



## Project tests mechanised SOIL MOISTURE CONSERVATION techniques in heavy clay soils

*Lack of adequate water poses a major constraint in increasing agricultural production in semi-arid areas in South Africa. However, the use of appropriate crop production techniques, especially those that conserve soil and water, could assist greatly in this regard.*

*Article by LF Joseph and JJ Botha.*

**L**ike many other semi-arid areas in the world, South Africa's food production is limited by its scarce water resources. Irrigated agriculture is the biggest consumer of water in the country.

There are various soil and water conservation techniques currently being practiced in the semi-arid areas of South Africa, mainly in homestead gardens. For example, successful application and adoption of techniques such as in-field rainwater harvesting has been reported in homestead gardens in Thaba Nchu in the Free State (more than 1 000 households) and around Alice in the Eastern Cape (more than 260 households). The challenge now is to mechanise some of these soil and water conservation techniques and extend their application to the croplands.

To this end the Water Research Commission is funding a research project entitled 'Rainwater harvesting and conservation for rangeland and cropland productivity in communal areas in selected provinces in the semi-arid area of South Africa'. One of the main objectives of this project is to perform on-station and on-farm research and testing/applying appropriate rainwater harvesting and conservation techniques and practices specifically for rangelands and croplands.

The Agricultural Research Council's Institute for Soil, Climate and Water (ARC-ISCW) is currently conducting the project at the Glen

Agricultural Institute as well as four rural communities in the Free State. Research is also being undertaken by the institute in Limpopo (Towoomba Research Station and Lambani community) and the Eastern Cape (Fort Cox Agriculture & Forestry College and Kwara Kwara community).

This article deals with the implementation of three mechanised soil and water conservation techniques, i.e. mechanised basin, daling plough and in-field rainwater harvesting, on heavy clay soil at the Towoomba research station in Limpopo.

## IMPLEMENTATION OF MECHANISED SOIL WATER CONSERVATION TECHNIQUES

The mechanised basin (MB) plough was originally developed for the purpose of veld rehabilitation. The implement creates basins for the collection of rainwater. The plough has a basin attachment which pivots on the rear of a three-point hitched ripper. The scraper at the rear of the attachment creates the basins.

The ripper tine operates directly in front of the attachment to break up compacted soil. Downward movement of the attachment is limited by a chain, thus enabling the tractor to lift the whole machine clear of the ground. When the ripper tine is engaged, the shaped control wheel controls the movement of the scraper blade, resulting in a row of basins being created.

In turn, the Daling plough was developed by a Mr Daling from Settlers in Limpopo. It works on the contour and creates two one-metre runoff areas with a basin in the middle. By making the runoff area shorter the farmer is now able to collect water event from the smaller rainfall events with little runoff. A chisel plough is connected directly to the transmission shaft of the tractor. The basin plough then follows directly behind the chisel plough. The chisel plough first loosens and turns the soil before the basins are constructed.

In-field rainwater harvesting consists of a no-till 2,4 m strip sloping towards a metre-wide basin area. The no-till strip is used to induce runoff by using the natural slope of the land and crusting characteristics of the soil. Runoff water is collected in the basins, the first phase is done by using a contour plough which creates 20-cm high contour ridges while the second phase of basin creation is done with a basin plough which creates a 10-cm deep and metre wide basin every 1,5 m.

**The biggest challenge of utilising these implements in heavy clay soil is to implement the treatments at the 'correct' soil moisture content. If the soil is too wet or dry the treatment cannot be implemented.**

During 2008/09 these treatments were implemented by using the three implements described above. It was found that it was practical to plant and control weeds using a boom sprayer. Planting (0,9 m row width) was done on the basin area where rainwater is collected.

The biggest challenge of utilising these implements in heavy clay soil is to implement the treatments at the 'correct' soil moisture content. If the soil is too wet or dry the treatment cannot be implemented. Every drop of rainwater is needed so that the rainwater harvested infiltrates the soil beyond the evaporation zone, but by delaying the implementation of treatments until the soil is at the correct moisture content, the rainwater that is supposed to be harvested can be lost through runoff.

Heavy clay soils are also known for their high physical activity – shrinking and swelling upon drying and wetting. It was observed in the 2008/09 seasons that by the end of the growing season, the ridges on all three catchments had disintegrated

due to high physical activity of the soil. To avoid this, maintenance of these treatments is needed during the growing season; however, this is currently impossible. Therefore, the implements should be modified so that it is possible to maintain ridges during the growing season when the farmer is still able to drive into the crop fields with a tractor.

## RESULTS

The results from the 2008/09 growing season indicate that, on average, mechanised soil and water conservation techniques increased grain yield by 18% and 5% for sunflower and maize respectively, compared to conventional tillage.

## RECOMMENDATIONS

It is recommended that the implementation of these treatments be done three times, i.e. during the fallow period, a few days before planting, and during the growing season. Implementation during the fallow period will ensure collection of rainwater which will increase pre-plant soil water content. □

*Implementation of in-field rainwater harvesting treatment.*



Courtesy Frans Joseph