

# PROSPECTS FOR ADOPTION OF THE CONSERVATION AGRICULTURE (CA) SYSTEM BY SEMI-COMMERCIAL GRAIN FARMERS IN SOUTH AFRICA

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## ABSTRACT

Unless a strong attempt is made to provide meaningful support to farmers, there is good reason to expect that the rate of adoption of CA technologies and practices by semi-commercial farmers will be slow. During three focus group interviews a selected group of farmers took the opportunity to express their views on CA as an alternative to the conventional approach. Although farmers indicated that they are aware of the advantages of CA they tend to focus more on the obstacles and challenges ahead. A significant paradigm shift will be required for these farmers to change from their traditional farming methods to accept the new principles of CA. A significant shift towards CA will necessitate intervention at two levels; firstly, the tangible involvement of agri-businesses and secondly, the on-farm evaluation of CA in close participation with farmers. Only by demonstrating the technologies and the resulting practical experience of the shortcomings and advantages of the system, CA may become an attractive option to semi-commercial farmers in South Africa.

## 1. INTRODUCTION

To the vast majority of semi-commercial farmers, a sub-group of farmers in the developing sector of South Africa, CA is yet a very new concept. This applies specifically to a large number of maize farmers of the Mpumalanga, Limpopo and North West provinces. In these areas farmers apply conventional production methods with maize as a single crop and their soil tillage practices completely based on mouldboard ploughing. On many of these farming units livestock forms an integral part of the farming system.

In contrast to the conventional approach, CA is an integrated system whereby traditional soil preparation methods, such as mouldboard ploughing, are replaced by a significant decrease in soil disturbance. In some cases land preparation is completely replaced by no-tillage and crops being planted by adapted planting equipment. CA also includes the establishment and maintenance of an organic soil cover in the form of a mulch or cover crop. Finally, when crop diversification and rotations, as opposed to mono-cropping, are also introduced into the system, the three principles of CA are met and the greatest benefits can be achieved (Calegari and Ashburner, 2005:1).

There are some who claim widespread adoption of CA methods in some areas of South Africa. At the same time others call in question whether these claims are prove of a significant and sustainable change in agricultural practice or if it is merely a temporary stage in adoption due to the change agent's campaign to promote CA (Giller *et al.*, 2009:7)? At this early stage in the development of CA in many parts of South Africa, the question is valid since there are many obstacles in the way of adopting such a complex innovation. This applies particularly to semi-commercial farmers who are facing many challenges in a harsh agricultural environment.

In a current project of the ARC-Grain Crops Institute the goal is to revitalise the cropping systems of selected farming communities in Mpumalanga and Limpopo through CA. In this Maize Trust funded project valuable experience is gained in on-farm experimentation with various CA practices. This paper highlights the value of the project since a platform has been created to interact with participating farmers with the aim to identify the shortcomings as well as the strengths of the CA approach. The paper also reveals the results of interviews with three selected farmer groups with the aim to determine their opinions on the concept of CA.

## 2. DEFINING THE TARGET GROUP: SEMI -COMMERCIAL GRAIN FARMERS

In this paper, semi-commercial farmers are seen as a sub-group of the developing agricultural sector in South Africa. In his typology of farmers at Sheila, a grain production area in the North West Province, Verschoor (2002:159-162) identified four farmer types or categories. The following is a very short exposition of three of the categories in his comprehensive typology: He describes semi-commercial farmers as those with an average of 125 hectare of land available and owning two tractors. A second group called “sharecroppers” have an average of 40 hectares available. Two thirds of this category has their own tractors while others use hired mechanization. The third type is named “opportunists”. This category has between 10 and 30 hectares available and less than one in ten farmers have a tractor.

In order to target a wider spectrum of farmer categories, the three types described by Verschoor were combined for the purpose of this investigation.

The following criteria, to define semi-commercial farmers, apply:

- Have access to 10 and more hectare of land
- Evidence of grain produced for commercial sales
- Own one or more tractors or have access to reliable tractor hire services
- Farm independently or aspires to develop into independent producers

Note: Well organised farmer groups may also collectively advance to develop into semi-commercial production units.

