

# Conservation Agriculture

## Learning from the South American Experience

*“The entire body of ‘reasoning’ about the management of the soil has been based upon the axiomatic assumption of the correctness of plowing. But plowing is not correct.”*

**Edward H. Faulkner**  
**Plowman’s Folly(1943)**

### **Background**

Conservation Agriculture(CA) is a system of crop production that involves minimal soil disturbance with no inversion of soil. Permanent soil cover with crop residues or the use of cover crops is desirable. Crop rotations including the use of specialized planters or drills and new techniques of crop husbandry are necessary. The adoption of CA requires the application of new techniques and improved management skills for the farmer.

The tangible benefits of CA systems are many and varied. At farm level significant cost reductions through greater efficiencies in the use of labour, machinery, time and fuel have all been realised. From an agronomic point of view yields have been maintained and enhanced with reduced input costs. The system has many positive environmental aspects with reduced CO<sub>2</sub> emissions, less nitrate leaching and reduced phosphate loss due to run-off to waterways. Water infiltration in soils and water holding capacity on land is greatly enhanced. As a result there is reduced potential for flooding and with less soil erosion there is a significant drop in soil contamination of waterways and build-up of silt in river beds and estuaries. Research has also shown increased biodiversity on farmland where the system is operated.

With all these recorded benefits CA has become a global and expanding practice. Adoption of the system, however, has been much slower in North Western Europe, Africa and Asia when compared with South America. In Ireland only eleven thousand hectares are under conservation tillage representing only three per cent of the total tillage area. Since the late eighties CA has shown a fifty fold increase in South America alone from just over half a million hectares in 1987 to over thirty-four million hectares in 2002 - just under half the total area devoted to the system worldwide. The South American region has huge climatic variation from tropical rainforest areas and savannah dry lands to warm humid plains and more temperate regions much like those experienced in North Western Europe. There are major differences in soil structure, texture, and type that combine with climate variation to present farmers with difficult challenges to producing a wide variety of crops on a profitable basis. This region provides a rich resource for learning about developments in agriculture in a non-subsidised environment where farmers are exposed to world market price fluctuations.

## **Aims of the Study Tour**

The primary aims of the study undertaken were:

1. Investigate the origin and rapid development of CA systems in South America over the last 20 years.
2. Identify reasons for adoption of such systems and factors that have influenced their uptake.
3. Identify if the methods used to promote CA uptake and development could be implemented in North-Western Europe.

## **Brazil**

Early adoption of CA systems became a necessity for some farmers in the early seventies when they observed that conventional plough based crop production led to excessive soil erosion on their farms. Some pioneer farmers brought new ideas and technology from the United Kingdom and North America in these early years. There was limited choice of equipment and there were but two herbicides available for weed control so many problems were encountered.

Formal research began in Parana in 1976 in collaboration with ICI. In response to practical needs of farmers interested in adopting the system farmer groups and clubs were established. The Earthworm Club was formed in 1979 in the Ponta Grossa and in 1982 the Friends of the Land Club movement started in Rio Grande do Sul. These clubs brought early adopters of CA systems together to discuss experiences and identify solutions to problems that were happening on farm. They were crucial in sharing information, experiences and new techniques and are now very popular on a nationwide basis.

National No-Tillage Conferences were held since the early eighties where latest research findings and methods used by pioneer farmers were presented. The commercial sector produced new drills that could cope with surface residues and herbicides that controlled problematic weeds making CA systems easier to manage. With these new developments the rate of uptake increased substantially. Over the years farmers have continued to improve and develop the system. Machinery companies have modified machines based on farmer experience and formal research and educational has responded to farmer information needs.

Green manure cover crops were used by all farmers interviewed and the benefits identified included soil texture improvement, increased organic matter, nitrogen fixation and also disease, pest and weed control. In southern Brazil in Parana alone four million hectares of cover crops, including black oat, radish, vetch and field pea, are grown annually. Many farmers and researchers now believe the full potential of no-tillage is just being realized and cover crops will have a dramatic effect in developing weed and pest control techniques together with enhancing subsequent crop performance and yields.

## **Argentina**

Early adopters of CA technology began their experiences with CA in the mid seventies. Many of the early pioneers, much like their Brazilian counterparts, were trying to eliminate soil erosion on their farms. Farmers used the system to produce two crops in one year and others were impressed with the positive impact on soils and the simplicity in operating the system. A number of farmers interviewed observed that no-tillage systems proved more costly than conventional systems being used at that time. The National Institute for Agriculture Technology (INTA) in collaboration with ICI promoted research, information meetings and open days at farm level in the early eighties.

