

*Full Length Research Paper*

# **An evaluation of mineral and organic fertilizers Utilization by small-Scale farmers in Vhembe district, Limpopo province, South Africa**

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The use of mineral and organic fertilizers as straight fertilizers or in appropriate combinations may alleviate the problem of declining soil fertility and hence lead to increased crop yields. The objectives of this study were to (i) assess the use of mineral and organic fertilizer and (ii) determine the constraints with regards to use of inorganic and organic fertilizers by smallholder farmers in Vhembe district municipality, Limpopo province, South Africa. A survey of 84 randomly sampled farmers was conducted using a standard questionnaire. An interview schedule was the main tool of data collection while descriptive statistics were the main analytical technique. Of the farmers interviewed, 79% accessed information from neighbouring farmers. Only 50% of the farmers had easy access to fertilizers and the fertilizers were always available when needed. However, 75% of the farmers could not afford the required quantities of fertilizers due to limited funds. Up to 97% of the farmers could not access any credit. Over 65% of the farmers knew how and when to apply manure. Manure was affordable and readily available but transportation costs were high. Over 60% of the farmers stored manure in the open leading to significant losses of nutrients. Based on the results of this study, majority of farmers could not afford fertilizers nor access credit facilities. Fertilizer accessibility was still a problem in some areas. Extension services, especially with regards to information on the appropriate use of mineral and organic fertilizers, were not available to most farmers.

**Key words:** Mineral fertilizers, organic fertilizers, smallholder farmers, Limpopo province.

## **INTRODUCTION**

Inadequate supply of nutrients due to declining soil fertility is one of the major constraints to crop production faced by the smallholder farmers in Vhembe District of Limpopo Province, South Africa (Ramaru et al., 2000). The smallholder farms are located mostly in the former homeland areas and they cover approximately 30% of the provincial land surface. It is recognized that resource degradation in the former homelands was mainly caused by poor living conditions and overpopulation (White Paper on Agriculture, 1995). Most soils in Vhembe, South Africa, are fragile and low in plant nutrients. The nutrient recycling mechanisms that sustain soil fertility are insuffi-

cient to support increased production without fertilizers. Soil nutrient mining is usually associated with low agricultural production and land productivity under severe constraints of poverty in terms of physical capital (infrastructure) and human capital (health and education) (ECAPAPA, 2006). Continuing nutrient mining of soils means a future of increased poverty, food insecurity, environmental damage and social and economic instability. Use of mineral and organic fertilizers as straight fertilizers or in combinations may help to alleviate declining soil fertility (Gruhn et al., 2000). However, surveys conducted suggest that fertilizer usage by small-holder farmers in southern Africa remains extremely low despite substantial resources having been invested by the National Agricultural Research Stations of the Southern African Development Community (SADC) in

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developing fertilizer recommendations (Ahmed et al., 1997; Mapfumo and Giller, 2001). The use of mineral fertilizers is constrained mainly by its high cost and risky returns (McGuinness, 1993). Majority of smallholder farmers in Vhembe district are resource poor and cannot afford the high costs of the fertilizers. Mineral fertilizer use is risky for two reasons. First, yields and output prices can vary widely on a year to year basis, so farmers fear that in any given year, their crop income will not be high enough to cover their fertilizer costs. Second, yield vary widely with the climate: rainfall is highly uncertain; in drought years the crop response to fertilizer can be practically non-existent. Mineral fertilizers on the other hand do not improve soil physical structure or enhance soil biological activity (McGuinness, 1993). They must be used in conjunction with strategies that are designed to manage and maintain soil organic matter. One such strategy is the use of organic manure. The enhancement of fertility factors by using organic fertilizers causes an immediate improvement in the utilization of mineral fertilizers. Increased water availability, for example, improves the utilization of fertilizer by crops. A few small-holder farmers in Vhembe district use kraal (farm-yard manure) or poultry manure but lack sufficient knowledge of handling and storage of manure. In addition, due to the limited number of animals kept by the smallholder farmers, the amount of manure produced is never sufficient. In order to improve productivity in smallholder farms in Vhembe district, given the afore-mentioned limitations, it is critical and necessary to assess the current use and the constraints with regards to the use of mineral and organic fertilizers by smallholder farmers with the view of designing and implementing appropriate strategies and policy measures that can favour increased use of mineral and organic fertilizers and consequently crop yield. The objectives of this study, therefore, were to (i) assess the use of mineral and organic fertilizer and (ii) determine the constraints with regards to use of inorganic and organic fertilizers by smallholder farmers in Vhembe district, Limpopo province, South Africa.

