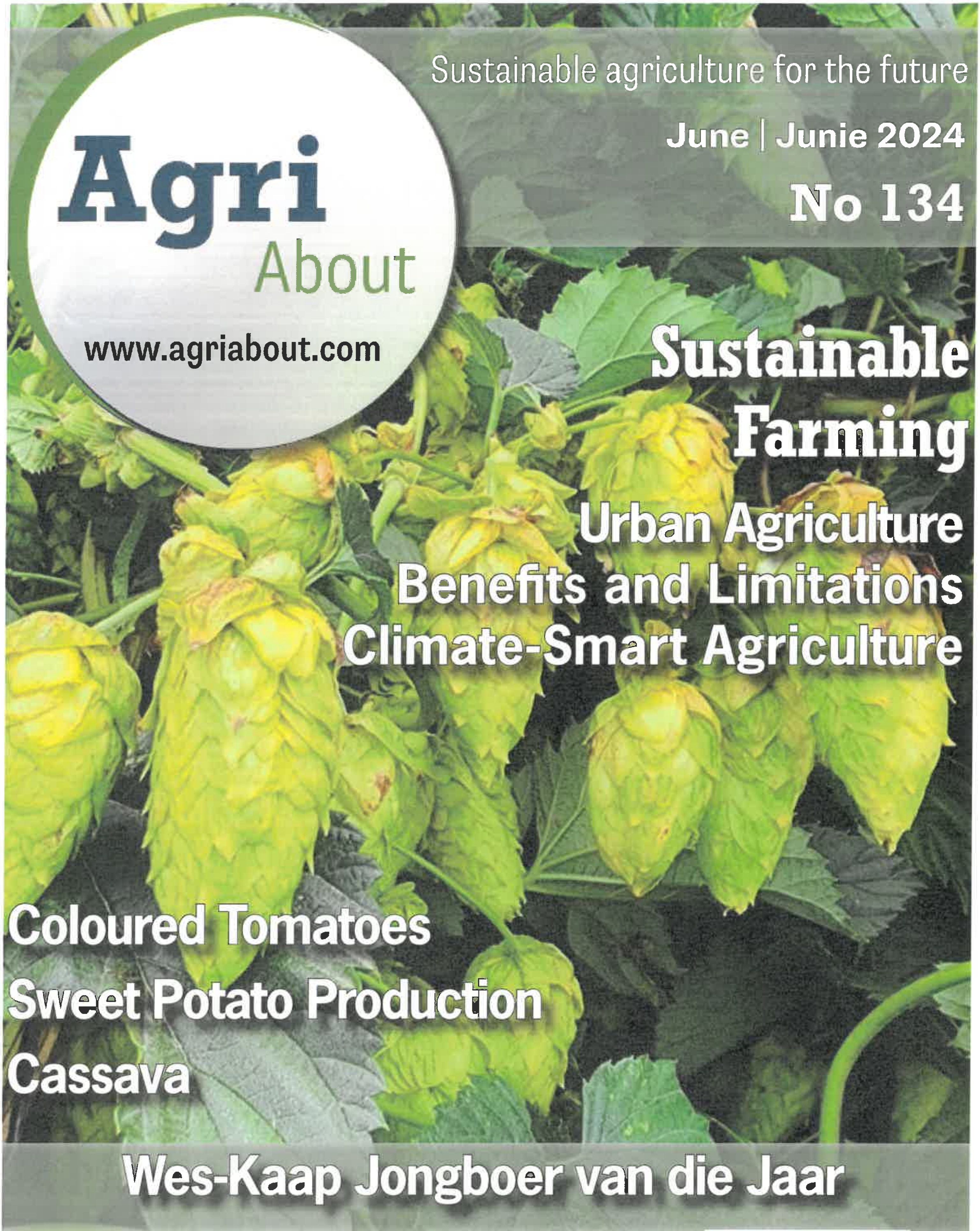

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# The benefits and limitations of sustainable farming methods for smallholders

