ISSN 0301-603X

SOIL FERTILITY MANAGEMENT PRACTICES BY SMALLHOLDER FARMERS IN VHEMBE DISTRICT, LIMPOPO PROVINCE

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Keywords: Soil fertility, food production, management practices, smallholder farmers.

ABSTRACT

Inadequate soil fertility is one of the most important constraints limiting food production in Vhembe district, Limpopo province. A survey of 85 randomly sampled farmers was conducted using a standard questionnaire to identify (i) the practices that smallholder farmers use to maintain or improve soil fertility and (ii) the constraints associated with soil fertility management practices used by the farmers. An interview schedule was the main tool of data collection while descriptive statistics were the main analytical technique. Findings indicated that 46% of the farmers allowed for fallow periods, with the majority (97%) allowing for fallow period between 3 months to one year. Up to 79% of the farmers' practised crop rotation and those who don't practise rotation gave reasons which included inadequate knowledge regarding the practice and shortage of land. Only 28% of the farmers practised intercropping, indicating inadequate knowledge about the practice. 76% of the farmers incorporated crop residues back into the soil. Erosion was identified by 57% of the farmers as a problem. Among the measures used to control soil erosion are ploughing along contours (43%), maintaining vegetative cover on soil surface (19%), using stone bunds (19%), planting trees in eroded areas (9.5%) and using cover crops (9.5%).

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1. INTRODUCTION

Vhembe district is located in the far northern part of Limpopo province of the Republic of South Africa. The district consists of four municipalities which are Thulamela, Makhado, Musina and Mutale. The climate is characterized by lowveld (arid and semi-arid), with an annual rainfall of ±500mm per annum and temperature range from a minimum of 10^{o}C during winter to a maximum of 40^{o}C during summer. The rural economy is heavily reliant on agriculture and 85% of the population in this region is involved in farming (Ramaru *et al*., 2000:1). 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: 13). Farming under smallholder system is characterized by low level of production and small farm sizes of approximately 1.5 ha, with production being primarily for subsistence and little marketable surplus. The increasing pressure on the land resource due to increasing human population has also resulted in intensive continuous cultivation and a rapid depletion of plant nutrients. In addition, these drier areas often have highly degradable soils that are susceptible to soil erosion and eventual decline in soil fertility, especially under arable cultivation where soil conservation measures are absent. One of the major constraints to crop production faced by the smallholder farmers in this region is inadequate supply of nutrients due to declining soil fertility (Ramaru *et al*, 2000:1).

2. OBJECTIVES

This study is geared towards understanding the farming systems of smallholder farms with regards to their soil fertility management practices and has the following objectives:

2.1 To identify the practices that smallholder farmers use to maintain or improve soil fertility.

2.2 To identify the constraints associated with the soil fertility management practices used by the farmers.

3. PROCEDURE

A survey was conducted in all the four municipalities of Vhembe district. The target population was the smallholder farmers. A total of 85 farmers were randomly selected from different district municipalities with the assistance of the local agricultural extension staff. The number of farmers selected per municipality ranged from 20 to 21. Since the area is mainly semi-arid to arid, most farmers use irrigation to grow their crops. Consequently, all the farmers interviewed in this study were using irrigation as the main source of water for their crops. The main system of irrigation was furrow irrigation, while the main source of water was from boreholes, with a few exceptions where river water was used. An interview schedule was the main tool of data collection while descriptive statistics were the main analytical technique. Where farms are 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 (SPSS) and summarized using graphs.

4. RESULTS

4.1 Background information

About 58% of the farmers are females and approximately 42% of the farmers have no formal education. Farm sizes varied from 1 to 5 ha. The majority (88%) of the farmers had settled on their current farms and have been farming for over five years.