## MATERIALS AND METHODS

### Study area description

Vhembe district is the northern most district municipality of Limpopo province, South Africa. It lies approximately between 22°08' and 23°24' latitudes and 28°54' and 31°05' longitudes. The district is generally semi-arid with rainfall ranging from 300 to 1000 mm per year. Soils in the district are variable – tending to be sandy in the west, but with a higher loam and clay content toward east. The soils are mainly developed on basalt, sandstone and biotite gneiss and are generally of low inherent soil fertility. The smallholder farms are located mostly in the former homeland areas. Farming under smallholder system is characterized by low level of production and small farm sizes of approximately 1.5 hectares with production being primarily for subsistence and little marketable surplus (White Paper on Agriculture, 1995). Maize is the dominant cereal grain despite the dry and drought prone agro-ecology of much of the district. The smallholder farmers also grow leguminous crops like

groundnuts, bambara nuts, and cowpea and vegetable crops which include spinach, cabbage, tomatoes and onions. (Nesamvuni et al., 2003). Cash investments in technologies such as fertilizer and insecticides are limited by capital and access constraints, as well as perceived riskiness of the production (Dimes and Carberry, 2007).

### Survey method

A survey was conducted in all the four municipalities (Makhado, Mutale, Thulamela and Musina) of Vhembe district. The target population was the smallholder farmers. A total of 84 farmers were randomly selected from different district municipalities with the assistance of the local agricultural extension staff. The number of farmers selected for interview from each municipality was 21. Since the area is mainly semi-arid, most farmers use irrigation (furrow) to grow their crops. The source of water is mainly from boreholes sunk by the government although a few farmers in parts of Thulamela and Mutale municipalities where the study was conducted also use water from Mutale river which flows close to their farms. Consequently, all the farmers interviewed in this study were using irrigation as the main source of water for their crops. An interview schedule was the main tool of data collection while descriptive statistics were the main analytical technique. Where farms were individually owned, the farmers were interviewed individually. In cases where the selected farm was a "community garden" (a group of individuals cultivating the same piece of land), the whole group was interviewed together. Data collected was analyzed using the Statistical Package for Social Sciences version 13.0 (SPSS, 2004).

## RESULTS AND DISCUSSION

### Background of the farmers interviewed

Of all the farmers interviewed, 56% of the respondents were females. Fifty-six percent of the respondents had no formal education, while only 4% had attained post secondary education. The survey showed that, 60% of the respondents had over 20 years of farming experience. Given that the majority of the farmers had no formal education, there is likelihood that they have insufficient knowledge on appropriate fertilizer use practices.

### Fertilizer Use

#### Factors Influencing Mineral Fertilizer Use

##### Accessibility

Of the farmers interviewed, 50% had easy access to fertilizers (Figure 1). This indicates that there is still need to make fertilizers more accessible, for example by establishing more depots closer to the farming communities. This will however be determined by the level of demand to stimulate investment in fertilizer distribution. The low percentage of farmers accessing fertilizers may also imply that there is need to improve the infrastructure so as to enable the farmers to access the fertilizers and other inputs as well as market for the farm produce with ease. Efforts to improve accessibility to fertilizer and seeds are being undertaken by Progress Milling Company (PMC) which was established about 5 years ago to

