

The impact of conservation agriculture on wheat production in the Western Cape

Compiled by ARC Economic & Biometrical Services for the ARC Small Grain Institute and Western Cape Department of Agriculture



The introduction of conservation agriculture (CA) to Western Cape wheat farmers has increased production and profit, reduced soil erosion and improved water quality and soil health.

South Africa currently imports about half of its wheat, making innovation essential to encourage an increase in domestic production.

Commercial wheat farmers in the Western Cape traditionally planted wheat using a monoculture system, but the ARC and the provincial agriculture department encouraged adoption of CA, which involves minimum soil disturbance, maximum soil cover and crop rotation.

The ARC has shown it is significantly cheaper to produce wheat with CA than with conventional farming techniques. CA also reduces risk and is recognised as best practice in farming. It is versatile and not limited to specific types of farm or farmer.

Although some costs increase as specialised equipment is required, the adoption of CA led to increased overall income for farmers, as well as reduced labour and fertilizer costs.

The increase in productivity was directly related to soil health, characterized by increased soil moisture, decreased temperature, increased micro-organisms and decreased compaction.

In the 2009/10 production year, it cost 46.3% more to produce wheat using conventional farming methods than with CA.

The lowest gross margins in wheat agriculture were recorded for monoculture farming, and the highest margins where wheat was rotated with crops such as clover, lupin, medic plant and canola.

A tough decision that paid off

Changing over to conservation agriculture was a tough decision for MD Joubert 25, who has 1400 hectares of workable land on the Malmesbury farm near Galesburg in the Western Cape. The biggest challenge was the initial cost, but "we should have done it much earlier as it was a simple process."

Joubert says his average yield is now higher and the farm conserves more water. He says the CA method

gives farmers scope to manage risks, because farmers are not so dependent on rain.

"I was taught from a young age that conservation is important, and this is what I want to do. With conservation agriculture, you have to build up the quality of the soil. Once you do that, better crops come during winter and water is conserved better. I strongly believe that I'm on the right road."

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Conservation agriculture

Soil conservation has an important role in agricultural productivity. Conservation agriculture combines the best modern and traditional practices to manage soil, water and agriculture. It has three main features - minimum soil disturbance, maximum soil cover and crop rotation - and they can be applied individually or together.

- Minimum soil disturbance** means ploughing less. Instead of conventional ploughing, which pulverizes the soil and degrades its structure, in CA the seed and fertilizer are sowed directly in the stubble of the previous crop. An implement with steel teeth or blades makes a furrow in the soil, into which the seed and fertilizer is placed, and the furrow closes upon itself after the tooth has moved on.
- Maximum soil cover** includes retention of plant stubble, which prevents soil erosion by wind and water. It also lowers soil temperature, preventing the destruction of bio-organisms. The stubble limits evaporation of moisture, which stimulates the degradation of organic material in the soil and has an enriching effect.
- Crop rotation** refers to the alternate cultivation of different crops on the same land, giving the soil an opportunity to recover.



CA leads to record yield for Pikeberg farmer

Abri Richter, 40, has 1060ha of workable land near Pikeberg in the Western Cape and has had a very positive experience with conservation agriculture. His record four tonne wheat crop yield in 2013 is twice as much as other farmers in his area. Richter says he finally feels like he's in line with what the global agricultural community is doing. "With something like this, it becomes very clear what is wrong and what is right."

Richter says it's in his genes to do everything with conservation in mind. But while conservation agriculture is easy to get right, it's not easy to get right the first time. Crops had to be taken out of production, and in the beginning there were a lot of expenses. But that didn't put Richter off.

"I wasn't reluctant. My love for innovation in mechanics and progress in soil management drove my decision. My neighbours did very well using these methods, and I wanted to get on par with them. When farmers around us using traditional methods didn't do as well, the evidence was on the other side of the fence."

According to Richter, it's all about water conservation. The CA methods have completely changed his crop yields, and the drive to innovate never stops.

"Even now there's a constant drive to do better, to farm better and to get higher yields for the lowest chemical input. Progress has to keep going."

Impact of conservation agriculture

In a 2013 ARC impact study of Western Cape wheat farmers who adopted CA technology, 84% reported an increase in total wheat production and 93% said they had increased total income per hectare. 81% of farmers said CA was easy to apply and 98% said uptake of CA was growing. 70% of farmers reported a decrease in labour costs.

The study involved a survey of 51 farmers, combined with data from GrainSA and experimental farms.

To produce a yield of three tons per hectare (t/ha) using conventional methods cost R4 444/ha in 2009/10 compared to R2 387 for conservation agriculture, making CA R2 057 cheaper per hectare. Data from GrainSA showed in 2009/10 that 46 times more herbicide was required with conventional farming than with CA.