4.2 Smallholder farmers' soil fertility management practices

Figure 1 illustrates the various cropping practices that farmers use to promote improved soil fertility. These practices are discussed below:

4.2.1 Fallow period

Fallow period is a strategy that is used to restore the chemical and physical fertility of the soil. Forty six percent of the farmers did allow for fallow periods (Figure 1). Of those farmers who allow for fallow periods, 46% allowed for a fallow period of 3-6 months,

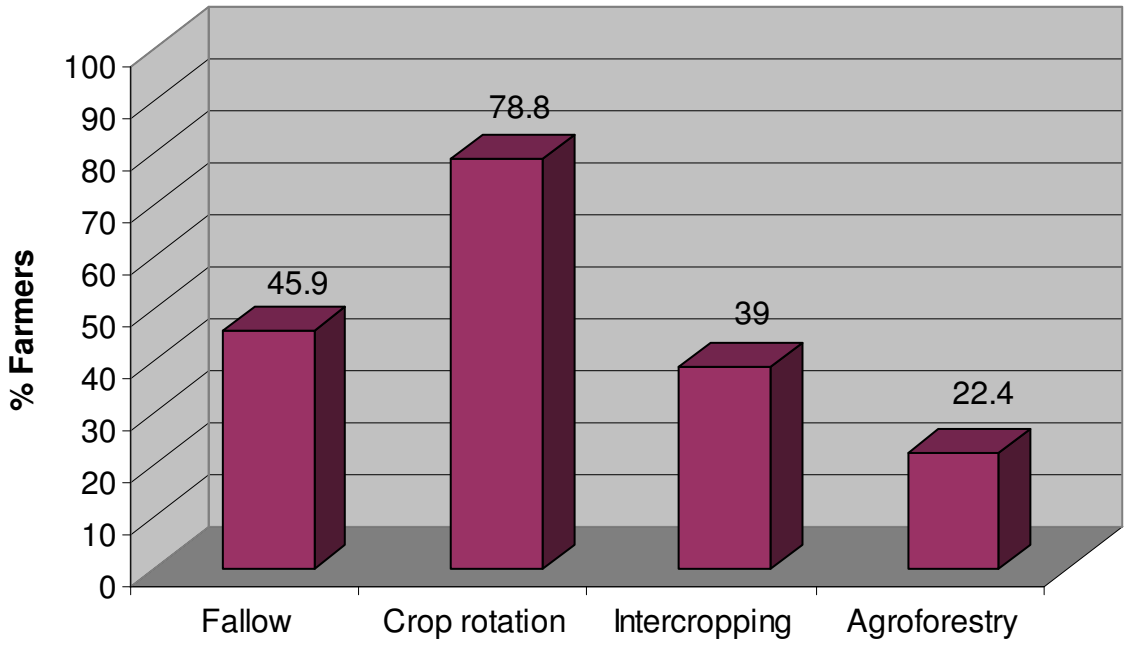

Figure 1: Cropping practices used by farmers for improving soil fertility

51% percent 6 months to one year and 3% over one year. Of those who did not allow for fallow periods, 44% mentioned shortage of land as the main reason, 48% indicated that they have never known fallow as a strategy for improving/maintaining soil fertility. The rest gave varied reasons, for example that since the main purpose of farming is to provide food for family members, they could not leave the land fallow for fear of food shortage.

4.2.2 Crop rotation

One way the farmers can avoid a decline in soil fertility is by practising crop rotation. A good crop rotation is that involving a legume and a cereal crop since the legumes add nitrogen to the soil through biological nitrogen fixation (Snapp *et al*, 1998:190). Up to 79% of the farmers interviewed practised crop rotation (Figure 1). However, individual farmers used various sequences depending on their objectives regardless of the scientifically correct and beneficial sequences. Of those who did not practise crop rotation, reasons given included inadequate knowledge regarding the practise and shortage of land.

4.2.3 Intercropping

Only 39% of the farmers indicated that they practise intercropping (Figure 1). Although intercropping was recognized as a major traditional soil management practise by the farmers, most farmers indicated that the reason for practising it was for increased food security and having a shortage of land. Considering that the primary objective of a farmer is to get improved crop yields and consequently to get food for his/her household and surplus for income to meet other family demands, farmers perceived intercropping as achieving these benefits. The fact that this area has rapid growing population explains the problem of inadequate land. As a result, reduced land sizes are susceptible to soil erosion leading to declining soil fertility which in turn leads to low crop yields. This poses risks of crop failure and as a result farmers opt for intercropping in order to reduce risks by being able to harvest a variety of crops from the same plot. This implied the farmers perceived the contribution of intercropping to increased household food security, a key aspect for a subsistence farmer. On the contrary, some farmers reported one of the disadvantages of intercropping as leading to low crop yields. This controversy may be explained by the fact that farmers use intercropping without putting into consideration other agronomic practices such as proper timing, spacing and appropriate crop combinations. Hence, knowledge of such would be important for some farmers in order not to underrate positive aspects of utilizing intercropping.

