

Water and agriculture

Conservation agriculture: Farming for the future



Conservation agriculture is proving well worth South African farmers' investment.

Article by Petro Kotzé.



Traditionally, a farmland is a neat block of upturned soil, divided into clean rows devoid of any vegetation, ready to be sowed with seeds. Though pleasing to behold, the consequences have not always been as pretty. "According to research, we are losing about three tons of topsoil per hectare each year per ton of maize that we produce," says Dr Johann Straus from the Research and Technology Development Services of the Western Cape's Department of Agriculture. A specialist in sustainable cropping systems and conservation agriculture, Dr Strauss is one of a growing group of researchers and farmers calling for more sustainable farming methods.

Zero tillage conservation agriculture

"Conservation agriculture is an alternative way of doing; it entails breaking away from the old way of breaking down earth to plough," explains Dr Strauss. He adds that if he has to sum it up, he would describe it as a sustainable farming method. Yet, perhaps more importantly if conservation agriculture is to become successful: "It is a mind shift."

Conservation agriculture is based on the three principles of minimum soil disturbance, maximum cover and crop diversification. Most available literature would include at least these key elements when discussing conservation agriculture, otherwise known as ZT/CA. The soil is not cultivated, crops are rotated over the years and crop residues are left on the surface.

Because the soil is thus left undisturbed and permanently covered, "conservation agriculture doesn't always look as pretty as conventional agriculture," explains Dr Strauss. Furthermore, no burning takes place and seeding is done directly into previously untilled soil, with specialised seeding equipment designed to plant seeds into undisturbed crop residue and soil.

This calls for an almost complete opposite approach to agriculture when compared to conventional methods. "Seeing as we're trying to not disturb the soil at all, we do not plough anymore," notes Dr Strauss.

The benefits are plentiful. Conservation agriculture allows the soil to recover from degradation that would have taken place due to traditional practices, and increases organic matter in the soil, and biology as a whole. Because the soil is not cultivated with heavy machinery, soil compaction is reduced, which leaves the old root holes to facilitate internal drainage.

The pulverisation of soil aggregates and formation of pans is averted, draft power for planting is reduced and fauna is provided with shelter, winter food and nesting sites. Crop residues on the surface practically eliminate wind and water erosion, reduce soil moisture loss through the mulch effect, and act as a reserve of organically-compounded nutrients as they decompose to humus.

In a nutshell, if you want to improve the health of your soil, move away from tilling, manage nourishment and pest control with deeper insight work, improve on biodiversity through cultivating more crops and even cover crops in a rotational system, keep soil cover as optimal as possible and pick the fruit of better returns and lower input costs.

The technique has gained traction internationally, particularly in Brazil, one of the first countries to apply it. As is often the case, the movement towards more sustainable and profitable agricultural practices here were driven by necessity. Their entire agricultural industry was threatened by the devastating effects of soil erosion, fuelled by torrential rainstorms common to the southern region. After many unsuccessful attempts, they

focused on erosion control through continued cover of the soil. Soil conservation became central to their sustainable farming activities, the central pillar of which is zero tillage.

The movement was spearheaded by farmer Herbert Bartz in southern Brazil, who adopted ZT/CA farming in 1972. Ten years later, efforts to expand cultivation into the very difficult production region of the Cerrados, in Brazil's centre-western savannah (Cerrado biome) were initiated by farmers, researchers, crop consultants and the agro-industry.

Pioneering work was done here by agronomist John Landers. Bartz and Landers are now both widely recognised as forerunners of the movement and key to achieving social, economic and environmental sustainability through ZT/CA. Their work contributed to the reversal of the historically accelerating degradation of soil organic matter and soil structure by abandoning conventional tillage. Adoption of the ZT/CA philosophy and technologies is currently practiced on more than 50% of the annual crop area in Brazil.

In South Africa, the movement started about 35 years ago, though it is still applied in relatively few numbers. For some crops, like rooibos, it's still very much in the beginning phases. For others, like wheat, which is one of the first crops where conservation agriculture was applied and experimented with, the impact has already been astounding.



One of the features of conservation farming is the alternation of crops.

Conservation agriculture in South Africa

In 2013, the Directorate Plant Sciences conducted a survey to assess the adoption and impact of conservation agriculture among wheat producers in the Western Cape. The data was analysed by the Economic Analysis Unit of the Agricultural Research Council (ARC). The information obtained from the survey, along with data from long-term crop rotation trials at Langgewens and Tygerhoek research farms were then processed by the ARC.

At the time of the survey, 166 000 ha of wheat was grown using conservation agriculture methods. The financial benefit to the province from these methods was determined at R341 million since the introduction of conservation agriculture, though that was thought to be very conservative figure.

Farmers (84%) reported an increase in total production, while 94% indicated that total income per ha has increased. It was found to be 16,5% more expensive to fertilise using conventional methods than with conservation agriculture. The average cost to produce three tons of wheat using conventional methods was R4 444/ha, compared to the R2 387/ha using conservation agriculture.