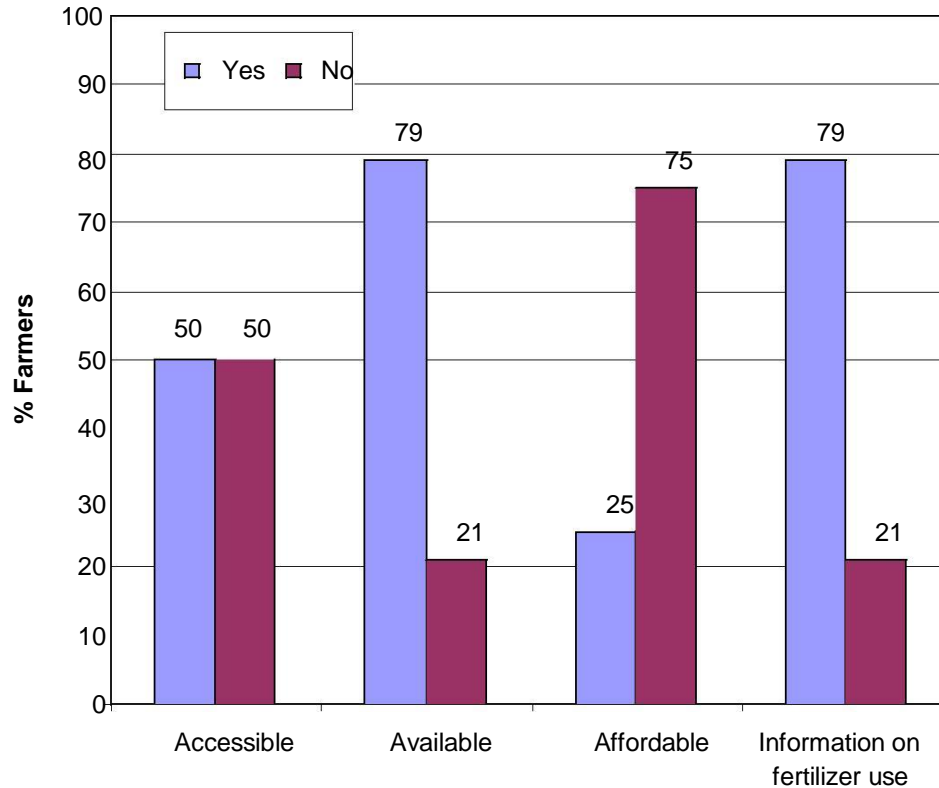


Figure 1. Factors influencing fertilizer use in Vhembe district, South Africa.

to promote commercialization of smallholder agriculture through establishment of small marketing depots throughout the province (Dimes and Carberry, 2007). Currently, PMC maintains roughly 100 marketing depots which also stock maize seeds and fertilizers. Sales of maize grain to the company have expanded over the past 5 years and this appears to increase overtime. Farmers seem to appreciate the improved access to better seed and to fertilizer. Other milling companies are also starting to establish similar buying points and this will further improve accessibility of seeds and fertilizer in the province.

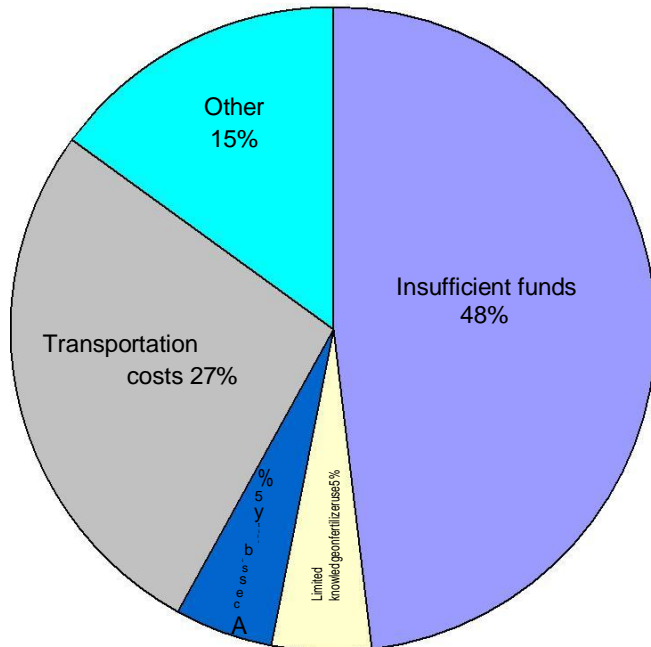
### Availability

Fertilizer availability can limit growth in fertilizer consumption. Of the farmers interviewed, 79% stated that the fertilizer was always available when needed (Figure 1). This indicates that as long as the farmers can access a fertilizer depot, they can always get the fertilizers that they need. Untimely local availability may prevent farmers from purchasing the fertilizer they want.

### Information on fertilizer type, method of application, time and rates of application

A high percentage (79%) of the farmers indicated that

they had the information on methods, time and rates of mineral fertilizer application (Figure 1). However, it emerged that the farmers were relying on what their neighbours were practicing hence risking adoption of incorrect practices. Thus, extension services to farmers needs to be improved so that farmers can access the relevant information on the use of fertilizers. Farmers ought to be stimulated to acquire needed information in regard to plant-foods and their proper use (McGuinness, 1993). Right choice of fertilizer, timing, methods and rates of application are all crucial factors in order to obtain maximum plant growth and yield. This may seem obvious, but inappropriate application of fertilizer or soil amendments can waste resources, cause water pollution, and damage soils. General recommendations for dry vs. humid, sandy vs. clay, acidic vs. non-acidic, and soils with varying cation exchange capacities must be supplemented with particular knowledge of individual sites (McGuinness, 1993). Current fertilizer recommendations in the province are largely based on the Fertilizer Society of South Africa (FSSA) handbook. The recommendations are too broad in the sense that the same recommendation is given regardless of site or circumstances, ignoring climatic and soil variability, and socio-economic constraints faced by farmers in these regions. Therefore, there is need to develop site specific recommendations which takes into consideration the soil and climate variability as well as the socio-economic status of the farmers.



