Chapter 4 was to describe the resources which affect maize production and how they were measured. This chapter describes how the resources are utilized in the production process. Farmers' opinions regarding certain aspects, such as the causes of low production, will also be included in this chapter. The first section gives an overall picture of resource utilization on all the schemes. In the second section, farmers are divided into two groups and resource utilization is described for each group.

5.1 SOCIAL CHARACTERISTICS

A discussion of the social characteristics is important as they may have some effect on agricultural development. They may act as con= straints to agricultural and rural development in terms of change (Bembridge, 1984 : 121). Although Schultz (1964) did not regard socio-cultural factors as being important determinants of farmer progressiveness in LDCs, it is documented in literature that the understanding of these factors is an essential prerequisite for successful agricultural and rural development (Foster, 1974; Ellis, 1980; Crouch and Chamala, 1981; Korsching et al, 1981; Bunting, 1975; Jones and Rolls, 1974; and Rogers and Svennig , 1969).

Managerial ability in farming is related to the age and experience of the farmer (Olukosi, 1979 : 79; Rogers, 1962; Buntjer, 1973; Norman and Pryor, 1978; Orkisz, 1968 : 131 - 139; Górecki, 1968 : 141 - 145). The sex of the farmer is of particular importance in African traditional agriculture where there is a division of labour by sex. Akenda-Ondoga (1980 : 10 - 15) notes that in Uganda the role of women as decision-makers is restricted to productive tasks which are related to food crops. Men, on the other hand, make all decisions regarding cash crop production and livestock. Fényes (1982 : 116) found that in Lebowa men are responsible for decisions regarding food crop production while both husband and wife take joint decision as regards food storage although the husband takes a decisive role.

It is evident from Table 1 that women form the majority of farmers in this study. Men form 76,5 percent of household heads. Of all families

which are headed by females 2,6 percent are widows and the other said their husbands were in permanent employment or divorced.

The average number of wives per man is 1,1. Only 7,6 percent of male farmers have more than one wife. The range is from two to three wives. The relatively low percentage could be an indication of a movement towards westernization or due to economic realities which compel farmers to have fewer children (Fényes, 1982 : 31). Although in the past poligamy served a socially constructive role by absorbing widowers into the extended family system, the practice is mainly for augmenting the labour force (Riddel, 1981 : 43; Olukosi, 1979 : 79).

The average age of the farmers is 56 years. Table 2 shows the age distribution of farmers. The most common age is 48 - 57 years. A total of 55,5 percent of farmers fall within this age group. Only 9,4 percent are within the 28 - 37 years category, pointing to the scarcity of young farmers.

The average size of families is 5 persons per household. The age dis= tribution of household members is shown in Table 3. It may be seen from Table 3 that most household members fall within the 20-50 years age group. It can also be noted that there is a striking difference between the number of male and female members within this age group. Only 8,0 percent of household members falling within this age category are males while 16,5 percent are females. This also provides further evidence to the scarcity of young farmers. Male and female children within the 10-14 age group comprise 18,3 percent of household members.

The size of the household influences the supply of labour as the major portion of the labour force in traditional agriculture is provided by the family. The ratio of hired to family labour is 1 : 4,2. Farmers who hired some labour form 29,9 percent. Only 5,7 percent hired labour form 29,9 percent. Only 5,7 percent hired labour on a permanent basis.

5.2 EDUCATION : FORMAL AND INFORMAL

The educational level of the farmers is relatively low. Only 13,7 percent of them have four years or more of formal schooling. The average number of years of formal schooling is 0,7. The proportion of farmers who indicated that they had some extension contact recently is 82,9 percent, while 12 percent attended lectures organized by the Lebowa Department of Agriculture and Environmental Affairs (See Table 7). According to Fényes (1982 : 90), most smallholders in Lebowa are aware of the usefulness of the extension advice given. He notes that only 4,4 percent of the farmers surveyed felt that the advice given was not useful. The ratio of agricultural officers employed by the Lebowa Department of Agriculture and Environmental Affairs to Lebowa smallholders is 1 : 175 (Fényes, 1983 : 90). Swynerton (1980 : 54) regards a ratio of 1 to 3 extension officers to 500 farmers as acceptable.

In order to determine the relationship between "working on a white farm" and productivity, farmers were asked whether they had previously worked for a white farmer. Farmers who replied that they have done so form 38,5 percent. A large number of farmers (67,5 percent) are in possession of radios but only 21,4 percent indicated that they do listen to agricultural programmes. No farmer possessed a television set (See Table 7).

TABLE 1. SEX OF FARMERS

	NUMBER	%
Male	43	36,8
Female	74	63,3

TABLE 2. AGE DISTRIBUTION OF FARMERS

AGE (IN YEARS)	NUMBER	%
28-37	11	9,4
38-47	15	12,8
48-57	35	29,9
58-67	30	25,6
68-77	21	18,0
78-87	5	4,3

TABLE 3. AGE DISTRIBUTION OF HOUSEHOLD MEMBERS

	AGE GROUP (YEARS)									
SEX	<10	%	10-14	%	15-19	%	20-50	%	>50	%
Male and Female	97	15,6	114	18,3						
Female					50	8,0	103	16,5	82	13,2
Male					39	6,3	50	8,0	88	14,3

5.3 LAND

The size of land holdings is the same for all farmers, namely, 1,3 ha, except where a farmer rents additional land from a colleague. Only two farmers have access to more than one plot in this manner.

Table 9 shows that 87,2 percent of farmers used all the available land for cultivating crops. Reasons given for not using all the available land include lack of money and water. It is also indicated in Table 9 that 47 percent of farmers are not satisfied with the amount of land they have available. They would like to have bigger plots. The main crops cultivated are maize and wheat and, to a small extent, vegetables. When asked which crop they regard as the most profitable, 43,6 percent chose wheat and 27,4 percent maize. The rest regard vegetables as most profitable.

5.4 CAPITAL

Capital has been defined to include the value of durable inputs like tools and equipment. Tools and equipment include animal-drawn ploughs, garden spades and forks, hoes, axes, tractors, etc.

The average value of investement in durable inputs is R106. The range is between R5 and R6000. Only one farmer has a tractor. The average value of fertilizer is R84-73 (178 kg) per hectare for 2.3.2. superphosphate and R37-44 (78 kg) per hectare for lime ammonium nitrate (LAN). The value of seed averages R10-50 (27 kg) per hectare.

5.5 SUMMARY

Table 4 gives a summary of the input-output situation on each irrigation scheme. Inter-irrigation scheme differences with respect to output and fertilizer use is evident. Krokodilheuwel and Coetzeesdraai produce more maize per hectare than all the other schemes (42,86 and 60,98 bags, respectively). The next highest output level after Krokodilheuwel is only 14,56 bags for Platklip. With regard to fertilizer, Coetzeesdraai, Krokodilheuwel and Wonderboom use more 2.3.2 superphosphate fertilizer than all other schemes. However, the output level for Wonderboom does not compare favourably with those for Coetzeesdraai and Krokodilheuwel.

Table 4 also shows a relatively low educational level, with Success having the highest level of only 2,08 years. Coetzeesdraai use more capital (R393 per hectare) than all other schemes. It is followed by Mapela and Apiesboom with capital investment of R131-78 and R104-75 per hectare, respectively.

5.6 FARMER GROUPING

In order to teach farmers to make better decisions in traditional agri= culture, it is desirable to group farmers who experience relatively homogeneous conditions. This is necessary as it is impossible or expensive to follow the individual farm management approach which is usually used in commercial agriculture (Collinson, 1981 : 44; Collinson, 1972 : 5; Johnson, 1968; for a more detailed discussion of this group management approach, see De Wilde, 1967 : 166; Sivaraman, 1976 : 405; Fényes, 1978 : 16; Fényes et al, 1980).

One of the most commonly used criterion for classifying farmers into groups is farm size. Classification according to farm size is only helpful in formulating policy proposals for increasing agricultural production on a country or regional basis. This type of classification may not be of assistance at the micro-level where farms may be of similar sizes (Vink, 1981 : 62). Other criteria should, therefore, be used in situations where farms are of similar sizes. De Swardt and Van Rooyen (1979 :3) used average net income per acre to group farmers into top and bottom classes. Vink (1981 : 62 - 63) used Galbraith's approach to group farmers into accomodators and non-accomodators. Accomodators are defined as those who have yet to escape the equilibrium of poverty and non-accomodators are those who have already, done so.

In this study, the level of output (yield) per hectare is used as a criterion for grouping farmers into top and bottom classes. Farmers who have produced 20 or more bags of maize per hectare are included within the top class and all other farmers are classified as falling within the bottom class. This results in 50 top and 67 bottom farmers. Top farmers are equally divided between sexes (50 percent females and 50 percent males) whilst females dominate the bottom class (73,1 percent are females). Classification of farmers according to yield is found to be more compatible with the objectives of this study.

TABLE 4. AVERAGE VALUES FOR RESOURCES AND OUTPUT PER IRRIGATION SCHEME

	OUTPUT (bags/ha)	2.3.2 FERTILIZER (kg/ha)	L.A.N. FERTILIZER (kg/ha)	DURABLE CAPITAL (R)	AGE	SEED (kg/ha)	FAMILY LABOUR (Adult male equivalent)	HIRED LABOUR (Adult male equivalent)	LISTEN * RADIO	EDUCATION (years)	EXTENSION* CONTACT	COURSE* ATTEN= DANCE	PREVIOUS* FARMWORK
APIESBOOM	6,99	141,74	0	104,75	52	29,98	239,33	30,83	0,83	1,08	0,92	0	0,42
COETZEESDRAAI	60,98	298,53	248,44	393,00	61	23,77	430,60	17,03	0,94	0	1,00	0,76	0,41
HAAKDORINGDRAAI	10,31	166,67	125,00	36,25	54	20,83	328,13	8,00	1,00	1,25	1,00	0,81	0,47
KROKODILHEUWEL	42,86	253,67	252,00	43,00	56	21,00	341,46	6,43	0,60	0,44	0,96	0,96	0,40
MAPELA	8,41	76,39	0	131,78	57	15,66	261,33	62,56	1,00	0	0,89	0,33	0,56
PLATKLIP	14,56	133,33	0	59,33	55	23,45	291,87	0	0,67	0,73	0,27	0,73	0,47
SUCCESS	8,78	95,14	0	52,83	52	50,90	328,83	65,92	0,82	2,08	0,91	0,75	0,08
WONDERBOOM	6,97	259,47	0	28,91	63	32,35	368,09	11,73	0,64	0	0,55	1,00	0,27

* See page 30 for the measurement of these inputs.

5.6.1 SOCIAL CHARACTERISTICS AND LABOUR SUPPLY

Table 5 shows the age distribution of members of households of top and bottom farmers. The most common age groups are "less than 10 years" and "10-14 years" for top and bottom farmers, respectively. The two groups of farmers do not appear to show any significant difference in the number of household members falling within the various age groups except for females and males less than ten years old (21,7 percent for top farmers and 12,1 percent for bottom farmers).