In 1986 the Argentine Association of No-Till Farmers (AAPRESID) was formed and has been hugely influential at farm level in the extension of CA technology. At this time twenty-five thousand hectares were in production using no-tillage technology. Within ten years the area of no-tillage in Argentina had increased to 4.5 million hectares. Availability of machines was the main constraint to development and uptake of CA but with increased interest and demand new equipment was developed and there are now in excess of thirty different drill manufacturers in the market place.

The healthy world market price for soybeans has led to the development of continuous production of this crop and consequently some problems have developed with the system. Soil compaction, weed species development and reduction of soil fertility have all resulted. The more experienced farmers continue to use crop rotations as they feel that soils deteriorate dramatically under a monoculture system.

## **Paraguay**

CA systems were not adopted until the early eighties in southern Paraguay. Problems soon developed with the imported machines used and many farmers reverted to conventional systems. A soil conservation project that began in 1993 as a collaborative effort with a German Government Agency, the GTZ, led to the steady development of no-tillage and resulted in the diffusion of appropriate skills at farm level. By the late nineties, half a million hectares had been converted to CA mainly for the production of soybeans. Increased farmer awareness of weed control through the use of technical guides has also contributed significantly to the success of CA systems.

A simple implement called a knife roller was developed at farm level and has revolutionized weed management in crops in Paraguay and southern parts of Brazil. Cover crops are now grown on widespread basis and just before or at flowering, the plants are rolled flat with this implement and their stems crushed and broken. The residue and mulch that results is very effective in suppressing weeds in the succeeding cash crop. One consultant observed that twenty years after adoption the Paraguayans are only now beginning to understand the inter-relationships between various plant species and the real potential of CA.

## **Main Observations**

- While initial motivation for uptake of CA systems was the control of soil erosion throughout the nineties the main reason for uptake today is significant reduction in cost of production.
- Farmer groups have had a major influence on the uptake and development of CA systems and regional and national CA organisations with a strong farmer focused ethos have been hugely supportive and influential in providing technical back up, information and practical advice to farmers.
- The majority of research work on CA is undertaken in collaboration with farmers and the majority of formal research is undertaken on-farm using farmer implements and techniques. Extension and advisory agencies also facilitate farmer to farmer education as much as possible.
- Land is never left fallow and constant soil cover with previous crop residue or cover crops is a vital component of all successful CA systems throughout the region.
- Crop rotations are vital to improve soil structure, build soil fertility and manage weed and pest development while green manure cover crops are successfully incorporated to optimise benefits of the system throughout South America.
- A wide range of seeding equipment is available to farmers with frequent evaluation trials on the suitability of such machinery made available to farmers from independent research institutions.
- Equipment required for successful implementation of CA need not be expensive or state of the art once the basic principles of the system are adhered to.
- CA is a suitable system for small, medium and large scale farm enterprises.

## **Conclusions**

- The mentality and attitudes of farmers, advisers and researchers involved in developing CA are very different to those traditionally observed and there is a genuine commitment to life long learning and a large amount of humility is required to succeed with the system .
- Lack of knowledge and information is the main constraint to adoption of CA at farm level; Information has to be relevant, factual and of practical use to farmers.
- Weed control has proven particularly difficult for some farmers adopting and managing CA systems and considering this fact a greater understanding on weed species and biology is essential together with ready access to information on herbicide choice and availability.
- Greater knowledge about soil properties - physical, biological and chemical - are vital for successful management of CA; Different methods for fertilisation of crops and building soil fertility are required for CA.

## Conclusions (contd.)

- The importance of constant soil cover, either with residue or cover crops, cannot be over emphasised; farmers are obsessed about and insist on constant soil cover.
- Compared with South America there is poor choice and availability of adequate and appropriate drills and planters for CA systems in North Western Europe.

## Recommendations

- CA technology is a truly sustainable system of crop production and should be promoted and developed by government and agriculture agencies involved in the arable sector.
- More specific and focused research based on farmer needs is required e.g. soil structure improvement, soil fertility building, cover crops interactions with cash crops, weed suppression, crop nutrient requirements under CA systems etc.
- Farm based research and farmer to farmer dissemination of experiences is essential to improve the rate of uptake and quality of techniques used.
- Agricultural education institutions need to place greater emphasis in relevant courses on sustainable soil husbandry to ensure that adequate knowledge and appreciation for soil management is present in the agricultural services sector.
- Appropriate drill technology already exists and every effort should be made to import and/or modify suitable machinery for use in CA systems in North Western Europe.
- In view of the positive impact on the environment it would be entirely appropriate for government to offer temporary subsidisation to farmers during the early adoption phase of CA systems as such initiatives are already in place in other EU member states.



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