## 3. METHODOLOGY

In a farmer first approach the main purpose of the investigation was to create an opportunity for semi-commercial farmers to express themselves in terms of their own understanding, opinions and perceptions of CA. Two on-farm experimental plots, respectively at Nokaneng in the JS Maroka Municipality (Mpumalanga) and Tafelkop in the Elias Motswaledi Municipality (Limpopo) served to expose the farmers to the CA system compared to conventional methods. The process started with visits to experimental plots where farmers could observe demonstrations and trials on various practices such as no-till, direct planting and crop rotation. In this way a platform was created to facilitate a process of interaction and communication between farmers, researchers and extension agents.

Following the in-field observations, a qualitative research method known as focus group interviews was used to obtain the farmers’ opinions on CA as opposed to the conventional approach. A focus group interview is used when a specific topic is discussed by a selected group. It is particularly useful when there are differences of opinion and a debate can be stimulated. During the interview participants discuss ideas, issues, insights and experiences among themselves under the guidance of a facilitator (Mettrick, 1993:144).

Three interviews were conducted; one at Nokaneng, a second at Tafelkop and a third interview at Goedgevonden in the North West province. Although no on-farm trials were planted for observation at Goedgevonden, a visual presentation on certain aspects of CA was used to engage farmers in a pre-interview discussion. Based on the abovementioned criteria for semi-commercial farmers, selected individuals were invited to participate in the interview conducted in their respective areas.

## 4. RESULTS AND DISCUSSION

During the interviews farmers were guided to compare the conventional approach with CA and then to give their perspectives on the advantages and challenges of CA. They were also requested to make suggestions and recommendations as to how CA as an alternative system should be approached in future. Special attention was given to the following components of CA:

- Mechanization and appropriate equipment
- Effective weed control practices
- Management of a soil cover in the form of a mulch
- Legume crops in a crop rotation system

The information captured in Tables 1 and 2 is the combined responses obtained at the three focus group interviews held respectively at Nokaneng with 14 farmers, Tafelkop with 13 farmers and Goedgevonden with 16 farmer participants, thus adding up to a total of 43 respondents.

#### 4.1 Perceived Advantages of CA

In the first part of the interview farmers were encouraged to, according to them, list the advantages of CA as an alternative system.

(See Table 1 below)

**Table 1: Farmers' perceived advantages of CA as compared to the conventional system (N = 43).**

Advantage of CA	Reason
<ul style="list-style-type: none"> <li>• CA can help to prevent soil erosion</li> <li>• It can help with moisture conservation</li> <li>• CA can contribute to savings on mechanization costs:</li> <li>• CA can prevent compaction of sandy soils</li> <li>• Labour costs will be saved</li> <li>• CA will improve soil health</li> <li>• CA will help to improve soil fertility</li> <li>• Time will be saved</li> <li>• The availability of Roundup Ready varieties</li> </ul>	<ul style="list-style-type: none"> <li>• Soil less disturbed and covered</li> <li>• By means of a mulch on an undisturbed soil surface</li> <li>• Less wear and tear of tractors and implements will occur &amp;</li> <li>• decreased consumption of diesel as less traction power is required</li> <li>• Sandy soils are more easily compacted by the mouldboard plough</li> <li>• Less manual weeding will be necessary</li> <li>• Because of improved living conditions for beneficial micro-organisms</li> <li>• Due to N fixation by legume crops in a crop rotation system</li> <li>• Because the need for mechanization (ploughing) and hand weeding activities is lower</li> <li>• Can help to control weeds more effectively</li> </ul>

It appears as if farmers have already reached a level of awareness about certain advantages of CA. It is encouraging that they were able to identify advantages not only with economic but also with agronomic as well as resource conservation implications.

