



CONSERVATION AGRICULTURE

Matching Production with Sustainability

What is the goal of Conservation Agriculture?

- ⇒ Conservation Agriculture (CA) aims to conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with external inputs. It contributes to environmental conservation as well as to enhanced and sustained agricultural production. It can also be referred to as resource-efficient / resource effective agriculture.

What are the characteristics of Conservation Agriculture?

- ⇒ Conservation Agriculture maintains a permanent or semi-permanent organic soil cover. This can be a growing crop or a dead mulch. Its function is to protect the soil physically from sun, rain and wind and to feed soil biota. The soil micro-organisms and soil fauna take over the tillage function and soil nutrient balancing. Mechanical tillage disturbs this process. Therefore, zero or minimum tillage and direct seeding are important elements of CA. A varied crop rotation is also important to avoid disease and pest problems.



- ⇒ Rather than incorporating biomass such as green manure crops, cover crops or crop residues, in CA this is left on the soil surface. The dead biomass serves as physical protection of the soil surface and as substrate for the soil fauna. In this way mineralization is reduced and suitable soil levels of organic matter are built up and maintained.



What is Conservation Agriculture not?

- ⇒ *Zero-tillage*: zero tillage is a technical component used in Conservation Agriculture but not everyone carrying out zero tillage is practising Conservation Agriculture. Conservation agriculture not only avoids tillage by forcing the seed with heavy direct drills into the soil, by maintaining a soil cover it also improves the structure of the soil. This facilitates direct planting. Conservation Agriculture uses biological tillage. Zero tillage as stand alone technique can also be applied in conventional agriculture under certain circumstances.
- ⇒ *Conservation tillage*: conservation tillage are practices that leave crop residues on the surface which increases water infiltration and reduces erosion. It is a practice used in conventional agriculture to reduce the effects of tillage on soil erosion, however, it still depends on tillage as the structure forming element in the soil. Never the less, conservation tillage practices such as zero tillage practices can be transition steps towards Conservation Agriculture.
- ⇒ *Direct planting/seeding*: this is only a technique that refers to seeding/planting without preparing a proper seedbed. The same equipment is used in Conservation Agriculture. However, the term direct seeding can also be used for implements which combine primary and secondary tillage and seeding in one machine/tractor operation.

- ⇒ *Organic farming*: Conservation Agriculture is not a synonym of organic farming, although it is based on natural processes. CA does not prohibit the use of farm chemical inputs. For example, herbicides are an important component in Conservation Agriculture, particularly in the transition phase, until the new balance of weed populations is managed. However, in view of the importance of the soil life for the system, farm chemicals, including fertilizer, are carefully applied and over the years, quantities applied tend to decline. In some cases organic farming can be practised within the CA framework.



Is Conservation Agriculture compatible with IPM?

- ⇒ Conservation Agriculture is not only compatible but actually works on IPM principles. CA, like IPM, enhances biological processes. It expands the IPM practices from crop and pest management to land husbandry. Without the use of IPM practices the build up of soil biota for the biological tillage would not be possible.



What is the role of Animal Husbandry in Conservation Agriculture?

- ⇒ Livestock production can be fully integrated into conservation agriculture, by making use of the recycling of nutrients. This reduces the environmental problems caused by concentrated intensive livestock production.
- ⇒ Integration of livestock into agricultural production enables the farmer to introduce forage crops into the crop rotation, thus widening it and reducing pest problems.
- ⇒ Forage crops can often be used as dual purpose crops for fodder and soil cover.
- ⇒ Particularly in arid areas with low production of biomass, the conflicts between the use of organic matter to feed the animals or to cover the soil has still to be resolved.

What are common prejudices?

- ⇒ *"It's only for large mechanized farms"* - Today technologies are also available (and used) to practice Conservation Agriculture on small farms with animal traction and on very small farms with only manual equipment.
- ⇒ *"Disease problems increase due to the residues left in the field"* - this will largely depend on the adoption of sound crop rotations. Mono cropping under 0-tillage is possible but not recommended, because, just like mono cropping in conventional farming practises, it creates pest problems and would therefore not be considered as Conservation Agriculture.
- ⇒ *"It only works for grain crops"* - the system has been adapted for vegetables and root crops. Now, not only grain crops and pulses but also a wide range of other crops such as sugar cane, vegetables, potatoes, beets and cassava, can be grown. Perennial crops like fruit and vine can also be grown using CA techniques.



- ⇒ *"It only works in certain climates or on certain soils"* - Conservation Agriculture is practised from the humid tropics to almost the arctic circle and on all kinds of soils. So far the only area where the concept has not been successfully adapted is arid areas with extreme water shortage and low production of organic matter. In these areas both humans and animals compete with the soil for crop residues.

What are the downsides of Conservation Agriculture?

- ⇒ Conservation Agriculture is generally a win-win situation. That does not mean that there are no problems.
- ⇒ CA may require the application of herbicides in the case of heavy weed infestation.
- ⇒ During the transition phase certain soil borne pests or pathogens might create new problems due to the change in the biological equilibrium. Once the Conservation Agriculture environment has stabilized it tends to be more stable than conventional agriculture. So far there has been no pest problem that could not be overcome in Conservation Agriculture.