The age distribution of farmers is shown in Table 6. The average age is 58 and 55 years for top and bottom farmers, respectively. The lower average age for the bottom group may be explained by the large number (73,1 percent) of female farmers included in the group. The most common age groups for top farmers are 48-57 and 68-77 years and for bottom farmers it is 48-57 years. It may also be seen that most bottom farmers fall between the ages of 28 and 67 years (85 percent for bottom farmers versus 70 percent for top farmers).

The average number of persons per household is 5 and 6 for top and bottom farmers, respectively. Only 20 percent (10) of top farmers hired some labour whilst the figure for bottom farmers is 37,3 percent (25). The proportion of hired labour input is 8,1 percent for top farmers and 7,1 percent for bottom farmers. The inference from this is that the major part of the labour force is provided by family members in both groups.

5.6.2 EDUCATION

Table 7 gives a summary of the educational levels achieved by top and bottom farmers, and the possible factors which might enhance the productivity of farmers by providing them with new knowledge. Differences in the educational levels (i.e. formal and informal) of top and bottom farmers lie, mainly in the following :

- the number of farmers who have achieved four or more years of schooling (top farmers, 8 percent and bottom farmers, 17,9 percent);
- the number of farmers who have had no extension contact recently (top farmers, 6 percent and bottom farmers, 25,4 percent); and
- the number of farmers who have not attended agricultural courses (14 percent for top farmers versus 38,8 percent for the bottom group).

TABLE 5. AGE OF HOUSEHOLD MEMBERS OF TOP AND BOTTOM FARMERS

	TOP		BOTTOM	
	Number	%	Number	%
Female and males ≤10 years	50	21,7	47	12,1
Female and males 10-14 years	36	15,6	74	19,0
Male 15-19 years	17	7,3	22	5,7
Female 15-19 years	19	8,2	31	8,0
Male 20-50 years	15	6,5	35	9,0
Female 20-50 years	40	17,3	63	16,2
Male ≥50 years	30	13,0	58	15,0
Female ≥50 years	24	10,4	58	15,0
	231	100	388	100

5.6.3 CAPITAL

Table 8 illustrates the large differences in investment in durable and non-durable inputs between top and bottom farmers. Investment in durable inputs is limited to tools although one farmer in the top class owns a tractor. Top farmers show a higher degree of progressiveness in that they use more fertilizer than the other group.

5.6.4 LAND

The largest difference between the two groups of farmers with regard to land lies in the number of farmers who have used all their available land for cultivation. It appears from Table 9 that in the top group, 98 percent of the farmers have used all their available land whilst the corresponding figure for the bottom group is 79,1 percent.

5.7 FARMER'S OPINIONS REGARDING CERTAIN ASPECTS AFFECTING PRODUCTION

5.7.1 CREDIT

Lack of credit may act as an obstacle to increased agricultural production. A relatively small percentage of farmers indicated that they do borrow some money - two and six percent for top and bottom farmers, respectively. All the farmers borrow from relatives. Most top farmers (88 percent) have indicated that inputs are made available to them on credit by the Department of Agriculture and Environmental Affairs. In the case of bottom farmers, the percentage is 58.2. Table 10 illustrates the reasons for not borrowing money to finance agricultural production. The main reason for not borrowing money to finance agricultural production in both farmer groups is the cost attached to borrowed funds (interest). Most farmers (58 percent for the top group and 39,7 percent for the bottom group) feel that the interest charged on loans is too high. A proportion of 33,4 percent of bottom farmers against only 12 percent of top farmers do not need any loan or never thought of borrowing money. A total of 23,8 percent of bottom farmers indicated that money is either not available on loan or did not know where to borrow against only 14 percent for top farmers.

TABLE 6. AGE OF TOP AND BOTTOM FARMERS

AGE GROUP (YEARS)	TOP (NUMBER)	%	CUMULATIVE PROPORTION (%)	BOTTOM (NUMBER)	%	CUMULATIVE PROPORTION (%)
28-37	3	6	6	8	11,9	11,9
38-47	5	10	16	10	14,9	26,8
48-57	14	28	44	21	31,3	58,1
58-67	13	26	70	18	26,9	85
68-77	14	28	98	6	9,0	94
78-87	1	2	100	4	6,0	100

TABLE 7. EDUCATION OF TOP AND BOTTOM FARMERS

	TOP		BOTTOM	
	(NUMBER)	%	(NUMBER)	%
Four or more years of formal schooling	4	8	12	17,9
Have no extension contact recently	3	6	17	25,4
Have not attended courses organized by Department of Agriculture	7	14	26	38,8
Have previously worked on a "white" farm	21	42	24	36,0
Have a radio	37	74	42	63,0
Do listen to agricultural programmes	12	24	13	19,4
Have television set	0	0	0	0

TABLE 8. INVESTMENT IN INPUTS

	TOP	BOTTOM
Durable inputs	R180	R54
2.3.2 Superphosphate fertilizer	R126	R61
Lime ammonium nitrate fertilizer	R 80	R12
Seed	R 9	R11

TALBE 9. USAGE OF LAND

	TOP (NUMBER)	%	BOTTOM (NUMBER)	%
Used all available land	49	98	53	79,1
Use more than one plot	1	2	1	1,5
Satisfied with amount of land available	27	54	35	52,2

5.7.2 INTENDED USES FOR MONEY

Farmers were asked to indicate what they would use their money for if their incomes were to rise substantially. Table 11 shows the response. Most farmers (32 percent for the top group and 35,8 percent for the bottom group) indicated that they would use it for meeting social needs. A proportion of 28 percent of top farmers would reinvest the money in farming against 20 percent of farmers in the bottom group.

5.7.3 OBSTACLES TO INCREASED PRODUCTION

Table 12 shows what farmers regard as obstacles to increased maize production. Both groups have singled out shortage of water as the most important obstacle. Shortage of capital and labour are the second most important obstacles in the bottom and top groups, respectively. Bottom farmers do not appear to have problems with labour as only 1,5 percent indicated that labour shortage is an obstacle.

5.8 RANKING OF IRRIGATION SCHEMES

In Table 13 irrigation schemes are ranked according to the performance of the farmers and the output levels of the schemes. Farmers on a particular irrigation scheme are divided into the two groups : top and bottom. The scheme which has the largest percentage of its farmers falling within the top group is ranked highest. Secondly, the scheme with the highest output level is ranked first. Thirdly, the percentage contribution (in terms of number of farmers) which a particular scheme has made to the total number of top farmers is used to rank the schemes. The three criteria are, finally, combined and used to produce an overall ranking of the schemes. The Coetzeesdraai and Krokodilheuwel irrigation schemes occupy the first position.

TABLE 10. REASONS FOR NOT BORROWING MONEY

	TOP (NUMBER)	%	BOTTOM (NUMBER)	%
Money not available on loan	6	12	14	22,2
Interest charged too high	29	58	25	39,7
Do not need any loan	3	6	10	15,9
Never thought of borrowing	3	6	11	17,5
Do not know where to borrow	1	2	1	1,6
Have no means of repaying	7	14	2	3,1

TABLE 11. INTENDED USES FOR MONEY

	TOP (NUMBER)	%	BOTTOM (NUMBER)	%
Re-invest in farming	14	28	14	20,9
Meet social needs	16	32	24	35,8
Repay existing debts	12	24	17	25,3
Educate children	2	4	3	4,5
Start a business	0	0	1	1,5
Buy cattle	3	6	2	3,0
Build a house	2	4	6	9,0

TABLE 12. MAJOR PROBLEM IN PRODUCTION

	TOP (NUMBER)	%	BOTTOM (NUMBER)	%
Shortage of labour	12	24	1	1,5
Shortage of capital	8	16	9	13,4
Shortage of water	20	40	38	56,7
Lack of know-how	1	2	7	10,5
Inadequate ploughing services	1	2	5	7,5
Weeds	0	0	1	1,5
Insufficient land	5	10	2	3,0
Poor soil structure	1	2	3	4,4
Incorrect ploughing of land by hired tractor	2	4	0	0
Faulty irrigation furrows	0	0	1	1,5

TABLE 13. RANKING OF IRRIGATION SCHEMES

	TOP (NUMBER)	%	BOTTOM (NUMBER)	%	RANK	% OF FARMERS FALLING WITHIN THE TOP CLASS	RANK	OUTPUT LEVEL (kg/ha)	RANK	OVERALL RANKING
MAPELA	1	2	8	11,9	5	11,1	5	8,41	6	5
COETZEESDRAAI	17	34	0	0	2	100	1	60,98	1	1
KROKODILHEUWEL	25	50	0	0	1	100	1	42,86	2	1
SUCCESS	1	2	11	16,4	5	14,3	3	8,78	5	4
APIESBOOM	0	0	12	17,9	6	0	6	6,99	7	6
WONDERBOOM	0	0	11	16,4	6	0	6	6,97	8	7
PLATKLIP	4	8	11	16,4	3	26,7	2	14,56	3	2
HAAKDOORNDRAAI	2	4	14	20,9	4	12,5	4	10,31	4	3
	50	100	67	100						

5.9 SUMMARY

The major conclusions which may be drawn from the analysis of resource utilization and the opinions of the farmers are as follows :

(a) The majority of farmers involved in the study are women. This is an indication of the role which is played by women in traditional agriculture.

(b) Poligamy is fast losing its importance among farmers. This could imply a movement towards westernization or that due to the economic pressure exerted upon the farmers, it becomes very difficult for them to have more than one wife.

(c) There is a general scarcity of young farmers. Farmers between the ages of 28 and 47, inclusive, form only 22,20 percent of the total. This could imply that younger people, especially men, only engage in farming provided there are no alternative jobs.

(d) The farmer's family provides the major part of the labour force with only a small amount of labour input being provided by hired workers.

(e) The educational level of the farmers as measured in terms of the number of years of formal schooling is relatively low.

(f) A large number of farmers have radios although only a few of them do ever listen to agricultural programmes.

(g) The size of land units is the same for all farmers with a substantial number indicating that the plots are too small. This is confirmed by the large number (87,20 percent) of farmers who stated that they used all their available land for cultivation.

(h) Investment in durable inputs is limited to tools.

(i) The classification of farmers according to their output levels results in a top group which consists of an equal number of males and females. Females form the majority of the farmers in the bottom group.

(j) There is a relatively small number of farmers who have indicated that they had no extension contact and those who have not attended lectures on farming within the top group.

(k) The ranking of the irrigation schemes leads to Krokodilheuwel and Coetzeesdraai occupying the first position.

(l) Relatives appear to be the main source of money credit. The high interest which is charged on institutional money credit was given as the main reason for not borrowing money to finance agricultural activities from institutions. Most top farmers do not experience any problems in obtaining inputs on credit.