**Mmakgabo Matlou**
**ARC-Natural Resources and Engineering**

In the rural landscapes of South Africa, agriculture forms the backbone of the economy. However, the sector faces numerous challenges such as climate change, limited access to resources, environmental degradation, and food insecurity. In recent years, there has been a growing recognition of the need for sustainable agricultural practices to ensure food security, preserve natural resources and mitigate environmental degradation. Sustainable farming holds immense potential to empower rural growth and improve the livelihoods of smallholder farmers worldwide. By prioritising environmental conservation, enhancing soil health, promoting economic viability, and fostering community empowerment, these practices offer holistic solutions to the complex challenges facing agriculture today. For smallholder farmers who often operate within resource-constrained environments, adopting sustainable farming methods can be a pathway to empowerment, ensuring long-term viability while preserving the environment.

To promote adoption of sustainable farming techniques by smallholder farmers, the Agricultural Research Council - Natural Resources and Engineering (ARC-NRE) carried out a Conservation Agriculture Technologies (CATs) project to transfer sustainable technologies in the uMsinga Local Municipality, KwaZulu-Natal Province. Inclusively in its implementation, the project engaged various stakeholders such as traditional leaders, farmers, the municipality, and the Provincial Department of Agriculture. This convergence of different partners was intended to create the change in farmer livelihoods as well as to ensure continuity and sustainability. The overall objective was to promote sustainable use and management of natural resources while enhancing food production and household income. Sustainable agricultural practices such as tower gardens, trench beds, rainwater harvesting and irrigation with greywater were implemented in the project using the demonstration approach with locally available resources. The learning emphasis was primarily on people empowerment towards ongoing processes of experimentation. These strategies hold immense promise for achieving sustainable development goals, including food security, poverty alleviation and balancing environmental stewardship, social equity, and economic viability. However, the adoption of sustainable practices tailored for smallholder farmers poses unique challenges and opportunities. This article delves into the multifaceted pros and cons associated with implementing sustainable agricultural practices by smallholder farmers in fostering rural growth and socio-economic development at uMsinga.

**Tower gardens** are raised gardens in the shape of a short and wide pillar. Vegetables are grown on the sides and on top (e.g. spinach on the sides and tomatoes on top). Figure 1 shows farmers at uMsinga Top village constructing a tower garden. Four poles and a shade-cloth maintain the shape of a tower and the inside is filled with a mixture of soil, kraal manure and wood ash which provides a medium for plant growth. Kraal manure and wood ash supply nutrients to plants, while wood ash also helps to neutralise any soap contained in greywater. When irrigating, greywater is poured into a stone core and flows towards edges of a tower where it will be absorbed by plants. Tower gardens can produce vegetables for three years using both greywater and rainwater.

The advantages of tower gardens include provision of vegetables throughout the year (i.e. improved food security), materials used to construct the garden are less expensive, low maintenance costs, and the need for less water and space. Tower gardens can be constructed in households without fences. In urban areas, they can be constructed on a balcony which has access to sunlight and air. A completed tower garden is shown in Figure 2.

Disadvantages of constructing tower gardens include limited crop variety and the use of heavy clay soil. For example, cabbages and root crops cannot be planted on the side of a shade net. Cabbage is too heavy and so will fall off before it reaches maturity, or in some cases even destroy the garden. Root crops will also destroy the garden during the harvesting process since farmers will have to put their hands into the holes made on the side of the tower garden to dig the growth medium and remove the vegetables. This exercise will damage the shade net. The use of heavy clay soils is not recommended for the mixture used in tower gardens due to low infiltration rates which might result in waterlogging.

The **trench bed** is a system of planting vegetables where plant nutrients are 'buried' below the vegetables in the ground. Beds are prepared by digging a trench of about 1 $m^3$ (i.e. 1 m long, 1 m wide and 1 m deep), although the length and width can be increased if farmers require larger trench beds. After a trench has been dug it is filled with a layer of cans (cold drink or food cans), organic waste like peels from kitchen waste, wood ash, dried grass, and leaves. Dry cow manure can also be mixed in. The trench is filled to the top with this organic mixture before a final layer of topsoil is added (Figures 3 & 4).