Wheat farmers primarily adopted CA technology to offset production costs and to remain profitable. The use of CA in the Western Cape's grain production areas has escalated from less than 5% in 2000 to about 60% in 2010.

The adoption of CA technology made a significant difference to farmers' profits. In the 2005/06 production year, wheat farmers using

CA yielded R4 041 more per hectare than those in the same area producing by conventional methods.

In the 2009/10 season, average wheat yield was 3.44 tonnes per hectare (t/ha) using CA on the Langwagters experimental farm near Malmesbury, and compared to local yields on conventional farming of 2.67 t/ha. This significant benefit of CA was demonstrated in the Malmesbury area each year from 2005-2010.

Paybacks on new equipment

"Farmers not using conservation agriculture yet need to do so as quickly as possible," says Fanie Joubert, who works the Tillyk, Brakrivier and Dossiekk farms near George.

Joubert began using conservation agriculture in 1998, and really got going in 2001 when he bought the first of a special range of planters from a friend. Since then he's been more and more successful. "You can't expect miracles during your first year or two. When you start, the implements and other costs are high, and then that's all you see. But, if you sell traditional equipment and add the money you save during the first

year on smaller fuel bills, fertilizer bills and seed bills, then you've made back your payments on the new equipment."

The costs savings in fuel bills are remarkable, says Joubert. Big planters now use around 6 litres of fuel per hectare, compared to 40 l/ha previously. Joubert warns that a mental shift is required to adopt CA. "That's the biggest issue. You've got to get your head right, and then just go for it. If someone has doubts, send them to the farmers that they are using these methods for two decades, so that they can see the difference in the soil for themselves."

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Impact in numbers

166 000 hectares of wheat grown using CA in the Western Cape

R341 million benefit from introduction of CA



It is 16.5% more expensive to fertilise using conventional methods than with CA



81% of farmers said CA was easy to apply



98% of farmers said uptake of CA was growing



2 000: Use of CA up from 5% in 2000 to 60% in 2010

64% of farmers had recently bought specialised equipment to reduce tillage



46 times more herbicide is required with conventional farming than with CA



84% of farmers reported an increase in total production



94% of farmers reported an increase in total income per hectare



70% of farmers reported a decrease in labour costs



63% of farmers reported an increase in equipment costs



R4444/ha to produce a yield of 3 tons using conventional methods



R2387/ha to produce a yield of 3 tons using CA



Rapid adoption of CA

Conservation agriculture was adopted at a spectacular rate following its introduction to Western Cape wheat farmers by the ARC and the Western Cape provincial department of agriculture. The adoption was assisted by the ARC's development of local no-till planters which can cope with the region's stony soils.

Other new technologies included the introduction of pre-plant herbicides to control herbicide resistant ryegrass. Most of these technologies originated in Australia and the ARC adapted them for local use.

The ARC liaised with Department officials who managed the CA experimental farms and directly with wheat producers using CA, providing farming advice including seedling densities, row width and fertilizer placement under CA conditions.



Wheat in South Africa

Wheat is by far the biggest winter cereal crop in South Africa. The three main wheat producing provinces are the Western Cape [winter rainfall], Free State [summer rainfall] and the Northern Cape [irrigation].

Low wheat prices, high input costs, unfavorable weather conditions, and the liberalization of the market in 1997 were followed by a dramatic decrease in production. SA's domestic requirements are not currently met and the country has to import half of its wheat.

In 2013, for example, production was 1 915 tonnes compared to consumption of 3 032 tonnes. Projections indicate production of 2 035 tonnes in 2016 against consumption of 3 266 tonnes.

A good return on research

The ARC's role in introducing CA to Western Cape wheat farmers was a high-value investment with huge returns. ARC research costs were R380 000 in 2009/10 and produced a net financial benefit of more than R2 000 per hectare. There are roughly 166 000 hectares of wheat grown using CA in the Western Cape, giving the introduction of CA an impact of around R341 million.



At the forefront of wheat research

Continued improvement in yields is needed if wheat production is to remain significant in South Africa.

The country's producers are better to improve yields through use of better seed varieties and the application of innovative systems such as conservation agriculture.

The ARC-Small Grain Institute has traditionally been at the forefront of wheat research, leading to development of new wheat varieties to improve yield, pest resistance and grain quality.

Yield increased by 22% during the 1970s, by 19% in the decade to 1990, and by 11% from 2000 to 2008.

This can mostly be attributed to improved breeding and better management as farmers introduced moisture conservation in dry land production areas, and moved from flood irrigation to pivot irrigation.

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