(m) Most farmers stated that if their incomes were to rise substantially, the first priority would be given to the meeting of social needs. The top group gave as their second priority the investment of more money in farming. The bottom group gave the repayment of existing debts as their second priority.

(n) According to the opinions given by the farmers, lack of water is regarded as the main obstacle to increased agricultural production. The second most important obstacles are shortage of labour and lack of know-how for the top and bottom groups, respectively.

CHAPTER 6

POSSIBLE CAUSES OF DIFFERENCES IN OUTPUT LEVELS

This chapter is concerned with the testing of the hypothesis put forward in Chapter 1. The objectives of the chapter are two-fold :

(a) to determine the relationship between the inputs used and output, on the one hand, and the relationship between inputs themselves, on the other; and

(b) to determine if there is any difference in the input and output levels of (i) the two groups of farmers and (ii) irrigation schemes.

No claim will be made in this study that all the relevant factors which influence maize production have been included. Major reasons for failing to include all the factors could be attributed to the measurement problems encountered and unavailability of data or the availability thereof in the form which renders them less useful. For example, factors such as the educational level (i.e. formal) of farmers, land and lime ammonium nitrate fertilizer used, which were covered in the survey, have been excluded from the analysis, because all farmers who applied lime ammonium nitrate, used the same amount and a large number of farmers (87,20 percent) used the same amount of land. As the number of farmers who attended formal schooling is small (15,38 percent) it was deemed necessary to exclude formal education from the analysis.

The chapter is divided into four sections. The first section deals with input-output relationships. The relationship between the inputs is described in the second section. Correlation analysis is employed in both sections to describe the relationship. A t-test is employed in the third section to determine differences in input and output levels. A summary of the results is presented in the fourth section.

6.1 RELATIONSHIP BETWEEN INPUT AND OUTPUT

Correlation analysis is done for (a) individual irrigation schemes; (b) top and bottom farmers; and (c) all farmers on the irrigation schemes. The results are presented in Tables 14 through 17.

The results presented in Table 14 indicate that with the exception of Krokodilheuwel and Haakdoorndraai, there is a positive correlation between 2.3.2 superphosphate fertilizer and maize output. The negative correlation coefficient for Krokodilheuwel is due to the fact that only a few farmers ($^{2}/_{25}$ or 8 percent)use fertilizer levels which are different from fertilizer amounts used by the other farmers. All the latter farmers use the same amounts of fertilizer. The correlation coefficient for Haakdoorndraai is zero as all farmers on the scheme use the same level of fertilizer.

Inputs which show a statistically significant correlation with output on individual irrigation schemes are 2.3.2 superphosphate fertilizer - Apiesboom, Platklip, Success and Wonderboom; durable capital - Platklip and Success; seed - Mapela and farmwork experience - Apiesboom, Haakdoorndraai and Wonderboom. The correlation coefficients for farmwork experience on the latter two schemes are negative. The correlation coefficients for extension contact are positive for all irrigation schemes with the exception of Wonderboom, Coetzeesdraai and Haakdoorndraai. The coefficients for the latter two schemes are zero because all farmers replied that they had extension contact recently. The negative coefficient for Wonderboom is due to the relatively large number of farmers who indicated that they were out of contact with their extension officer recently.

With regard to top and bottom farmers it would appear that there is no significant difference between their correlation coefficients except in the case of family and hired labour (see Table 16). Family labour for top farmers shows a statistically significant positive correlation with output. Hired labour for the bottom group is significantly negatively correlated with output. The reason for this is that bottom farmers hire relatively more labour yet their output level is relatively low. Table 15 indicates that hired labour adult male equivalents for top and bottom farmers are 10,94 and 28,12 respectively, while the corresponding output levels are 46,43 and 7,64 bags per hectare.

The overall picture of the relationship between inputs and output for all the irrigation schemes combined is given by Table 17. 2.3.2 superphosphate fertilizer, extension contact, course attendance and family labour show a statistically significant positive correlation with output. Other inputs which are positively related to output are durable capital, age and farmwork experience. Although the correlation coefficients for the latter inputs are not statistically significant here, it has already been shown in the previous discussion that durable capital, farmwork experience and seed are significantly correlated with output on individual irrigation schemes. The explanation already put forward for the negative correlation coefficients for hired labour in the case of individual irrigation schemes is also valid here. A similar explanation can be given for the negative correlation coefficients for seed. It would also appear that there is no correlation between "listening to radio programmes" and output. This could be an indication of the ineffectiveness of the radio media in enhancing the productivity of farmers.

6.2 RELATIONSHIP BETWEEN INPUTS

Input relationships are studied for the two groups of farmers and all farmers together. The results of the correlation analysis are presented in Tables 18,19 and 20.

A few observations with regard to bottom farmers can be made from Table 18.

(a) Extension contact and "listening to radio programmes" are significantly negatively related to the application of 2.3.2 superphosphate fertilizer.

(b) Course attendance is significantly negatively correlated with durable capital.

(c) Extension contact and "listening to radio programmes" are significantly negatively related to age while course attendance and farmwork experience show a significant positive correlation.

(d) "Listening to radio programmes" is significantly positively related to extension contact.

(e) Hired labour is significantly negatively correlated with farmwork experience.

(f) Family labour is significantly positively related to seed.

Table 19 indicates the following relationship with regard to inputs of top farmers :

(a) Seed and extension contact are significantly positively related to 2.3.2 superphosphate fertilizer.

(b) Course attendance is significantly negatively correlated with durable capital while the relationship between the latter and family labour is statistically significant and positive.

(c) Hired labour is significantly negatively related to course attendance.

(d) Hired labour is significantly positively related to seed.

Input relationships of all farmers on the irrigation schemes are presented in Table 20 and the following observations can be made :

(a) Family labour and course attendance are significantly positively related to 2.3.2 superphosphate fertilizer while the relation= ship between the latter and hired labour is negative.

(b) Hired and family labour show a significant positive relationship with durable capital while the relationship between the latter and course attendance is significantly negative.

(c) Course attendance and farmwork experience are significantly positively related to age.

(d) "Listening to radio programmes" and extension contact are significantly positively related.

(e) Hired labour is significantly negatively related to course attendance and family labour.

6.3 DIFFERENCES IN OUTPUT AND INPUT LEVELS

The purpose of this section is to determine if there is any significant difference in the input and output levels of (a) irrigation schemes, and (b) bottom and top farmers. A t-test is used to meet the objective of this section and the t-values for the inputs and output of irrigation schemes and top and bottom farmers are presented in Tables 21 through 32.

6.3.1 IRRIGATION SCHEMES

Table 21 clearly shows the dominant position of Coetzeesdraai and Krokodil= heuwel with regard to output. The output levels of these two schemes differ significantly from those of all other irrigation schemes. The t-value of 2,76 for output of Coetzeesdraai and Krokodilheuwel is rela= tively small in comparison with the t-value for output of these schemes and all other irrigation schemes. The output for Platklip also differs significantly from those of other schemes except for Success.

Large differences between the input levels of 2.3.2 superphosphate fertilizer for Coetzeesdraai and Krokodilheuwel and all other schemes with the exception of Wonderboom are evident from Table 22. Mapela, which has the lowest level of 2.3.2 superphosphate, also shows significant differences between its input level of 2.3.2 superphosphate and the other irrigation schemes except for Platklip and Success.

Table 23 shows only one significant difference between the levels of capital used on the schemes. The only significant difference is between the levels of capital for Mapela and Krokodilheuwel.

There is not much interscheme difference in the age levels of farmers. Only four cases show some significant differences as can be seen from Table 24.

The difference in extension contact between irrigation schemes mainly lies between Platklip and Wonderboom and the other irrigation schemes. This is depicted by Table 25.

Table 26 indicates that there are significant differences between the levels of course attendance for Krokodilheuwel, Wonderboom, Mapela and Apiesboom and other irrigation schemes. Mapela and Apiesboom have the lowest levels of course attendance.

Success shows the largest number of cases which are significant with regard to previous farmwork experience as depicted by Table 27. This irrigation scheme has the lowest level of previous farmwork experience.

A number of cases which show significant differences between the levels of seed used on the irrigation schemes are evident from Table 28 but Success, Krokodilheuwel and Coetzeesdraai appear to be dominating the scene.

Haakdoorndraai has the largest number of significant cases with regard to "listening to radio programmes" according to Table 29. This is due to the fact that all farmers on this scheme indicated that they do listen to radio programmes.

In Table 30 there is no single irrigation scheme which appears to be dominant with regard to family labour although a few significant cases exist.

Mapela appears to be occupying the most dominant position with regard to hired family labour although Apiesboom, Platklip and Krokodilheuwel also show a number of significant cases as shown in Table 31.

In order to determine the extent of the differences in output and input levels of irrigation schemes, the number of t-values which are statistically significant (as indicated in Tables 21 through 31) are expressed as a percentage of the total number of t-values. The results are shown in Table 33.

According to the information contained in Table 33, the number of t-values which are statistically significant is relatively larger in the case of the following factors : 2.3.2 superphosphate fertilizer, extension contact, course attendance, seed, "listening to radio programmes", hired labour and output. The largest difference appears to be in course attendance. The differences in durable capital, age, farmwork experience and family labour seem to be relatively small.

The analysis is carried further by making a comparison between the two top schemes, Coetzeesdraai and Krokodilheuwel, and all other irrigation schemes. The reuslts are presented in Tables 34 and 35. The observation which can be made from these tables is that differences between the input levels of top and bottom schemes lie mainly in 2.3.2 superphosphate fertilizer, course attendance, seed and hired labour.

TABLE 14. CORRELATION BETWEEN INPUTS AND OUTPUT FOR INDIVIDUAL IRRIGATION SCHEMES

	2.3.2 super= phosphate fertilizer	Durable capital	Age	Seed	Family labour	Hired labour	Listen to radio	Extension contact	Course attendance	Previous farmwork
APIESBOOM	0,64	-0,45	0,41	0,33	0,35	-0,24	0,16	0,16	0,00	0,50*
COETZEESDRAAI	0,26	0,01	0,04	0,15	0,31	-0,01	0,19	0,00	-0,11	-0,29
HAAKDOORNDRAAI	0,00	-0,11	0,21	0,00	0,16	-0,11	0,00	0,00	0,13	-0,48
KROKODILHEUWEL	-0,22	-0,11	-0,29	0,00	-0,02	0,10	-0,07	0,03	0,16	0,20
MAPELA	0,00	-0,16	0,21	0,59*	-0,29	0,38	0,00	0,15	-0,14	0,47
PLATKLIP	0,56*	0,47*	0,11	0,42	-0,11	0,00	-0,01	0,29	-0,05	0,41
SUCCESS	0,97**	0,97**	-0,26	-0,13	0,32	-0,22	0,08	0,18	0,20	-0,03
WONDERBOOM	0,67*	0,44	-0,21	0,50	0,15	0,03	-0,33	-0,05	0,00	-0,55*

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 15. INPUT AND OUTPUT LEVELS OF TOP AND BOTTOM FARMERS

	TOP	BOTTOM
Output (bags/ha)	46,43	7,64
2.3.2 superphosphate fertilizer (kg/ha)	265,33	127,38
Durable capital (R)	179,64	54,31
Age	57,96	55,13
Extension contact *	0,94	0,75
Listen to radio *	0,76	0,81
Course attendance *	0,86	0,61
Previous farmwork *	0,42	0,35
Seed (kg/ha)	23,03	28,80
Family labour (AME)	369,07	302,24
Hired labour (AME)	10,94	28,12

* See page 30 for the measurement of these inputs.