Advantages of trench beds are that the ingredients produce highly fertile soils with high water-holding capacity, resulting in less frequent irrigation and fertilizer application. Loss of water through runoff is minimised as the runoff is collected and stored in the trenches. Trench beds also minimise soil erosion and the risk of crop failure due to drought. However, disadvantages include waterlogging and rotting of crops if there is continuous rainfall. Construction of trench beds is labour intensive, while the use of pest- and disease-infested waste is more likely to affect crop growth. The raised beds also sag over time and as a result there will be a need to replace the ingredients.

**Figure 1. Farmers constructing a tower garden**

**Figure 2. A completed tower garden**

**Figure 3. Farmers constructing a trench bed**

**Figure 4. Planting of vegetables on a trench bed**

**Roof rainwater harvesting** was implemented at household level at uMsinga, contributing to community self-sufficiency in water resources. By collecting rainwater from the roof and storing it in water tanks, farmers were able to produce vegetables throughout the year. Roof rainwater harvesting allowed for the collection of rainwater, which would otherwise run off and be wasted. This collected water was used to irrigate vegetable crops, reducing reliance on freshwater sources. Having an alternative water source available during dry periods can improve crop resilience and reduce the risk of crop failure due to drought or water scarcity.

The disadvantages of roof rainwater harvesting include collection of runoff from houses not suitable for rainwater harvesting, the cost of infrastructure and rainfall seasonal variability. In some households the water tank was higher than the house and as a result it was difficult to install gutters on timbers or roofs to collect rainwater. Figure 5 shows a water tank which was higher than the roof of a house and a few adjustments were necessary for both the tank stand and gutter fitment. Setting up a rainwater harvesting system requires a significant initial investment in infrastructure such as collection tanks, gutters,

**Figure 5. Fitting of gutters to a roof to allow collection of rainwater**

**Figure 6. Old, corrugated iron sheets and maize meal bags used as fencing materials**

**Figure 7. Dried thorn tree branches used as fencing material**

filters, cement, and bricks. This cost can be a barrier for small-scale farmers or those with limited financial resources. However, the farmers at uMsinga were given water tanks, construction materials and gutters as an incentive for participating in the project.

Rainfall patterns vary significantly from year to year, leading to fluctuations in water availability for irrigation, so the farmers used other water sources such as **greywater** during periods of low rainfall to supplement the roof rainwater harvesting. The latter is dependent on seasonal rainfall, whereas greywater conserves water, saves costs and is available consistently throughout the year, providing a reliable water source for irrigation even during dry periods. Despite its potential benefits, using greywater for irrigation faced resistance or scepticism. For example, farmers did not want to use greywater that they had bathed with for irrigation, preferring greywater from the kitchen only. However, greywater guidelines published by the Department of Water and Sanitation prohibit the use of greywater from the kitchen for irrigation (Carden *et al*., 2018). Compliance with these regulations adds another layer of complexity to implementing greywater reuse systems. In some households, irrigation with greywater also caused soil crusting, so farmers were advised to mix greywater with wood ash.

Another challenge of adopting sustainable farming systems is lack of access to infrastructure. For example, in some households, farmers did not have fences to protect their vegetable gardens. As a result, they improvised and used old, corrugated iron sheets, containers, and branches of trees as fencing materials. Figures 6 & 7 show vegetable gardens protected using locally available materials.

Sustainable farming techniques benefited the uMsinga communities by reducing soil erosion, conserving water, and energy, preserving biodiversity, and minimising the use of harmful chemicals. They also promoted healthier ecosystems and contributed to mitigating climate change through carbon sequestration in the soil. By empowering smallholder farmers with knowledge, resources and support needed to adopt sustainable practices, the project unlocked the transformative power of sustainable farming and built more equitable and resilient agriculture for rural communities in the uMsinga Local Municipality of KZN.

**Reference:**

Carden, K.; Fisher-Jeffes, L.; Young, C.; Barnes, J. and Winter, K. 2018. Guidelines for greywater use and management in South Africa: A report to the Water Research Commission. WRC Report No. TT 746/17. Pretoria, South Africa.

***For more information contact:***
*Ms Mmakgabo Matlou*
*ARC-Natural Resources and Engineering*
*E-mail: mmakgabom@arc.agric.za*