4.2.4 Agroforestry

Agroforesty was being practised by only 22% of the farmers. Among the reasons given by the farmers who don't practise agroforestry were lack of information on agroforestry, shortage of land, and competition between trees and crops for resources such as energy and water. A number of studies have shown that agroforestry can help rural farmers increase their income, mitigate land degradation, reduce loss of biodiversity and combat desertification and climate change (McDonald *et al*, 1997:23; Gardner & Mawdesley, 1997:25-29). In Jamaica, for example, agroforestry has been shown to have a positive effect on soil and water resources (McDonald *et al*, 1997:23). However, agroforestry is still not a common practice in South Africa where the woodlots (with eucalyptuses) and windbreaks (with casuarinas) are the most common

agroforestry systems. These systems are, however unsuitable to address the problem of low and declining soil fertility, shortage of fuel-wood and fodder as well as low household income that are prevalent in smallholder farming systems. Agroforestry systems suitable for the more marginal areas (such as Limpopo province) where household incomes are low should be simple with potential to exist on fairly meager resources, and to build gradually upon local initiatives, while depending on local knowledge, technology and labour. This should lead to wider integration of agroforestry systems into biodiversity conservation at household level.

4.2.5 Fertilizer and manure application

Most farmers (87%) apply fertilizer to their crops. However, only 19% indicated that they can afford the fertilizer without any constraint, and 35% applied the recommended rate. This implies that although a high percentage indicated that they apply the fertilizer to their crops, the rates applied are below the recommended rates. For those who do not apply fertilizers, the main reason given was limited financial resources. A total of 71% of the farmers indicated that they apply manure to the soil to improve soil fertility. The manure applied is mainly kraal manure and some chicken manure. The manure is readily available and majority of the farmers apply the manure before planting, with 44% applying manure when planting a new crop.

4.2.6 Crop residue management

In Figure 2, respondents indicated the management of the crop residues. Crop residues play a role in soil fertility maintenance by increasing soil organic matter (Magdoff & Van Es, 2000:64-65). Up to 76% of the farmers indicated that they incorporated crop residues back into the soil, which is the best practice for managing crop residues. However, in the dry season, animals are allowed grazing access to the cropping lands resulting in limited crop residue recycling for soil fertility improvement purposes. The advantage of grazing animals on cropping sites is that the consumed residue is returned back to the soil in the form of manure. In certain cases, crop residues may be fed to livestock outside the system and manure is seldom brought back to the field from where the residue was removed. In this survey, about 13% of the farmers indicated that they feed crop residues to livestock either by letting the

livestock graze in the field or carry the residue to feed the livestock in the homesteads. About 6% of the farmers indicated that they burn crop residues. Residue is usually burned to help control insects or diseases or to make next year's fieldwork easier (Magdoff & Van Es, 2000:67). Burning residues, however, diminishes the amount or organic matter returned to the soil and the amount of protection against raindrop. Hence the practice should not be encouraged. About 6% of the farmers indicated that they sell crop residues to other farmers mostly to feed their livestock.