TABLE 16. CORRELATION BETWEEN INPUTS AND OUTPUT OF TOP AND BOTTOM FARMERS

	TOP	BOTTOM
2.3.2 superphosphate fertilizer	0,28*	0,27*
Durable capital	0,08	-0,11
Age	0,00	0,01
Extension contact	0,21	-0,16
Listen to radio	0,10	-0,11
Course attendance	-0,06	0,05
Previous farmwork	-0,10	0,05
Seed	0,03	0,00
Family labour	0,27*	0,11
Hired labour	0,07	-0,24*

* Significant at 10 % confidence level.

TABLE 17. CORRELATION BETWEEN INPUT AND OUTPUT FOR ALL IRRIGATION SCHEMES

2.3.2 superphosphate fertilizer	0,49**
Durable capital	0,13
Age	0,12
Extension contact	0,23**
Listen to radio	0,00
Course attendance	0,19*
Previous farmwork	0,07
Seed	-0,12
Family labour	0,26**
Hired labour	-0,13

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 18. CORRELATION BETWEEN INPUTS OF BOTTOM FARMERS

	2.3.2 superphosphate fertilizer	Durable capital	Age	Extension contact	Listen to radio	Course attendance	Previous farmwork	Seed	Family labour	Hired labour
2.3.2 superphos= phate fertilizer	1,00	-0,03	-0,01	-0,24*	-0,35**	0,07	-0,07	-0,01	0,06	-0,13
Durable capital		1,00	0,07	-0,05	0,10	-0,22*	0,07	-0,15	0,05	-0,03
Age			1,00	-0,20*	-0,23*	0,32**	0,33**	-0,08	-0,07	0,03
Extension contact				1,00	0,38**	-0,11	-0,12	0,13	0,04	-0,09
Listen to radio					1,00	-0,17	-0,03	0,06	0,10	0,05
Course attendance						1,00	0,04	0,15	0,14	-0,24*
Previous farmwork							1,00	-0,11	-0,02	-0,07
Seed								1,00	0,21*	-0,15
Family labour									1,00	-0,17
Hired labour										1,00

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 19. CORRELATION BETWEEN INPUTS OF TOP FARMERS

	2.3.2 Superphosphate fertilizer	Durable capital	Age	Extension contact	Listen to radio	Course attendance	Previous farmwork	Seed	Family labour	Hired labour
2.3.2 super= phosphate fertilizer	1,00	0,07	-0,07	0,30*	-0,18	0,02	0,01	0,35**	0,11	-0,07
Durable capital		1,00	-0,11	0,03	0,09	-0,32*	-0,06	0,09	0,36**	-0,07
Age			1,00	0,07	0,04	0,03	-0,07	-0,03	-0,08	0,09
Extension contact				1,00	-0,14	0,14	0,04	-0,07	0,03	0,09
Listen to radio					1,00	-0,09	0,03	0,06	0,22	0,12
Course attendance						1,00	0,11	-0,19	-0,19	-0,32*
Previous farmwork							1,00	0,08	-0,11	0,04
Seed								1,00	0,07	0,24*
Family labour									1,00	-0,20
Hired labour										1,00

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 20. CORRELATION BETWEEN INPUTS FOR ALL IRRIGATION SCHEMES

	2.3.2 superphosphate fertilizer	Durable capital	Age	Extension contact	Listen to radio	Course attendance	Previous farmwork	Seed	Family labour	Hired labour
2.3.2 superphos= phate fertilizer	1,00	0,08	0,05	0,01	-0,28**	0,19*	0,03	-0,06	0,15*	-0,17*
Durable capital		1,00	-0,04	0,03	0,07	-0,18*	-0,06	-0,03	0,26**	0,68**
Age			1,00	-0,11	-0,16	0,25**	0,18*	-0,06	-0,05	0,04
Extension contact				1,00	0,21*	0,02	-0,01	0,07	0,08	-0,11
Listen to radio					1,00	-0,14	-0,03	0,00	0,14	0,05
Course attendance						1,00	0,08	0,08	0,10	-0,23**
Previous farmwork							1,00	-0,14	-0,04	-0,04
Seed								1,00	0,13	-0,14
Family labour									1,00	-0,17*
Hired labour										1,00

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 21. T-VALUES FOR OUTPUT BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-6,35**	-1,78*	-9,47**	-0,63	-3,00**	-0,47	0,01
Coetzeesdraai		-	6,84**	2,76**	5,30**	5,97**	5,80**	6,06**
Haakdoorndraai			-	-9,59**	-0,77	1,72*	-0,43	-1,62
Krokodilheuwel				-	7,69**	7,70**	7,60**	8,98**
Mapela					-	-1,94*	-0,08	0,57
Platklip						-	1,43	2,78*
Success							-	0,44
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 22. T-VALUES FOR 2.3.2 SUPERPHOSPHATE FERTILIZER BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-11,03*	1,66	-12,68*	4,08**	0,18	1,35	-1,35
Coetzeesdraai		-	31,25**	5,82**	16,03**	4,29**	7,01**	0,54
Haakdoorndraai			-	-9,03**	6,71**	-0,68	1,07	-1,81*
Krokodilheuwel				-	24,77**	3,91**	7,04**	-0,10
Mapela					-	-1,08	-0,48	-1,81*
Platklip						-	0,57	-1,40
Success							-	-1,77*
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 23. T-VALUES FOR DURABLE CAPITAL BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-0,67	0,95	1,07	-0,23	0,57	0,57	0,87
Coetzeesdraai		-	0,98	1,20	0,53	0,88	0,80	0,82
Haakdoorndraai			-	-0,54	-1,54	-0,81	-0,50	0,62
Krokodilheuwel				-	-1,78*	-0,69	-0,36	1,12
Mapela					-	1,00	0,96	1,38
Platklip						-	0,15	0,93
Success							-	0,63
Wonderboom								-

* Significant at 10 % confidence level

TABLE 24. T-VALUES FOR AGE BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-2,09*	-0,41	-0,94	-0,87	-0,65	0,21	-2,04*
Coetzeesdraai		-	1,57	1,44	0,73	1,40	2,48*	-0,46
Haakdoorndraai			-	-0,44	-0,50	-0,21	0,63	-1,63
Krokodilheuwel				-	-0,26	0,20	1,23	-1,64
Mapela					-	0,36	1,11	-0,90
Platklip						-	0,90	0,65
Success							-	-2,36*
Wonderboom								-

* Significant at 10 % confidence level

TABLE 25. T-VALUES FOR EXTENSION CONTACT BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-1,20	-1,16	-0,53	0,20	4,28**	0	2,13*
Coetzeesdraai		-	0	2,52*	1,40	6,62**	1,44	3,63**
Haakdoorndraai			-	1,09	1,24	5,49**	1,16	4,01**
Krokodilheuwel				-	0,75	4,28**	1,32	3,48**
Mapela					-	3,54**	-0,20	1,70
Platklip						-	-4,28**	-1,45
Success							-	2,13*
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 26. T-VALUES FOR COURSE ATTENDANCE BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-6,03**	0,05	-2,70**	-2,22**	-5,53**	-5,74**	1,83*
Coetzeesdraai		-	-0,33	-1,96*	2,28*	0,20	0,09	-1,77*
Haakdoorndraai			-	-1,56	2,62*	0,51	0,39	-2,58*
Krokodilheuwel				-	5,30**	2,62*	3,71**	2,99**
Mapela					-	-2,00*	-2,00*	-4,45**
Platklip						-	-0,09	-3,88**
Success							-	-1,83*
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 27. T-VALUES FOR PREVIOUS FARMWORK BETWEEN SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	0,03	-0,11	0,09	-2,65*	-0,25	2,76	0,70
Coetzeesdraai		-	-0,14	0,07	-0,68	-0,30	2,02*	0,73
Haakdoorndraai			-	0,23	-0,55	-0,16	-1,04	0,85
Krokodilheuwel				-	-0,79	-0,40	2,03*	0,72
Mapela					-	0,41	2,63*	1,27
Platklip						-	-2,22*	0,98
Success							-	-1,18
Wonderboom								-

* Significant at 10 % confidence level

TABLE 28. T-VALUES FOR SEED BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	1,18	1,69	2,09*	1,64	1,13	-1,76*	-0,24
Coetzeesdraai		-	6,01**	6,32**	2,02*	0,26	-3,22**	-1,42
Haakdoorndraai			-	-0,80	1,26	-2,21*	-3,46**	-1,86*
Krokodilheuwel				-	1,64	-2,54*	-4,34**	-2,29*
Mapela					-	-1,72*	-2,78*	-1,71
Platklip						-	-1,82*	-1,36
Success							-	1,45
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 29. T-VALUES FOR LISTENING TO RADIO PROGRAMMES BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-0,92	-2,86**	1,42	-1,28	0,96	0,48	1,05
Coetzeesdraai		-	-0,97	2,61*	-0,72	1,63	2,49*	2,15*
Haakdoorndraai			-	5,52**	0,00	2,89**	2,23*	2,91**
Krokodilheuwel				-	-2,38*	-0,41	-0,88	-0,20
Mapela					-	2,03*	1,65	2,15*
Platklip						-	-0,46	0,15
Success							-	0,57
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 30. T-VALUES FOR FAMILY LABOUR BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	-3,14**	-1,50	-1,79*	-0,38	-1,17	-1,11	-1,86*
Coetzeesdraai		-	1,58	1,53	2,27*	2,43*	1,23	0,81
Haakdoorndraai			-	-0,23	0,92	0,65	0,01	0,53
Krokodilheuwel				-	1,17	0,94	0,17	-0,39
Mapela					-	-0,53	-0,69	-1,25
Platklip						-	-0,49	-1,17
Success							-	-0,40
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 31. T-VALUES FOR HIRED LABOUR BETWEEN IRRIGATION SCHEMES

	APIESBOOM	COETZEESDRAAI	HAAKDOORNDRAAI	KROKODILHEUWEL	MAPELA	PLATKLIP	SUCCESS	WONDERBOOM
Apiesboom	-	1,06	1,84*	2,27*	-1,75*	2,80**	-0,83	1,27
Coetzeesdraai		-	0,88	1,34	-3,47**	2,24*	-1,22	0,49
Haakdoomdraai			-	-0,22	-4,56**	1,42	-1,16	-0,4
Krokodilheuwel				-	-5,24**	1,20	-2,72**	-0,61
Mapela					-	6,40**	-0,06	3,47**
Platklip						-	-1,58	-1,73*
Success							-	1,09
Wonderboom								-