As a result of the application of conservation agriculture, the Western Cape is currently producing nearly double the amount of wheat on less than half of the area previously planted with wheat. Results from the Langgewens long-term crop rotation trial speaks directly to the increase of wheat production within crop rotation systems.

It's tough to argue with the benefits, which is perhaps why the use of conservation agriculture methods among wheat producers in the Western Cape has increased from 5% in 2000 to 60% in 2010, and the idea is slowly taking root more widely, including more types of crops.

"We were approached by rooibos farmers in 2003 for assistance," says Deon Heydenrych, also from the Western Cape Department of Agriculture's Sustainable Resource Management branch. Farmers were reporting that while their parents were able to get

five to seven harvests per plant, they were getting less and less, and often only managed four harvests per plant.

Traditionally, rooibos fields were ploughed, and the residue burnt before the plot is left to sterilise in the sun for two years. After those two years during which wind and rain removed a lot of good topsoil the rooibos is planted and during its lifetime weeding is done by ploughing between rows. In most soils continuous ploughing over time creates a plough-pan at the depth of the bottom of the plough disc that hinder water and roots to enter deeper into the soil. Where conservation farming is applied to an old land, the land is first inspected to see if a plough-pan is present. If so a deep tine is used to break it. Soil samples is taken and chemical corrections applied if necessary. Then the whole land is planted with oats by the use of a conservation farming planter. At planting of the rooibos, narrow rows are cleared were the rooibos is to be planted between the oats in double rows like train tracks with an open space before the next two rows are planted. This open space, wide enough for a tractor to drive down is used to build up the soil with cover crops. When the current tea comes to the end of its lifetime, the new rooibos will be planted down this open space and were the old tea was flattened with a knife-roller the build-up of soil with cover crops are starting again.

Where conservation agriculture is applied, the plot only lies for one year between rooibos crops instead of the traditional two and the soil is covered instead of being ploughed/burnt clean and left in the elements. Rooibos is planted in the two 'train track' rows with a broader lane in between planted with cover crops. The first two years this will be natural cover, while years three and four is usually lupine. This is then followed with oats again.

During weed control in the conservation farming rooibos lands a boom sprayer is not used anymore to spray the whole land like in the past with traditional rooibos plantations. A knife-roller is used to break the food channels and flatten grassy weeds and broadleaf weeds are spot sprayed with a rucksack sprayer or handgun sprayers connected to a spray tank pulled by a tractor.



Butch talks about conservation agriculture.



Producers, trade and researchers discuss conservation agriculture.



One of the joys of conservation agriculture is seeing life, like earthworms, return to the soil.

According to Heydenrych their results have been very positive, particularly in terms of the biodiversity that quickly increased. "Things that were not previously there, returned," he says. Earthworms were suddenly found in the soil again, and couch grass and gerbils returned. A solution for the latter was made by erecting poles to attract birds of prey to the fields to catch the gerbils.

"Sometimes dune mole-rats give us problems. Then you have to think about how to control them without hurting mole snakes." The biggest change, is changing the way that you think, he says. The producer now has to think innovatively about solutions to problems that will still keep the soil as healthy as possible.

Heydenrych says a challenge that they are currently dealing with is weeds that also returned to the fields. "We are looking at chemical and mechanical control, though the latter is not ideal as the goal is to not disturb the soil." They are also looking at using different cover crops, efforts which are hampered by the previous year's below average rainfall coupled with very hot temperatures. "It's still completely a story in development," he says, "but we simply have to make it work."

Though there has not yet been higher yield from the rooibos plots where conservation agriculture is applied, certain costs have declined significantly. "According to Heydenrych, there has been a 50% reduction off fuel cost alone.

This is echoed by Dr Strauss, who says: "There are growing pains, but you have to stick it out. The biggest hurdle is the cost of the machinery. It takes about five years to get the system going and start reaping the benefits, but making the mind-shift is the most difficult."

Surging ahead

"We believe it has to be the accepted method of farming in South Africa," maintains Dr Strauss. Though policies are in the process of being developed, he says that there are still challenges. "We do have the support from the industry, but we need to help them to make the transition." He adds that discounts can perhaps be implemented to help producers carry that financial cost of making the transition, until they see the financial benefits.

More plans include expanding on the cash crops currently produced under conservation agriculture. At the moment, these are mainly canola, grain and legumes. "We'd like to see more diversity of cash crops as well as cover crops. Furthermore, as soon as our cover crops take off, it can be applied as a management resource."

Research is also focusing on developing more low-input agriculture, trials of which are set to start this year. "Though we are spraying considerably less than usual, we are still depending on insecticides. The next step would be to move away from it completely, and we'd like to fine-tune that system," says Dr Strauss.

Heydenrych says he has received phone calls from farmers who say that they do not agree with the new methods, but that they have no other choice. "For me, it became clear very early on that it is about more than merely the implementation. It is about the entire biodiversity, including insect, organism, owls and so forth."

"We cannot afford to lose more of our topsoil," says Dr Strauss. "We have to realise that the old ways of doing things are over."