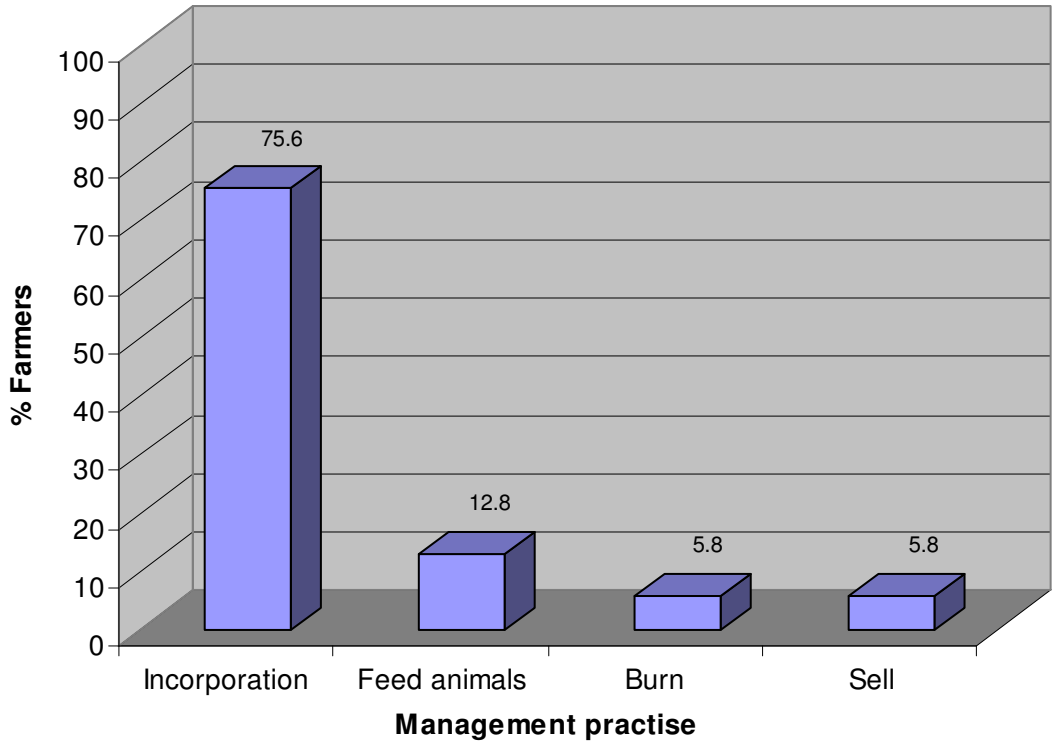

Figure 2: Crop residue management practices used by farmers

4.2.7 Soil conservation

57% of the farmers identified soil erosion as a problem. Out of these, only 43% were taking measures to control soil erosion. Among the measures the farmers used to control soil erosion were ploughing along contours (43%), maintaining vegetative cover (19%), use of stone bunds (19%), planting trees in eroded areas (9.5%) and using cover crops (9.5%).

4.3 Conclusion

The farmers in Vhembe district have to some extend adopted some good soil fertility management practises although there is reason for improvement. Allowing for fallow periods is difficult for the farmers due to shortage of land. Intercropping and agroforestry seem not to be very popular practises among the farmers possibly due to inadequate knowledge on the practises. Soil erosion is still a major problem especially in areas with steep slopes.

4.4 Recommendations

There is need for agricultural extension officers to advise farmers on (i) agronomic practises such as proper timing, spacing and appropriate crop combinations under intercropping practises so as to increase the crop yields, (ii) additional soil erosion control measures on steep slopes, for example as terracing, (iii) agroforestry practices and benefits associated with the practise and (iv) growing and use of green manure legumes as a soil cover and organic matter source. Effective advise, clear understanding of farmers' intentions and subsequent training of farmers on these practises may possibly lead to sustainable soil productivity and effective soil erosion control, in turn leading to improved crop yield and resulting in better livelihoods and food security. This process will need to be monitored to ensure its success.

ACKNOWLEDGEMENT

This study was part of a larger study funded by the National Research Foundation (NRF).The authors wish to thank the NRF for making this study possible.

REFERENCES

GARDNER, R. & MAWDESLEY, K., 1997. Soil erosion in the middle mountains of Nepal. *Agroforestry Forum*, 84:25-29.

MAGDOFF, F & VAN ES, H., 2000. *Building soils for better crops. Sustainable Agricultural Network.* Handbook Series Book 4. Sustainable Agricultural publications, University of Vermont, Burlington VT 05405-0082, USA. ISBN 1-888626-05-4.

McDONALD, M.A., STEVENS, P.A., HEALEY, J.R. & DEVI PRASAD, P.V., 1997. Maintenance of soil fertility on steeplands in the blue mountains of Jamaica: The role of contour hedgerows. *Agroforestry Forum,* 8:4:21-25.

RAMARU, J., MAMABOLO, Z. & LEKGORO, J., 2000. *Improving soil fertility management in South Africa: Learning through participatory extension approaches*. Managing Africa's Soils No.19. Russell Press, Nottingham, UK.

SNAPP, S.S., MAFONGOYA, P.L. & WADDINGTON, S., 1998. Organic matter technologies for integrated nutrient management in smallholder cropping systems of southern Africa. Agriculture, *Ecosystems and Environment*, 71:185-200.

WHITE PAPER ON AGRICULTURE, 1995. *Limpopo Province, Department of Agriculture*. Pietersburg, South Africa. ISBN 0-621-16111-x.