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 32. T-VALUES FOR OUTPUT AND INPUTS OF TOP VERSUS BOTTOM FARMERS

FERTILIZER (2.3.2)	6,26**
CAPITAL	1,18
AGE	1,60
EXTENSION	2,82**
RADIO	-0,60
COURSES	3,04**
PREVIOUS FARM EXPERIENCE	0,68
SEED	-1,86*
FAMILY LABOUR	2,12*
HIRED LABOUR	-1,28
OUTPUT	13,70**

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 33. MAGNITUDE OF THE DIFFERENCES IN INPUT AND OUTPUT LEVELS OF IRRIGATION SCHEMES

	NUMBER OF SIGNIFICANT T-VALUES	%
Output	18	64,29
2.3.2 superphosphate fertilizer	16	57,14
Durable capital	1	3,57
Age	4	14,29
Extension contact	12	42,86
Course attendance	20	71,43
Previous farmwork	6	21,43
Seed	15	53,47
Listening to radio	11	39,29
Family labour	5	17,86
Hired labour	12	42,86

TABLE 34. T-VALUES FOR COETZEESDRAAI VERSUS ALL OTHER SCHEMES, EXCLUDING KROKODILHEUWEL

		2.3.2 Superphosphate fertilizer	Durable capital	Age	Extension contact	Course attendance	Previous farmwork	Seed	Listening to radio	Family labour	Hired labour
Apiesboom		-11,03**	-0,67	2,09*	-1,20	-6,03**	0,03	1,18	-0,92	-3,14**	1,06
Haakdoorndraai		31,25**	0,98	1,57	0	-0,33	-0,14	6,01**	-0,97	1,58	0,88
Mapela		16,03**	0,53	0,73	1,40	2,28**	-0,68	2,02*	-0,72	2,27*	-3,47**
Platklip		4,29**	0,88	1,40	6,62**	0,20	-0,30	0,26	1,63	2,43**	2,24*
Success		7,01**	0,80	2,48*	1,44**	0,09	-2,02*	-3,22**	2,49*	1,23	-1,22
Wonderboom		0,54	0,82	-0,46	3,63	-1,77	0,73	-1,42	2,15*	0,81	0,49
Significant T-values	Number	5	0	2	2	2	1	3	2	3	2
	%	83,33	0	33,33	33,33	33,33	16,67	50,00	33,33	50,00	33,33

* Significant at 10 % confidence level

** Significant at 1 % confidence level

TABLE 35. T-VALUES FOR KROKODILHEUWEL VERSUS ALL OTHER SCHEMES, EXCLUDING COETZEESDRAAI

		2.3.2 superphosphate fertilizer	Durable capital	Age	Extension contact	Course attendance	Previous farmwork	Seed	Listening to radio	Family labour	Hired labour
Apiesboom		-12,68**	1,07	0,94	-0,53	2,70**	-0,09	-2,09*	1,42	1,79*	-2,27*
Haakdoorndraai		-9,03**	-0,54*	0,44	1,09	1,56	-0,23	0,80	5,52**	0,23	0,22
Mapela		24,77**	-1,78*	-0,26	0,75	5,30*	-0,79	1,64	-2,38*	1,17	-5,24**
Platklip		3,91**	-0,69	0,20	4,28**	2,62*	-0,40	-2,54*	-0,41	0,94	1,20
Success		7,04**	-0,36	1,23	1,32	3,71**	2,03*	4,34**	-0,88	0,17	-2,72**
Wonderboom		-0,10	1,12	-1,64	3,48**	2,99**	0,72	-2,29*	-0,20	-0,39	-0,61
Significant T-values	Number	5	1	0	2	5	1	4	2	1	3
	%	83,33	16,67	0	33,33	83,33	16,67	66,67	33,33	16,67	50,00

* Significant at 10 % level

** Significant at 1 % level

6.3.2 Top and bottom farmers

According to Table 32 there exist significant differences between the output and the following input levels of top and bottom farmers : 2.3.2 superphosphate fertilizer, extension contact, course attendance, seed and family labour.The 2.3.2 superphosphate fertilizer shows the largest difference among the inputs. One may be inclined to believe that these large differences in fertilizer levels are attributed to the cost of purchasing fertilizer and, thus, suggest that in order to reduce these differences, fertilizer input be subsidized. However, Nieuwoudt (1979 :14) has observed that sugar cane farmers apply optimum levels of fertilizer probably because of the zero cost of obtaining services such as soil and leaf analyses. He also notes that some farmers apply excess fertilizer in order to reduce their income tax. On the basis of these observations, Nieuwoudt (1979 : 19) concludes that "... subsidising information, in the form of offering free soil analysis and fertilizer recommendations on an individual farm basis, is far more efficient than subsidising fertilizers".

6.4 SUMMARY

The major conslusions which may be drawn from the analysis made in this chapter are as follows :

(a) There exist significant inter-scheme and inter-group differences in output and some input levels. It would appear that differences in the levels of durable capital, age, farmwork experience and family labour do not explain the differences in output levels of irrigation schemes. However, family labour appears to be an important factor in explaining differences in output levels of top and bottom farmers.

(b) There is no significant difference between the correlation coefficients for input with output of top and bottom farmers except in the case of family and hired labour. Family labour is positively related to output in both groups although the relationship is only significant in the top group. Hired labour is significantly negatively correlated with output in the bottom group whereas it is positively related to output in the top

group but not significant.

(c) For all farmers put together, 2.3.2 superphosphate fertilizer, extension contact, course attendance and family labour are significantly negatively correlated with output.

(d) Inputs such as 2.3.2 superphosphate fertilizer, durable capital, seed and farmwork experience are significantly positively related to output on certain irrigation schemes. Farmwork experience shows a significant negative relation to output on some irrigation schemes.

(e) Extension contact and 2.3.2 superphosphate fertilizer show a significant negative relationship in the bottom farmer group while the relationship is significant and positive in the top group. The relationship between the two inputs for all farmers combined is positive but not statistically significant.

(f) Course attendance and durable capital are significantly negatively correlated in both farmer groups and for all farmers together.

(g) Seed and 2.3.2 superphosphate fertilizer are significantly positively related in the top farmer group but negatively related in the bottom group and for all farmers together.

(h) "Listening to radio programmes" and extension contact are significantly positively related in the bottom farmer group and for all farmers while the relationship is negative in the top group but not statistically significant.

(i) Hired labour is significantly negatively related to course attendance in the top farmer group and for all farmers. For all farmers, the relationship between hired and family labour is negative and significant.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 SUMMARY OF THE STUDY

The crucial role of the agricultural sector in the economy of Less Developed Countries (LDCs) is highlighted in the study. It has been observed that in many LDCs the agricultural sector is usually not regarded as a more or less equal partner with other sectors of the economy. This attitude towards agriculture is largely responsible for the acute food problems which many countries of Africa are facing today. Africa is known to be the only continent in the world where per capita food production has declined over the past decades.

The present study is an attempt to suggest possible ways of increasing maize production in the less developed areas of South Africa (Homelands). The food situation prevailing in these homelands is not different from that in other African countries. The study is concerned with the determination of the possible causes of the differences in the output levels of farmers and irrigation schemes. It is hypothesized that these differences may largely be attributed to the existing differences in the input levels of the farmers and irrigation schemes. The specific objectives of the study were to :

(a) isolate the factors which affect maize production;

(b) determine the resource base of farmers and irrigation schemes and the utilization of these resources in order to establish possible constraints to increased maize production; and

(c) make policy proposals which might lead to an increase in production.

7.2 CONCLUSIONS AND POLICY PROPOSALS

The results of this study indicate that there are large differences between the output levels of top and bottom farmers and irrigation schemes. These differences are largely attributable to the differences in the levels of certain inputs. It may, therefore, be suggested that in order to bring the output levels of bottom farmers and irrigation schemes to those of top farmers and irrigation schemes, the gap between certain input levels will have to be bridged. Large differences in the following input levels are observed : 2.3.2 superphosphate fertilizer, extension contact and course attendance. It may, therefore, be concluded that differences in output levels due to differences in input levels may be attributed to the factors above. Factors like durable capital, age, farmwork experience and family labour do not appear to explain the existing differences in output levels. Thus, no appreciable increases in output levels are expected to result from the adjustment in the levels of these factors. It has also been found that bottom farmers and irrigation schemes use more seed than top farmers and irrigation schemes.

Radio media, which has been shown to have some positive effect on production in certain parts of Africa does not appear to have any impact on the performance of the farmers in the areas covered. Contrary to expectations, having previously worked for a white farmer does not show any significant relation to output.

The land units which are made available to the farmers are too small for some of them. This makes it necessary for them to hire additional land from colleagues. Water shortage has been singled out as the most important obstacle to increased maize production.

In view of the abovementioned findings, the following policy proposals may be suggested :

(a) Although changes to the land tenure system would be desirable and could probably lead to an increase in production, significant increases in maize output may be achieved by making certain adjustments within the present system of land tenure. In order to alleviate land shortage problems encountered by some farmers, it is suggested that productive farmers be identified on the irrigation schemes and it should be made easier for them to be provided with more land when required. This should be possible without effecting any changes to the present land tenure system. This suggestion should be regarded as a short-term measure. However, in the long run, changes to the present land tenure system should receive attention.

(b) The largest difference in the input levels of irrigation schemes and farmers lies in fertilizer. This difference could largely be attributed to the preferential treatment received by the top irrigation schemes. Top schemes do not experience any problems as regards the supply of fertilizer on credit. This "discrimination" against bottom schemes should be dis= couraged as it is likely to lead to a skewed income distri= bution which is undesirable for economic progress. Farmers could also attempt to solve their problems by forming agricultural co-operatives where there are none. Where these are already in existence, means should be made of making fertilizer available on credit and at the lowest cost possible. For reasons already given elsewhere in this thesis, it would appear more desirable to subsidize information on essential services which might enable farmers to use optimum levels of fertilizer than to subsidize fertilizer input.

(c) The problem of water shortage should receive urgent attention. Further research into this issue should be conducted.

(d) Large differences also exist in the levels of extension contact. Top farmers and irrigation schemes have a reasonably high level of extension contact. The low level of extension contact found among bottom farmers and irrigation schemes could be attributed to :

- the inability of the extension officers on these irrigation schemes to discharge their responsibilities adequately, and/or
- the conditions under which the extension officers operate. Although the ratio of one extension officer to 175 farmers in Lebowa would seem acceptable if the ratio of 1 to 3 extension officers to 500 farmers is regarded as the norm, other unfavourable working conditions could still prevent extension officers from increasing their contact with farmers.

It is suggested that attention be given to these aspects so as to raise the level of extension contact on the bottom schemes.