What are the attractions of Conservation Agriculture?

- ⇒ Conservation Agriculture attracts different people for different reasons:

Farmers:

- ⇒ Reduction in labour, time, farm power
- ⇒ Reduction in cost
- ⇒ In case of mechanized farmers: longer lifetime and less repair of tractors, less power and fewer passes, hence much lower fuel consumption
- ⇒ More stable yields, particularly in dry years

- ⇒ Better trafficability in the field
- ⇒ Gradually increasing yields with decreasing inputs
- ⇒ Increased profit, in some cases from the beginning, in all cases after a few years.

Communities/Environment/Watershed:

- ⇒ More constant water flows in the rivers, re-emergence of dried wells
- ⇒ Cleaner water due to less erosion
- ⇒ Less flooding
- ⇒ Less impact of extreme climatic situations (hurricanes, drought etc.)
- ⇒ Less cost for road and waterway maintenance
- ⇒ Better food security

At global level:

- ⇒ Carbon sequestration (greenhouse effect): in some places no-till farmers start to receive carbon-grant payments; the global potential of Conservation Agriculture in carbon sequestration could equal the human made increase in CO₂ in the atmosphere.
- ⇒ Less leaching of soil nutrients or chemicals into the ground water
- ⇒ Less pollution of the water
- ⇒ Practically no erosion (erosion is less than soil build up)
- ⇒ Recharge of the aquifers through better infiltration
- ⇒ Less fuel use in agriculture

Is Conservation Agriculture real?

- ⇒ Conservation Agriculture is being practised on about 45 million ha, mostly in South and North America. Its use is growing exponentially on small and large farms in South America, due to economic and environmental pressures. Farmers practising CA in South America are highly organized (in regional, national and local farmers organizations), and are supported by institutions from North and South America. In Europe the European Conservation Agricultural Federation, a regional lobby group, has been founded. This body unites national CA associations in the UK, France, Germany, Italy, Portugal and Spain.

No-tillage in different countries (hectares)

COUNTRY	1998/99
U.S.A.	19.347.000
Brazil	11.200.000
Argentina	7.270.000
Canada	4.080.000
Australia	1.000.000
Paraguay	790.000
Mexico	500.000
Bolivia	200.000
Chile	96.000
Uruguay	50.000
Others	1.000.000
Total	45.533.000

cited from Rolf Derpsch: Frontiers in Conservation Tillage and Advances in Conservation Practice in: Proceedings der 10th ISCO Konferenz, 24. - 28. 5. 1999 in West Lafayette, In., USA



What are the issues?

- ⇒ Despite its advantages, CA has so far spread relatively slowly for a number of reasons. Firstly, there is greater pressure to adopt Conservation Agriculture in tropical, rather than temperate climates. Therefore in Latin America it is catching on. It has taken a long time, but over the past 20 years the establishment of a local knowledge base has ensured its spread. In some states of Brazil it is official policy, in Costa Rica the Ministry of Agriculture has a Department for Conservation Agriculture - so in these cases the policy makers have been convinced. The adoption of CA in the US was probably due to a mixture of public pressure to fight erosion and the financial incentives of reduced tillage. Europe is slowly getting there - farmers still do not feel sufficient pressure and environmental indicators (erosion, flooding) are not yet taken seriously enough.
- ⇒ CA has great potential in **Africa** due to its propensity to control erosion, give more stable yields and reduce labour. There are a number of ongoing initiatives promoting different practices, from conservation tillage up to Conservation Agriculture.
- ⇒ Another vast area where the adoption of CA would be extremely beneficial is **Central Asia**. In the countries of the former USSR conventional agriculture is virtually impossible because of environmental problems (erosion) and because of a lack of farm machinery, which has to be replaced. Unless Conservation Agriculture is adopted, the investment in new machinery will have to be very high.
- ⇒ Converting to Conservation Agriculture needs higher management skills, the first years might be very difficult for the farmer, therefore she/he might need moral support (from other farmers or from extension services) and perhaps even financial support (to invest into new machinery like zero-tillage planters). As it requires a complete change of understanding, the scientific and technical sectors often do not support Conservation Agriculture, fearing that they would contradict themselves.
- ⇒ Necessary technologies are often unavailable: in order to try CA, the minimum a farmer needs is a zero tillage planter, which might not be available in the neighbourhood. Buying one without knowing the system or even having seen it, is a risk that few farmers take. Machinery dealers might not wish to promote CA as long as it is not supported by extension. This is partly due to the cost of the equipment but more importantly because the widespread adoption of CA will reduce machinery sales, particularly of large tractors.

What is FAO doing?

- ⇒ FAO has been promoting this concept for more than 10 years, particularly in Latin America. As conservation agriculture is becoming a success story in Latin America, FAO is expanding the programme to other regions, such as Africa and Central Asia. An interdisciplinary project on Conservation Agriculture has been formulated within the Agriculture Department of FAO. More details and literature about CA and FAO's CA-programme can be explored on the FAO homepage: <http://www.fao.org>