**Figure 2.** Constraints regarding mineral fertilizer use in Vhembe district, South Africa.

This may entail conducting long-term field trials in different agro-ecological zones.

### Affordability and availability of credit facilities

Up to 75% of the farmers interviewed stated that fertilizers were very expensive and not affordable (Figure 1). This implies that those who can afford may not be able to buy the recommended quantity thus leading to applications which are below the recommended rates. Most of these farmers did not have any formal employment and tended to rely on government pension grants and social assistance grants to fund their farming activities. With regards to obtaining credit, 97% of the farmers could not access credit facilities. This suggests that it is still difficult for smallholder farmers to access credit facilities. This may be due to the fact that they did not have any recognizable collateral to access loans from commercial and agricultural banks. High interest rates charged by financial institutions was the main reason hindering most farmers from getting loans from the banks. Ignorance on the availability of loans and credit facilities was the second major contributor to failure in obtaining credit facilities, with collateral requirement being the last reason, probably due to the fact that few farmers attempted to get loans. Formation of cooperatives, whereby the farmers can pull their resources together in order to acquire farm inputs such as fertilizers and seeds in bulk and also to obtain credit, should therefore be encouraged as a solution to the problem of obtaining credit.

### Types of fertilizers applied to crops

The most commonly used fertilizer was NPK fertilizers with NPK (2:3:2) being the most popular among farmers (57%), followed by NPK (2:3:4). These were closely followed by NPK (3:2:1) and Lime Ammonium Nitrate (LAN) in popularity. Urea and NPK (2:3:4) had considerable usage in Mutale municipality. This varied usage may be associated with the soil types existing in different areas of the district and the crops grown and hence the need to balance the nutrients supplied to crops.

### Constraints regarding mineral fertilizer use

When asked to state the main constraints with regards to fertilizer use, the farmers mentioned insufficient funds to purchase fertilizers (48%) as the main constraint (Figure 2). The other constraints cited regarding fertilizer use were transportation costs (27%), accessibility (5%) and little knowledge about fertilizer use (5%) (Figure 2). More than 85% of the farmers financed their farming activities through income generated from farming. A drought year would therefore imply difficulties in purchasing inputs for the following season. Other sources of income they relied on included government pension fund and social development assistance grants. Failure to obtain credit facilities would also hinder the use of mineral fertilizers.

### Manure use

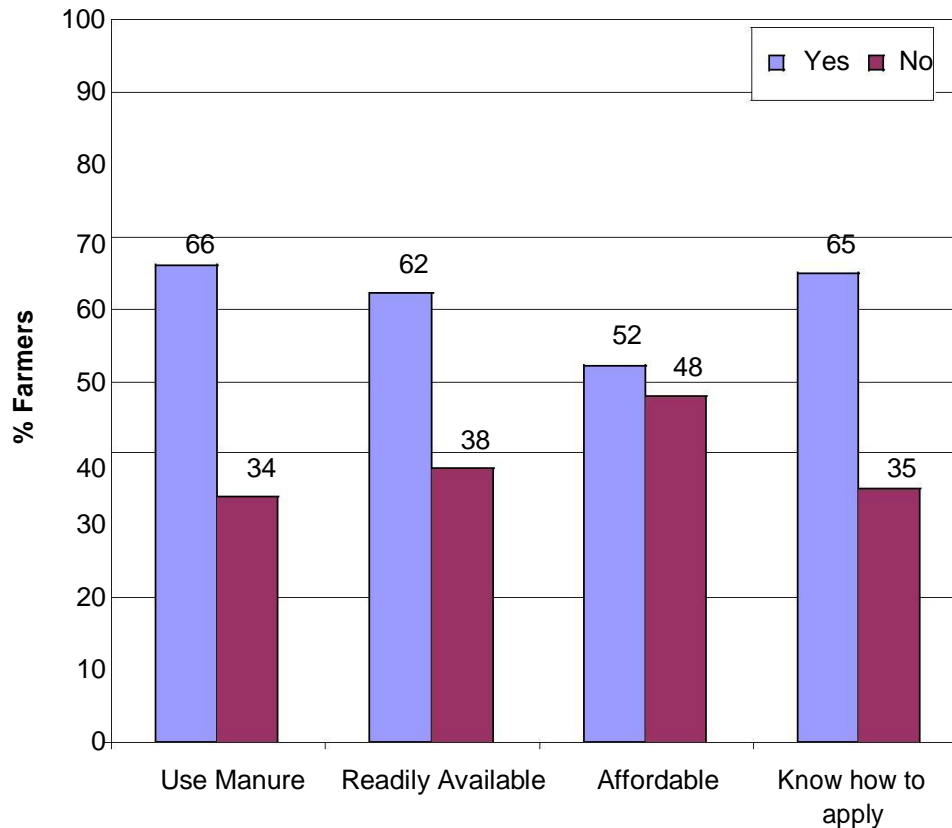
In terms of manure use, up to 66% of the farmers applied manure, mainly kraal (farmyard) manure (Figure 3). Over 50% of the farmers stated that manure was readily available when needed, and affordable. Up to 65% of the farmers knew how and when to apply manure to their crops.