(e) As the attendance of farming lectures appears to have a positive effect on production, it is suggested that the Department of Agriculture and Environmental Affairs look into possible ways of increasing the number of farmers who attend these lectures. Farmers should, however, find it worthwhile attending these lectures if their numbers is to increase. This implies that the lectures should be practical and relevant to farming.

(f) The amount of seed which is used by bottom farmers could be an indication of lack of proper guidance given to these farmers. Proper extension advice could help reduce the quantity of seed used and this would lead to a reduction in production costs and probably raise maize production.

(g) If radio programmes are to contribute positively to the produc= tivity of farmers, it will be necessary to present them at the most appropriate time. These programmes should be made more relevant and be easily understood by the farmers.

(h) It is surprising to note that having worked for a white farmer does not have any effect on the performance of farmers whatsoever. This could be the result of many factors which are beyond the scope of the present study. It would, however, be interesting to investigate this issue further.

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APPENDIX 1 *

Information supplied will be treated as strictly confidential

Ditaba tše re di filwegoke khupamarama

PRODUCTION AND MARKETING OF AGRICULTURAL PRODUCTS IN LEBOWA

TŠWELETŠO LE THEKIŠO YA DITŠWELETŠWA TSA TEMO MO LEBOWA

Name of enumerator : _____
Mmotšiši

Date of interview : _____
Letšatšikgwedi

* Not all the information collected by means of this questionnaire has been used for this thesis. Some of the data have been used for the project on rural development strategy for Lebowa, done by the University of the North.

SCHEDULE A : PRODUCTION

LENANEO A : TSWELETSO

I IDENTIFICATION/BOITSHUPO

1 Name of farmer (respondent)
Leina la molemi (moarabiswa) : _____

2 Plot number
Nomoro ya tshemo : _____

3 Name of scheme
Leina la lenaneotemo : _____

4 Name of district
Leina la selete : _____

II HOUSEHOLD-HEAD CHARACTERISTICS/MABALANTLHA A MONGMOTSE

1 Who is the head of the household ?
Mongmotse ke mang ?

Name Leina	Sex Bong	Age Mengwaga	Marital status O nyetse/nyetswi	Number of wives Palo ya basadi

2 Where is your place of origin ?
A o belegetswe kae ?

a Same village/
Mo motseng wona wo ☐

b Same chieftainship/
Kgosi e le yona ye ☐

c Same district/
Seleteng sona se ☐

d Other Lebowa district/
Seleteng se sengwe sa Lebowa ☐

e Outside Lebowa/
Ka ntle ga Lebowa ☐

If answer is not (a), why did you move ?
Ge karabo e se ya (a), o tlositswe keng ?

a Better land/
Mobu o kaone ☐

b Conflict with other community members/
Ke go se kwane le baagisani ☐

c Resettlement/
Ke filwe madulo ka lefsa ☐

d Allocated a plot on the scheme/
Ke filwe tshemo mo lenaneotemong ☐

e Other (specify)
Mabaka a mangwe (hlalosa) : _____

_____

III EDUCATIONAL AND LITERACY LEVELS/MAEMO DITHUTONG

1 What is the highest educational qualification achieved ?
Na o fihlile bokgole bjo bokae ka dithuto ?

_____

2 Have you attended any agricultural school/ college/university ?
A na o tsene sekolo sa temo/kholetshe ya temo/ yunibesiti ya temo ?

Yes	No
E	Aowa

3 Did you work on a farm before you started your own farming ?
A o kile wa soma polaseng pele ga ge o eba molemi ?

Yes	No
E	Aowa

4 Indicate the language(s) you can write and/or read
Laetsa gore a leleme goba maleme a o kgonago go a ngwala goba go a bala ke afe

Language Lelemi	Can read Kgona go bala	Can write Kgona go ngwala	Can read and write Kgona go bala le go ngwala
Sepedi			
English			
Afrikaans			
Zulu			
Setswana			
Sesotho sa Borwa			
Swazi			
Venda			
Tsonga/ Shangaan			

IV EXPOSURE TO SOURCES OF INNOVATIVE INFORMATION/
PHIHLELLO YA METSWEDI YA DITABA TSA DIPHETOGO

1 Do you possess any radio ?
A o na le radio ?

Yes	No
E	Aowa

If yes, do you listen to agricultural programmes ?
Ge eba o nayo, a e o ke o theetše mananeo a tša temo ?

Yes	No
E	Aowa

If you do not listen to agricultural programmes, why ?
Ge o sa theetše mananeo a tša temo lebaka keng ?

a Not aware of any programmes/
Ga ke tsebe gore a gona ☐

b Presented too early/
A gaswa e sale bosego kudu ☐

c Not interested/
Ga ke na kganyogo ☐

d Other (specify)
Mabaka a mangwe (hlalosa) _____

2 If you do not possess any radio, do you listen to any radio belonging to friends or relatives ?
Ge eba ga o na le radio, a e o ke o theetšše ya bagwera goba metswalle ?

Yes	No
E	Aowa

3 Do you have any television set ?
A o na le thelebišene ?

Yes	No
E	Aowa

If no, do you watch it at a friend's or relative's place ?
Ge eba ga o nayo, a o bona ya mogwerago goba ya motswalle ?

Yes	No
E	Aowa

4 How many times did the local extension officer visit you this year ?
A na molemiši wa tikologo ya geno o etetšše ga kae lenyaga ?

_____

5 Have you attended any agricultural courses this year ?
A o kile wa ya dithutotšošeletšong tša balemi lenyaga ?

Yes	No
E	Aowa

If yes, who organised the courses ?
Ge eba o kile wa ya, na dithuto tšeo di be di rulagantšwe ke mang ?

_____

If no, why didn't you attend ?
Ge eba ga se wa ke wa ya, ke ka lebaka la eng ?

a No courses organised/
Di be di se gona ☐

b Not interested/
Ke be ke sa kganyoge go ya ☐

c Other (specify)
Mabaka a mangwe (hlalosa) _____

V LABOUR SUPPLY AND UTILIZATION/KABO LE TŠHOMISO YA BAŠOMI

1 Who are the other members of the household, excluding yourself ?
Ka ntle le wena, ba bangwe ba lapa la gago ke bomang ?

Name Leina	Sex Bong	Age Mengwaga	Relationship to household head Leloko le mongmotse	School standard passed Mphato wo o phasitswego	Occupation Modiro	Income per month Moputso ka kgwedi

2 Do you hire labour on permanent basis ?
A o hira bašomedi sa ruri ?

Yes	No
E	Aowa

3 Do you hire labour on temporary basis ?
A o hira bašomedi nakwana fela ?

Yes	No
E	Aowa

4 Indicate the number of days in a week and hours per day spent working on the plot/farm by each of the following categories of labour
Laetša palo ya matšatši ka beke le diiri ka letšatši tšeo sehlopa se sengwe le se sengwe sa bašomedi se di tšeago ge ba šoma tšhemong/polaseng

		Days per week Matšatši ka beke	Hours per day Diiri ka letšatši
OWNED LABOUR BA LAPA	Male adults Banna		
	Male children Bašimane		
	Female adults Basadi		
	Female children Basetsana		
HIRED PERMANENT LABOUR BA GO HIRELWA SA RURI	Male adults Banna		
	Male children Bašimane		
	Female adults Basadi		
	Female children Basetsana		
HIRED TEMPORARY LABOUR BA GO HIRELWA NAKWANA FELA	Male adults Banna		
	Male children Bašimane		
	Female adults Basadi		
	Female children Basetsana		

5 Indicate the number of permanent hired labourers and the wages per month
Bontšha palo ya bašomedi ba go hirelwa sa ruri le meputso ya bona ya kgwedi

	Number Palo	Wage per month Moputso ka kgwedi
Male adult/ Banna		
Female adult/ Basadi		
Male children/ Bašimane		
Female children/ Basetsana		

6 Indicate for temporary labour the month(s) during which hired, number hired each month, days worked each month and wage per month
Mabapi le bašomedi ba nakwana fela, bontšha gore a ba hirwa kgweding goba dikgweding dife, palo ya bona ka kgwedi, matšatši a go šoma mo kgweding, le moputso ka kgwedi

	J		F		M		A		M		J		J		A		S		O		N		D		Wage Moputso
	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	No./Palo	Days/Tšatši	
Male adult Banna																									
Male chil- dren Bašimane																									
Female adult Basadi																									
Female children Basetsana																									

7 Complete the following table for each crop separately. Indicate the number of hours spent per day on each task and number of days it takes to complete the task
Feleletša lenaneo le la sebjwalwa se sengwe le se sengwe. Bontšha palo ya diiri tše di tšwewago mošomong o tee le palo ya matšatši ao a tšewago go fetša mošomo. Sebjwalwa se sengwe le se sengwe se be le letlakalana la sona

	Male Adult Banna	Male Children Bašimane	Female Adult Basadi	Female Children Basetsana	Days Matšatši
Land preparation up to final seedbed/ Tokišo ya mobu go fihlela go 'seedbed' ya mafelo					
Soil preparation/ Tokišo ya mobu					
Soil treatment/ Tshwaro ya mobu					
Sowing or planting/ Go bjala					
Manuring/ Go tšhela mmutele					
Weeding/ Go hlagola					
Spraying/ Go foka					
Irrigation/ Go nošetša					
Harvesting/ Go buna					
Processing/ Tokišetšo-tirišo					

8 Do you pay labour in kind ?
A bašomedi ba gago o ba lefa ka ditšweletšwa ?

Yes	No
E	Aowa

If yes, motivate
Ge o re e, fahlela _____

_____

_____

_____

_____

VI LAND TENURE AND UTILIZATION/BOMONGNAGA LE TŠHOMIŠO YA YONA

1 For how long have you been on this plot ?
Na ke nako ye kae o lema mo tšhemong ye ?

_____

2 How did you acquire this plot ?
A tšhemo ye o e hweditše bjang ?

a Inheritance/
Ka bohwa ☐

b Allocated by management/
Ke e abetšwe ☐

c Purchased/
Ke e rekile ☐

d Other (specify)
Mokgwa o mongwe (hlalosa) _____

3 What is the size of your plot, if one is occupied ?
A bogolo bja tšhemo ya gago ke bjo bokae, ge eba
ke e tee ?

_____

If more than one is occupied, give size of each
Ge eba ke a mantšhi, fa bogolo bja ye nngwe le ye nngwe

Plot/tšhemo	1	2	3	4	5
Size/Bogolo					

4 How much do you pay per plot as rent ?
A rente ya tšhemo e tee ke bokae ?

_____ Rand per annum
Diranta ka ngwaga

5 Is there any additional payment for the use of the plot(s) ?
A go na le tefo ye nngwe ya go šomiša tšhemo goba mašemo ao ?