At this point the following issues necessitate more clarification:

- It is important to mention that chemical weed control was significantly emphasised both at the demonstration plots and in discussions which preceded the focus group interviews. This resulted specifically in the identification of time and labour cost savings as labour costs, even in rural South Africa has increased substantially in recent years. The implication however is that farmers will first need to obtain the necessary skills to use and apply herbicides correctly in order to reap the benefits of chemical weed control as a crucial component to ensure the successful implementation of a CA system.
- At the Nokaneng experimental plot, farmers were also exposed to Roundup Ready maize cultivars and the implication of these cultivars for effective weed control. Although the relative high cost of the seed was emphasised, farmers at the interview indicated that they were optimistic about the potential benefits of this genetically manipulated (GMO) group of cultivars.

- Farmers at Nokaneng and Tafelkop particularly are aware of the advantages of grain legume crops such as groundnut (*Arachis hypogaea L.*) and cowpea (*Vigna unguiculata (L.) Walp.*) in a rotation system with maize. Various on-farm grain legume experiments were conducted at these localities since 2004. Farmers, however, remain reluctant to expand in growing these crops probably due to poor access to seed suppliers. In the case of cowpea the lack of a reliable market for the grain also hampers expansion. In a CA context, the advantages of multipurpose varieties should be exploited more (Giller *et al.*, 2009:7). New cowpea varieties have been developed that produce prolific biomass that can be used as fodder or to enhance soil fertility and yet give good yields of grain.

## 4.2 Challenges of CA Identified by Farmers

In the second part of the interview farmers were requested to mention the challenges and obstacles which they see will restrict or even prevent them from adopting the CA system. Table 2 gives a clear indication of the farmer's opinions on this.

**Table 2: Challenges of CA as a production system identified by farmers (N = 43).**

Challenges	Explanation
<ul style="list-style-type: none"> <li>• Lack of capital to buy appropriate CA equipment</li> <li>• A lack of access to CA specific equipment</li> <li>• Increased cost implications of fencing</li> <li>• The risk of a decline in maize yields</li> <li>• To obtain a significant level of soil cover in the form of a mulch appears to be almost unattainable</li> <li>• The practicality of lime application in a CA system is questioned</li> <li>• A lack of knowledge and experience</li> <li>• High levels of chemical use in the early stages of CA</li> <li>• The potential for increased termite infestation</li> </ul>	<ul style="list-style-type: none"> <li>• Start up capital</li> <li>• Sprayers and no-till planters</li> <li>• In order to maintain crop residue for soil cover, livestock need to be controlled by fences</li> <li>• May occur at the early stages of changing from conventional practices to CA</li> <li>• Especially under dry land production conditions in the dryer regions of SA</li> <li>• The traditional way to apply lime is to mix it with the top soil by using a disc harrow</li> <li>• How to practise CA</li> <li>• The negative impact on the environment</li> <li>• A result of reduced soil tillage actions</li> </ul>

### 4.2.1 Discussion

Despite the identification of the advantages of CA, in this part of the interview, farmers clearly revealed their concerns about the shortcomings of CA and their doubts about the potential of CA to significantly change agriculture in their regions.

In the following discussion some of the key issues in Table 2 are critically analysed:

- **Start up capital and the high cost of mechanization**  
Although an original capital layout will be needed for a suitable planter in particular, cost savings on implement maintenance and repairs will recover the original capital expenditure in a relatively short time. This was identified by farmers interviewed as an advantage of CA

since they argued that CA can contribute to savings on mechanization costs due to the fact that less wear and tear of tractors and implements will occur. The prospects for semi-commercial farmers to obtain planters suitable for no-till practices appear to be limited. The current price of two row no-till planters varies between R50 000 and R80 000 per unit. It is probable that only a small portion of semi-commercial farmers are in a position to obtain such equipment through the support of a financial institution.

One possibility to curb high mechanization costs is to assist farmers to convert their existing implements such as planters to minimum-till or no-till planters. In Brazil, because the first no-till planters were only commercially available, many pioneering farmers started no-till by converting their older conventional equipment. This trend resulted in a large variety of implements that are more suitable for conditions on smaller farming units (Bolliger *et al.*, 2006: 85).