### Sources of manure

The main source of manure was from neighboring farms (64%) since less than 33% of the farmers kept livestock, mainly cattle. Only 23% used manure from their animals and the quantity was not enough indicating that the farmers kept very few livestock. The neighbouring farms in this case referred mainly to feedlots and poultry farms ran by commercial farmers which could be quite a distance away. Consequently, the quantity of manure applied by the farmers may not be sufficient due to high transportation costs. For those farmers that use manure from their own animals, the quality of manure from smallholder areas is often low, due to the inferior quality grazing available to cattle (Nyamangara et al., 2001).

### Manure storage

Over 60% of the farmers stored manure in the open. This



**Figure 3.** Factors affecting manure use in Vhembe district, South Africa.

raises doubt about the quality of manure used. Nutrient losses, especially nitrogen, were bound to occur due to leaching during the rains or even denitrification when the sheds become soggy and anaerobic conditions prevail. Extension staff should train farmers on the advantages of proper manure storage in order to minimize nutrient losses during storage as well as to encourage farmers to use appropriate combinations of both mineral and organic fertilizers in order to minimize costs and build up soil organic matter.

### Constraints and problems regarding manure use

Transportation (30%) was the main constraint regarding manure use followed by insufficient funds (23%). Problems cited with regards to use of manure included presence of weed seeds (29%), and increased incidences pests, for example of cut worms (18%).

### Conclusions and Recommendations

Based on the information gathered, it was evident that very few smallholder farmers in Vhembe district of Limpopo province in South Africa could afford fertilizers. Agriculture supporting banks like Landbank which sup-

ports commercialization of smallholder farmers should be encouraged by the government to provide low interest rate loans to smallholder farmers, with the government providing collateral security. Farmers can all pull together their financial resources so that they can be able to buy farm inputs in bulk for purposes of getting a discount. Formation of cooperatives is also another alternative of by-passing the hindrance of financial constraints. For those farmers who afforded fertilizers, accessibility was still a problem in some instances and also the rates applied were below the recommended rates. The government needs to provide better infrastructure so that farmers in remote locations can have access to information and technology and have the ability to reach markets with their produce. Current efforts by milling companies to establish small marketing depots should be encourage so that they cater for as many farming community areas as possible. Extension services to the farmers are not easily accessed by all the farmers in Vhembe district. There is therefore need for the government to train more agricultural extension staff to cater for the majority of farmers. Given that the majority of farmers have no formal education, there is need to train the farmers on the use of fertilizers and the benefits accrued. Although a significant proportion of farmers indicated that they applied manure, they mainly relied on neighbouring farms for ma-

nure, which maybe quite far resulting in high transportation costs. As a result, it was likely that the quantity of manure applied was very low. Due to lack of proper storage facilities, the quality of manure applied was likely to be poor in terms of nutrient supply. Extension staff and farmers therefore ought to be trained on the use and application of organic manure. In summary, successful implementation of the above-mentioned policy recommendations will greatly enhance fertilizer use in Vhembe district of Limpopo province and thereby improve crop productivity and consequently the livelihoods of the smallholder farmers in the district.

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