Yes	No
E	Aowa

If yes, provide the following information
Ge eba go bjalo, fa tsebo ye e latelago

Type of additional payment Mohuta wa tefo ya tlaleletšo	Amount Bokae

6 Complete the table below
Feleletša lenaneo le le latelago

Crops grown this and last year Dibjalwa tša lenyaga le tša ngwagola	Area of land last year Bogolo bja tšhemo ngwagola	Area of land this year Bogolo bja tšhemo lenyaga	If area this year not same as last year, why? Ge eba bogolo ga e sale bjola bja ngwagola, fa lebaka ?

7 Did you use all available land this year for cultivation ?
A lenyaga o lemile tšhemo goba ditšhemo ka moka ?

Yes	No
E	Aowa

If no, why ?
Ge go se bjalo, lebaka ke eng ? _____

_____

8 Are you satisfied with the amount of land you occupy ?
A o kgotsofetše ka bogolo bja tshemo ya gago ?

Yes	No
E	Aowa

9 Would you prefer to use the land for crops of your own choice without being told which crops to grow ?
A o bona bokaone e le go bjala tša gago dibjalwa go na le gore o botšwe gore o bjale dife ?

Yes	No
E	Aowa

If yes, which crops would you like to grow and why ?
Ge o re e, o kganyoga go bjala dife, ka lebaka la eng ?

Crop/Sebjalwa	Reason/Lebaka

10 Rank crops according to profitability, starting with the most profitable
Latelanya dibjalwa go fetana ka poelo ya tšona, o thoma ka tšeo di nago le poelo e kgolokgolo

a _____

b _____

c _____

d _____

11 What is your main reason for growing crops ?
Labaka le legolo la ge o bjala dibjwalwa ke eng ?

a Human consumption/
Go ja ☐

b Sale/
Go rekiša ☐

c Feeding livestock/
Go fepa dikgomo ☐

d Other (specify)
Mabaka a mangwe (hlalosa) _____

VII INVENTORY OF FARM IMPLEMENTS/TOOLS OWNED AND MECHANISATION/ LENANEO LA DIGERESISEKAPA/DITHULUSU LE METSHENE

1 Please provide the information below
Fa tsebo mabapi le tše di latelago

	Quantity/ Palo	Purchase date or age/ Tšatši la theko goba botala	Purchase price per unit/ Theko ya setee	Cash or credit/ Kheše goba sekoloto	Place of purchase/ Lefelo la theko	If credit, interest paid/ Ge eba sekoloto tefo ya lešokotšo
Plough/Mogoma						
Tractor/Terekere						
Planter/Polantere						
Row cultivator						
Harrow/Ege						
Wheelbarrow/Kiribane						
Spade/Sepeiti						
Garden fork/Foroko						
Rake/Araka						
Hoe/Letšepe						
Axe/Selepe						
Saw/Saga						
Sickle/Sekele						
Pliers/Kinipitang						
Thresher/Motšhene wa go fola						
Pick/Peke						
Hammer/Hamola						
Screwdriver/Sekuruterai						
Other (specify) Tše dingwe (hlalosa)						

2 Do you hire any tractor for the performance of certain tasks on your plot ?
A e o ke o hira terekere go phetha meholana ye mengwe mo tšhemong ya gago ?

Yes	No
E	Aowa

If yes, indicate
Ge eba go bjalo, bontšha

Owner/ Mong	Tasks/ Mešomo/mehola	Amount paid/ Tefo

Do you get the tractor at the time when you need it ?
A o hwetša terekere ka nako yeo o e nyakago ka yona ?

Yes	No
E	Aowa

If no, motivate
Ge go se bjalo, fahlela

_____

_____

3 Do you hire any machinery for the processing of your products ?
A na o hira metšhene go lokiša ditšweletšwa gore di dirišwe ?

Yes	No
E	Aowa

If yes, provide the following information
Ge go le bjalo, fa tsebo ye e latelago

Crop/ Sebjalwa	Owner of machinery/ Mong wa motšhene	Amount paid/ Tefo

4 Do you use any animal-drawn instruments other than a plough ?
A o šomiša digereisekapa tše dingwe tša go gogwa ke diruiwa, ntle le mogoma ?

Yes	No
E	Aowa

If yes, name the implement(s) and tasks used for
Ge go le bjalo fa maina a digereisekapa tšeo le mešomo ya tšona

_____

_____

VIII VARIABLE INPUTS/DITLABELE

1 Please provide the information below regarding the inputs used for the different crops cultivated
Fa tsebo mabapi le ditlabele tše di latelago di šomišwago ge go lengwa mehutahuta ya dibjalwa

Input/ Ditlabele	Crop/ Sebjalwa		Crop/ Sebjalwa		Crop/ Sebjalwa		Crop/ Sebjalwa		Crop/ Sebjalwa	
	Amount Bontši	Price/ Theko	Amount Bontši	Price Theko	Amount Bontši	Price Theko	Amount Bontši	Price Theko	Amount Bontši	Price Theko
Seed/Peu										
Fertilizer/Manyoro										
Fungicides/Dihlare tša go bolaya boori										
Manure/Mmutele										
Herbicides/Dihlare tša go bolaya ngwang										
Insecticides/Dihlare tša go bolaya diji										
Sacks/boxes/ Mekotla/mabokisi										

2 Is the seed used bought or farm produced ?
A peu ye šomišwago e a rekwa goba ke ye e tšwago mašemong ?

Crop/ Sebjalwa	Bought/ Rekilwe	Farm produced/ E tšwa mašemong

3 If you do not use any fertilizer, give reasons for this
Ge eba ga o šomiši manyoro, fa mabaka

_____

_____

4 If you do use fertilizer
Ge eba o a a šomiša

a Do you find it productive ?
A o hwetša a na le moputso ?

Yes	No
E	Aowa

b At what stage do you apply it and what method of application is used, e.g by hand ?
A o a šomiša neng ka mokgwa wa mohuta mang, go swana le go a gaša ka seatla ?

Crop/ Sebjalwa	Stage/Nako ya tšhomišo		Method used, e.g by hand/ Mokgwa wa tšhomišo e.g ka seatla
	After planting Morago ga go bjala	Before planting Pele ga go bjala	

5 What method of application is used for irrigation water ?
A o nošetša ka mokgwa wa mohuta mang ?

a Canal/
Kanala ☐

b Sprinkler/
Sebero ☐

c Other (specify)
Mokgwa wo mongwe (hlalosa) _____

_____

6 What charges do you pay for irrigation water ?
Meetse a go nosetša o a lefela bokae ?

_____ Rand per annum/
Diranta ka ngwaga

7 Do you ever experience a serious shortage of water ?
A e o ke o hloke meetse gakudu ?

Yes	No
E	Aowa

If yes, during which time of the year ?
Ge eba go bjalo, o a hloka neng ?

_____

8 Did you apply any agricultural lime in any of the previous seasons ?
A o kile wa šomiša laeme ya bolemi mo dihleng tše dingwe tše di fetilego ?

Yes	No
E	Aowa

If yes, for which crops ?
Ge eba e, o e šomišitše go dibjalwa dife ?

_____

_____

IX AGRICULTURAL CREDIT/KADIMO YA TŠA TEMO

1 Do you borrow money for agricultural purposes ?
A o adingwa tšhelete go e šomiša go tša temo ?

Yes	No
E	Aowa

If no, why ?
Ge eba aowa, lebaka ke eng ?

a Unavailable/
Ke go se be gona ga yona ☐

b Interest charges too high/
Ditefiso tša lešokotšo di godimo kudu ☐

c Do not need it/
Ga ke e hloke ☐

d Do not qualify for loan/
Kadimo ga ya nswanela ☐

e Other (specify)/
Lebaka le lengwe (hlalosa) _____

_____

If yes, provide the following information:
Ge go le bjalo, re fe mo:

Source, e.g bank/ Motswedi, e.g panka	Amount/ Bokae	Used for/ E šomišetšwa	Interest charged/ Lešokotšo	Payment terms e.g 1 month/ Mokgwa wa go patela, e.g kwedi

2 Are you able to buy some of your inputs, like seed, on credit ?
A o kgona go reka tše dingwe tša ditlabele tša gago, go swana le peu, ka go di tšea mokitwane ?

Yes	No
E	Aowa

If yes, provide the following information:
Ge eba go bjalo, re fe tsebo ka ga tše di latelago:

Input/ Ditlabele	Source/ Motswedi	Amount/ Bokae	Payment terms/ Mokgwa wa tefo	Interest charges/ Lešokotšo

X OUTPUT AND INCOME/POELO YA DIBJALWA LE YA TSHELETE

1 Please provide the following information regarding your crops:
Fa tsebo mabapi le dibjalwa tša gago:

Crop/ Sebjalwa	Amount produced this year/ Tšweletšo lenyaga	Amount lost/ Tshenyegelo	Reason for loss/ Lebaka la tshenyegelo	Amount consumed/ E šomiši tšwego	Amount sold/ E rekišitšwego	Price received per unit/ Poreisi ya setee

2 Please provide the following information on livestock and livestock products sold this year:
Fa tsebo mabapi le diruiwa le ditšweletšwa tša tšona tšeo di rekišitšwego lenyaga

Livestock or livestock products/ Diruiwa goba ditšweletšwa tša tšona	Number or quantity sold/ Palo goba bontši bjo bo rekišitšwego	Amount of money received/ Tšhelete ye e amogetšwego
Cattle/Dikgomo		
Goats/Dipudi		
Sheep/Dinku		
Fowl/Dikgogo		
Pigs/Dikolobe		
Milk/Maswi		
Goat wool/ Boya bja dipudi		
Sheep wool/ Boya bja dinku		
Eggs/Mae		
Hides and skins/ Mekgopha		
Manure/Mmutele		

3 Please provide the following information on non-farm income, i.e income derived from sources other than farming:
Fa tsebo mabapi le tšhelete yeo e sa tlišwego ke ditšweletšwa tša temo; yeo e tlišwago ke metswedi ye mengwe ye e sego ya temo:

Source/Motswedi	Income per annum Tšhelete ka ngwaga
Selling beer/ Thekišo ya bjala	
Selling fish/ Thekišo ya dihlapi	
Selling herbs/ Thekišo ya ditala	
Part-time work/ Mošomo wa nakwana	
Interest on savings/ Lešokotšo la poloko ya tšhelete	
Income from children/ Tšhelete ye e tšwago baneng	
Other (specify) Tše dingwe (hlalosa)	

XI GENERAL/KAKARETŠO

1 If your income from farming were to rise substantially, what would you do with it ?
A ge tšhelete ya gago ye e tšwago mo temong e ka oketšega kudu, a o ka e dirišetša eng ?

Rank/Maemo

a Reinvest in farming/
Go e šomišetša temo gape ____

b Buy a car/
Go reka motoro ____

c Meet social needs/
Go e somišetša dinyakwa tša ka gae ____

d Repay existing debts/
Go lefa melato ye e lego gona ____

e Other (specify)
Se sengwe (hlalosa) _____

2 Do you receive your inputs, e.g fertilizer, at the time when you need them ?
A ditlabele tša go swana le manyoro o di hwetša ka nako ye o di nyakago ?