- **Managing a soil cover in the form of a mulch**

Applying this principle of CA appears to be very difficult under certain conditions. Firstly, where farmers are relying on crop residues to be utilised by livestock a conflict of interest arises as maize stover in particular is well known for its highly valued fodder. Giller *et al.* (2009:3) argued that in semi-arid areas where livestock are of great importance, the costs of retaining crop residue by restricting the access of animals with fences may be too great in relation to the potential benefits of CA. One alternative possibility is that farmers opt to improve their fodder production on separate land by introducing a fodder crop with a high biomass potential (Calegari and Ashburner, 2005). Secondly, the US Conservation Technology Information Centre (CTIC) defined conservation tillage as “any tillage and planting system that covers at least 30 percent of the surface with crop residue” (CTIC, 1999, cited by Giller *et al.*, 2009). The benefits of CA are most directly attributed to the mulch of crop residues retained in the field. Farmers interviewed are sceptic about the attainability of a proper soil cover especially in dry seasons when crop yields are low. The limited availability of crop residue might therefore be an important constraint for the adoption of CA practices.

- **The risk of a decline in crop yields**

Farmers at the Goedgevonden interview particularly indicated that they cannot afford the risk of reduced crop yields due to the implementation of a new production system. Although the introduction of CA can result in crop yield benefits in the long term, in the short term yield losses or no yield benefits are just as likely (Giller *et al.*, 2009:3). Many variables such as soil characteristics, climate and the occurrence of soil borne diseases contribute to a complex of interactions which determine the yield response of a cropping system. The concerns of farmers with regard to yield losses are valid and it is the short term benefits which to a large extent will determine the attractiveness of an innovation. The unpredictability of yield benefits in the short term will probably contribute to discourage farmers to adopt the CA system.

## 5. RECOMMENDATIONS

Based on the outcome of the focus group interviews and in consultation with farmers interviewed, the following recommendations are made:

- Where CA is considered to be explored as an option to farmers, local on-farm demonstration trials should become a prerequisite. The implementation of on-farm trials is the best method to expose farmers to CA practices and to compare it with the conventional system. As such, on-farm trials provide an ideal classroom for hands-on experiential training opportunities. According to Lele and Makki (1996:55) risk averse farmers need to be convinced about the potential success rates of the innovation. The decision to adopt or not to adopt depends on their subjective probabilities of success with the new technology.
- Assist farmers to convert their existing implements such as planters to minimum-till or no-till planters. In one interview farmers suggested that old John Deere type planters should be used since they are ideal for conversion into no-till planters.

- A purposeful attempt should be made to expose farmers to existing CA equipment and in so doing close the existing gap between semi-commercial farmers and the CA trade industry. The search for appropriate technologies remains a great challenge in the development process. This calls for commitment on the side of the relevant agri-businesses.
- More should be done in an adaptive research process to explore the role and value multipurpose cowpea varieties, now available in South Africa, can add to a CA system.

Any form of progress in the attempt to promote CA as a viable option for semi-commercial grain farmers will require the following strategic imperatives:

- A strong stance for participatory technology development with farmers as the prime beneficiaries
- A serious commitment by relevant role players, e. g. technical experts, extension agents and input suppliers to work together as an integrated team
- The need for patience to achieve the status of sustainability. Right from the start of the intervention, all role players including funders, should realise that the full benefits of CA may take a number of years to achieve.
- The continuously changing environmental and socio-economic forces in agriculture will also demand a constant search to improve and adapt the system to the prevailing farming conditions (Calegari and Ashburner 2005:11).

## 6. CONCLUSIONS

In order to ensure a good match between the technology and semi-commercial farmers, the real potential of CA should be explored in a context based approach. This also implies that the development of appropriate technology, which can only materialise in close collaboration with farmers, holds the key to a significant change towards the adoption of CA. Although there is good reason to question the approach and that scepticism may be justified in some cases, semi-commercial farmers are in a category for which CA has the potential to unlock a better farming future.

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