

Increasing small-scale farming impact

Good soil fertility management is the first step to sustainable agricultural production for smallholder farmers

Previous attempts to increase food production by small-scale farmers have mostly been the result of expanding cropping areas while causing severe environmental impacts such as soil fertility degradation, soil erosion, greenhouse gas (GHG) emissions and groundwater depletion. Despite these efforts, crop production of smallholder farmers in South Africa has remained very low.

Clearly, it cannot be “business as usual”, given that the population is growing rapidly and there is little suitable land available to expand cropping areas. Sustainable agricultural intensification is the most promising and viable approach to increasing agricultural productivity from the same area of land through more efficient use of available resources, while at the same time preventing or reducing negative environmental impacts. The Agricultural Research Council–Soil, Climate and Water (ARC-SCW) is at the forefront in conducting scientific research to support sustainable agricultural production

and the efficient use of natural resources in South Africa. Research has shown that sustainable agricultural intensification has great potential to improve food production, profitability and climate resilience of smallholder farmers. However, poor soil fertility management is one of the key challenges that limits their productivity.

Low soil fertility is mainly caused by nutrient mining as the result of continuous cultivation of soil with little or no application of either organic or chemical fertilizers. Furthermore, the situation is worsened by the use of poor agronomic practices due to a lack of knowledge on sustainable crop production that results in the depletion of soil organic matter, loss of nutrients (either to the atmosphere as GHG emissions or via water resources through leaching) and soil erosion. Low soil organic matter results in poor soil structure as well as reduced water- and nutrient-holding capacity of the soil. Limited use of fertilizers prevents resource-poor farmers from achieving sustainable agricultural productivity. Limited use of organic fertilizers or animal manure is often due to a lack of

knowledge, low livestock ownership and shortage of labour, whereas limited use of chemical fertilizers is normally due to their unaffordability as a result of low incomes and restricted access to credit facilities. Poor infrastructure and means of reliable transport further limit the accessibility of chemical fertilizers to smallholder farmers who are often located in remote areas.

In some instances, small-scale farmers have been discouraged by low crop yields and profitability despite their significant investments in fertilizers. These low yield returns are often attributed to the combination of poor soil fertility management, bad agronomic practices and climate variability. For maximum yield returns, farmers should always apply the correct amount of fertilizer at the right time and at a depth where it is accessible by the roots using an appropriate application method that will maximize the efficient use of fertilizers and minimize contamination of the environment. For example, chemical fertilizer can be applied during planting but direct seeding on such fertilizer must be avoided to prevent the burning of



Figure 1: Excessive application of animal manure causes weed infestation.



Figure 2: Do not guess how much fertilizer needs to be applied to the soil! Proper soil sampling and testing can improve crop yields whilst saving farmers money and reducing the negative environmental impacts of excessive fertilizer application

crop leaves. Research has shown that animal manure can be used as an affordable and effective supplementary or in combination with chemical fertilizers to supply the essen-

groundwater. Generally, for annual field crops, recommended application rates will range from 5 to 10 t/ha for kraal manure, 1 to 2 t/ha for sheep manure and around

For efficient use of animal manure or chemical fertilizers, it is highly recommended that application rates per specific field are based on soil test results, nutrient content of the fertilizer and the targeted crop yields (Figure 2). The local extension officer should be able to assist farmers with arrangements for soil testing and crop nutrient recommendations. Alternatively, the ARC-SCW Analytical Services laboratory in Pretoria can be contacted on 012 310 2531 for more information.

Acknowledgments

Financial support from the European Union’s H2020 Research and Innovation Programme under Grant Agreement No. 727201 is gratefully acknowledged. This work was carried out as part of the InnovAfrica project (www.innovafrika.eu) and we acknowledge our international partners from various institutions for their support. The views conveyed in this article are those of the author and do not necessarily reflect the opinions of the ARC or other partners. ■

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Sustainable agricultural intensification is the most promising and viable approach to increasing agricultural productivity from the same area of land

tial plant nutrients required if stored and handled correctly.

Given that the nutrient content of animal manure varies depending on the type and age of livestock, feed source and handling method, it is essential that the application rates are calculated based on chemical analysis of the specific manure to be used. The excessive use of animal manure could burn crops, induce weeds or pests (Figure 1), increase GHG emissions and contaminate

2 t/ha for chicken manure. Animal manure should be applied uniformly over the soil surface and incorporated into the soil through ploughing immediately after application to obtain the maximum benefit from the nutrients. This is because immediate incorporation will minimize the loss of nitrogen to the atmosphere or runoff and enhance microbial activity which decomposes the organic matter in manure, thereby releasing nutrients for plant uptake.