Yes	No
E	Aowa

If no, which inputs are in greatest shortage ?
Ge eba aowa, ditlabele tse go lego bothata go di hwetša ke dife ?

_____

_____

Is the reason for not receiving inputs at the right time
A lebaka la go se di hwetše ka nako yeo o di nyakago ka yona

a Not available at the place where I buy inputs ?
Di be di se gona moo di hwetšwago ? ☐

b Shortage of money when inputs are needed ?
Go hloka tšhelete e lekanego ka nako yeo di hlokegago ? ☐

c Lack of means to transport inputs to home or plot ?
Go hloka magetla a go di tliša gae goba tšhemong ☐

d Other (sepcify)
Mabaka a mangwe (hlalosa) _____

_____

3 What do you regard as the major problem(s) and limitations to increasing crop production ?
A ke eng seo o bonago e le bothata bjo bogolo goba lepheko leo le šitišago go oketšega ga tšweletšo ya dibjalwa ?

Rank/Maemo

a Shortage of labour/
Tlhaello ya diatla ____

b Shortage of capital/
Tlhaello ya tšhelete ____

c Shortage of water/
Tlhaello ya meetse ____

d Lack of know-how/
Go se be le tsebo ____

e Other (specify)/
Se sengwe (hlalosa) _____

_____

4 If water were available throughout the year, would you cultivate crops throughout the year ?
A ge nkabe meetse a be a le gona ngwaga ka moka, a o be o ka lema ngwaga ka moka ?

Yes	No
E	Aowa

If yes, why would you do this ?
Ge eba go bjalo, fa lebaka ?

_____

_____

If no, why would you not do it ?
Ge eba ga go bjalo, lebaka ke eng ?

_____

_____

SCHEDULE B : MARKETING

LENANEO B : PAPATŠO

I SELLING/THEKIŠO

1 Who is the selling agent for your products ?
Morekiši wa ditšweletšwa tša gago ke mang ?

a Local co-operative/
Koporase ya kgauswi ☐

b Local trader/
Ralebenkele wa kgauswi ☐

c Other (specify)
Se sengwe (hlalosa) _____

2 Do you receive proceeds from the sale of products as soon as they are delivered to the selling agent ?
A o hwetša tšhelete ya gago ya ge o rekiša ditšweletšwa ka nako ye o di fago morekiši ka yona ?

a Receive part of proceeds on the same day/
Ke hwetša seripa sa dipoelo lona tšatši leo ☐

b Receive all proceeds on the same day/
Ke hwetša dipoelo ka moka lona tšatši leo ☐

c Receive no money until products have been sold by the selling agent/
Ga ke hwetše selo go fihlela ge di rekišitšwe ke morekiši ☐

d Receive all proceeds after several months/
Ke hwetša tšhelete ka morago ga kgwedi tše ntšhi ☐

e Receive all proceeds after a few days or weeks/
Ke di hwetša ka morago ga matšatši goba dibeke di se kae ☐

f Other (specify)/
Se sengwe (hlalosa) _____

_____

3 Do you sell any of your products at a place other than the selling agent ?
A o rekiša ditšweletšwa tša gago mo gongwe ntle le ge o di fa morekiši gore a go rekišetše tšona ?

Yes	No
E	Aowa

If yes, where and why ?
Ge eba go bjalo, fa lefelo le lebaka ?

Product/ Setšweletšwa	Place/ Lefelo	Reason/ Lebaka

4 Is there any time during which you are unable to sell your products due to lack of market outlets ?
A go ke go be nako yeo go yona o palelwago ke go rekiša ditšweletšwa tša gago ka baka la go hloka ditsela tša papatšo ?

Yes	No
E	Aowa

If yes, indicate the products affected and what is done with the unsold products
Ge go le bjalo, bontšha ditšweletšwa tše di angwago le gore a tše di sego tša rekišwa o dira eng ka tšona

Product/ Setšweletšwa	What is done with unsold products Se se dirwago ka tše di sego tša rekišwa

5 When do you want payment for the products sold ?
Na tefo ya ditšweletšwa tše di rekišitšwego o e nyaka neng ?

a Immediately/
Ka pelapela ☐

b After 1 week/
Ka morago ga beke ☐

c After 1 month/
Ka morago ga kgwedi ☐

d Doesn't mind as long as I get paid/
Ga go taba kgang ke ge ke lefiwa ☐

e Other (specify)
Se sengwe (hlalosa) _____

II TRANSPORTATION/GO RWALA DITŠWELETŠWA

1 How far is the local selling agent from your plot ?
A morekiši wa geno o bokgole bjo bokae le tšhemo ya gago ?

_____ Kilometres/
Dikhilometere

2 How far is your home from the plot ?
A gae gago ke bokgole bjo bokae le tšhemo ya gago ?

_____ Kilometres/
Dikhilometere

3 Indicate in each case the means of transport used for products
Laetša go ya ka dihlopha mokgwa wa go rwala ditšweletšwa

	Plot to home/ Tšhemong go ya gae	Home to local selling agent/ Gae go ya go morekiši	Local selling agent to SA co-operative/ Morekiši go ya go kopo-rase ya SA	Owned/hired/ Ya gago/hi-rilwe
Pick-up/Mmotoro				
Tractor/Terekere				
Donkeys/Ditonki				
Cattle/Dikgomo				
Wheelbarrow/Kiribane				
Carry them/Ka mmele				

4 If the means of transport in (3) is hired, indicate the charges per trip
Ge eba mokgwa wa go rwala mo go (3) o hirilwe, gona bontšha patela ya leeto letee

	Plot to home/ Tšhemong go ya gae	Home to local selling agent/ Gae go ya go morekiši	Local selling agent to SA co-operative/ Morekiši go ya go koporase ya SA	Owned/ hired/ Ya gago/ Hirilwe
Pick-up/Mmotoro				
Tractor/Terekere				
Donkeys/Ditonki				
Cattle/Dikgomo				
Wheelbarrow/Kiribane				
Carry them/Ka mmele				

5 How are the transport charges paid ?
Dirwala di patelelwa bjang ?

a Deducted from my total returns/
Ka seripa sa dipoelo tša gago ☐

b Paid after total returns have been received by me/
Ka morago ga ge dipoelo ke di amongetše ☐

c Other (specify)
Ka mokgwa o mongwe (hlalosa) _____

_____

III PACKAGING/GO PAKA

1 What sort of packaging material is used for the products?
Na o šomiša eng go paka ditšweletšwa ?

a Cardboxes/
Dikhatepokisi ☐

b Bags/
Mekotla ☐

c Other (specify)/
Tše dingwe (hlalosa) _____

2 Do you buy the packaging material ?
A na o reka dilo tša go pakiša ?

Yes	No
E	Aowa

3 Are there any damages during storage ?
A go na le ditshenyagelelo ge go bolokwa ditšweletšwa ?

Yes	No
E	Aowa

If yes, how much of each crop was lost this year ?
Ge go le bjalo o senyegetšwe mo go kae lenyaga sebjalweng se sengwe le se sengwe ?

_____

_____

4 For how long do you store your products before taken to the local co-operative or selling agent ?
A ditšweletšwa tša gago o di boloka nako e kae pele ga ge o di iša koporaseng ya kgauswi ?

_____

V GRADING/TLHAOGANYO

1 Who does the grading of your products ?
Ditšweletšwa tša gago di hlaoganywa ke mang ?

_____

2 What grades do you normally obtain for each product ?
Dikereiti tše o yego o di hwetše go ditšweletšwa tša gago ke dife ?

_____

VI PROCESSING/TOKISO YA DITSWELETSWA GORE DI DIRISWE

1 Who processes your products ?
Ke mang yo a go lokišetšago ditšweletšwa tša gago gore di dirišwe ?

_____

2 If you don't do it yourself, what do you pay for getting them processed for you ?
Ge eba ga o itirele, a na o lefa bokae ge o direlwa ?

_____

VII CREDIT/TŠHELETE YA GO KADINGWA

1 Is credit available to finance marketing functions such as transportation, processing, etc. ?
A tšhelete ya go kadingwa e gona ya medirwana ya mabapi le thekišo ya ditšweletšwa, go swana le go di rwala le go lokišetša go dirišwa ?

Yes	No
E	Aowa

2 Do you need any credit for the financing of marketing functions ?
A o nyaka go adingwa tšhelete mabapi le medirwana ya papatšo ?

Yes	No
E	Aowa

VIII GENERAL/KAKARETŠO

1 Are the products insured while in transit ?
A o inšora ditšweletšwa tša gago ge o di iša thekišong ?

Yes	No
E	Aowa

2 If the price of your products were to increase substantially, would you increase or like to increase production ?
A ge theko ya ditšweletšwa tša gago e ka tloga e oketšega kudu, a o ka oketša goba wa rata go oketša tšweletšo ya tšona ?

Yes	No
E	Aowa

If yes, how ?
Ge eba go bjalo, bjang ?

a Increasing the amount of land cultivated/
Ka go oketša tšhemo ☐

b Using more fertilizer/
Ka go šomiša manyoro a mantši ☐

c Employing more labour/
Ka go oketša bašomedi ☐

d Other (specify)/
Se sengwe (hlalosa) _____

3 What do you regard as more important ?
Se o bonago se le bohlokwa go feta se sengwe ke sefe ?

a Subsidisation of input prices, e.g cheap fertilizer, or
Go tšewa kgopu maloka le theko ya ditlabele, go swana le manyoro a go tšhipa, goba ☐

b Free information regarding the correct use of inputs
Go fiwa tsebo ya mphiwafela mabapi le go šomiša ditlabele gabotse ☐

Please motivate your answer/
Fahlela karabo ya gago

_____

_____

4 When money is available for investment, where do you invest it ?
Ge tšhelete e le gona ya go bolokwa, o e boloka kae ?

Reason/Lebaka

a Bank/
Pankeng _____

b Buying cattle/
Reka dikgomo _____

c House improvement/
Kaonafatša ntlo _____

d Buy shares/
Reka dišere _____

e Other (specify)/
Tše dingwe (hlalosa) _____

5 Do you know what the prices of the different products are before harvesting ?
A pele ga ge o buna o tseba theko ya setšweletšwa se sengwe le se sengwe ?

Yes	No
E	Aowa

If no, would you prefer to know the prices before harvesting ?
Ge go se bjalo, a o bona bokaone e le go tseba ditheko pele ga go buna ?

Yes	No
E	Aowa

6 What do you regard as being the major problem(s) in marketing your products ? List according to importance
A o bona bothata bjo bogologolo mabapi le thekišo ya ditšweletšwa tša gago e le bofe ? Lokologanya go ya ka go fetana ga ona

a _____

_____

b _____

_____

C _____

_____

d _____

_____

e _____

_____