ECAF position paper for Modernising and Simplifying the Common Agriculture Policy

The following document is a brief summary of a wider publication "**Conservation Agriculture and its contribution to the achievement of agri-environmental and economic challenges in Europe"** published in AIMS Agriculture and Food International Open Access journal.
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Abstract: Conservation Agriculture (CA) is an ecosystem approach to farming capable of providing solutions for numerous of the agri-environmental concerns in Europe. Certainly, most of the challenges addressed in the Common Agriculture Policy (CAP) could be tackled through CA. Not only the agri-environmental ones, but also those concerning farmer and rural communities' prosperity. The optimisation of inputs and similar yields than conventional tillage, make CA a profitable system compared to the tillage based agriculture. Whereas this sustainable agricultural system was conceived for protecting agrarian soils from its degradation, the numerous collateral benefits that emanate from soil conservation, i.e., climate change mitigation and adaptation, have raised CA as one of the global emerging agrosciences, being adopted by an increasing number of farmers worldwide, including Europe.

1. Introduction. Sustainability and Conservation Agriculture

The European Commission tries to head EU agriculture towards sustainability, in its holistic sense, through different European policies implementation more focused on environmental objectives; such as the greening contributing to achieve the Europe 2020 Strategy objectives. In practical terms agricultural system should be productive with regard to total production per unit land area and to be resource efficient, which means to produce more with less, primarily with regard to soil and water, but also other inputs such as fertilizers, plant protection products, energy and labour. The realisation of these two goals would not only contribute to competitiveness and economic sustainability but would also enhance environmental protection and biodiversity.

A concurrent approach to realise all the objectives outlined by the Commission for modernising and simplifying the CAP requires a production process which respects natural capital and uses available knowledge and technology to optimise production, while enhancing and improving the environment and the production base for future generations. This is reminiscent of the meaning of agricultural sustainability and Sustainable Crop Production Intensification and is reflected in the concept of CA. The basic principles of CA are: minimum or no soil disturbance, permanent soil cover (with residues / cover crops), and implementing well balanced and wide crop rotations.

The adoption of these principles in locally adapted production systems for the growth of annual and perennial crops, pastures and forages, together with good quality seeds and optimally integrated nutrient, water and pest management, would realise the goals outlined in the CAP by:

- providing similar or even higher yields through improvements in soil structure, organic matter and overall soil fertility;
- lowering production costs through reduced inputs of energy, labour, machinery, fertilizers, water and pesticides, thus raising related productivity and efficiency;
- mitigating CO_2 emissions through reduced fuel consumption and sequestration of atmospheric carbon into soil organic matter, and reducing N_2O and CH_4 emissions through reduced use of mineral nitrogen and improved soil drainage;
- reducing runoff and erosion through better soil aggregate stability and improved water infiltration, and protective cover of the soil by crops and/or crop residues;

- diminishing off-site damage of infrastructures and pollution of water bodies through less runoff with a much reduced sediment load;
- maintaining in-field and off-site biodiversity through the absence of destructive soil disturbance, protective soil shelter and less off-site transport of contaminants;
- maintaining the diversity of rural landscape through enhanced crop and species diversity and cover crops;
- maintaining less favoured rural areas under production through adoption of economically and environmentally viable production methods;

The characteristics of locally adapted CA production systems together with the rational and responsible use of external inputs will optimize crop yields, farm income, competitiveness and biodiversity, and minimize some negative ecological impacts associated with intensive farming.

Adoption of CA will also provide a foundation for developing environmental service schemes such as carbon sequestration and trading, clean water provision, soil erosion control, and biodiversity enhancement, etc., in which incentives and payments can be linked to specific production systems and services.

Today CA is practiced on some 156 Mha around the world across all continents where agriculture takes place and in all agroecologies, with some 50% of the area located in the developing world. The spread of CA has been increasing at annual rate of 10 Mha during the past decade. This widespread adoption of CA is direct proof of its viability and sustainability, especially in some countries where there is no subsidy support for primary producers, and where CA is used on more than 60% of the arable land. In addition, the fact that CA is successfully applied under very different climate conditions strongly indicates that there is great potential for the adoption of CA principles on a Europe-wide basis.

2. Conservation Agriculture and ecosystem services

Farming must be able to produce the required volume of biological products efficiently to remain competitive, which means at least cost, and socially sustainably which mean that the productive capacity of the resource base and ecosystem functions that generate and regulate ecosystem services must be maintained in the social-ecological system. Productivity and economic advantages from CA include similar or higher yields as the new system transforms and reaches a new equilibrium, improved productivity which means more output with less inputs, and system resilience which involves adaptation to climate change due to increased infiltration and soil moisture storage and availability of soil moisture to crops, reduced risks of runoff and flooding, and improved drought and heat tolerance by crops. Advantages also include climate change mitigation through reduced emissions due to 60–70% lower fuel use, 20–50% lower fertilizer and pesticides use, 50% reduction in machinery and labour requirement, C-sequestration 0.85 t ha−1 y−1 or more, and no CO_2 release as a result of no burning of residues. These advantages of greater soil health and productive capacity and lower cost of production leads to higher crop yields and factor productivities. Also, lower costs of production with CA leads to greater profit margins and competitiveness. To the mechanised farmers in Europe, CA offers reduced fuel use, lower capital outlay on machinery and decreased maintenance costs. Overall, CA has a much lower carbon foot print than tillage agriculture, and GHG emissions of CO_2, CH_4 and NO_2 are all reduced with CA.

For any agricultural system to remain productive and sustainable over the long term, the rate of soil formation—from the surface downwards—must exceed the rate of any degradation due to loss of organic matter, and of soil porosity, as evidenced by consequent soil erosion. In the majority of agroecosystems this is not possible if the soil is mechanically disturbed. For this reason the avoidance of unwarranted mechanical soil disturbance is a starting point for sustainable production and the reversal of soil degradation, leading to higher soil carbon levels and microorganism activity over time, reduction in soil compaction, minimisation or avoidance of soil erosion and runoff, improved soil moisture storage due to improved soil porosity, and increased aquifer recharge due to greater density of soil biopores due to more earthworms and more extensive rooting. Not tilling the soil is therefore a necessary condition for stopping land degradation and maintaining ecosystem functions. For high output ecological and economic sustainability, other complementary techniques including mulch cover, crop rotations and legume cover crops are also required to create a sufficient condition for enhancing and sustaining soil productive capacity and ecosystem services, and for efficient integration and management of production inputs of seeds, land, labour, energy, plant nutrients, pesticides and water in CA production systems.

Indeed, societies benefit from the many resources and processes supplied by nature which are collectively known as ecosystem services. Under CA systems, it is possible to harness many of the ecosystem services mainly because the ecosystem functions that generate these services are enhanced and protected by CA practices, so that production on agricultural land is not in competition with nature but works in harmony with it.

Ecosystem services are derived in CA systems as a result of improved conditions in the soil volume used by plant roots, and by enhanced functional agrobiodiversity. Avoidance or minimisation of soil disturbance leads to increase in soil organic matter and improvements in soil structure and porosity which is brought about by the actions of the soil biota that are present in greater abundance in the soil under CA. The organic mulch on the soil surface in CA systems protects against the compacting and erosive effects of heavy rain, buffers temperature fluctuations, and provides energy and nutrients to the organisms below the soil surface. The co-benefits of more water infiltrating into the ground beyond the depth of plant roots is perceptible in terms of more regular stream flow from groundwater through the year, and/or more reliable yields of water from wells and boreholes. The benefits of carbon capture become apparent in terms of improvements in crop growth, plus less erosion and hence less deposition of sediment in adjacent waterways.

CA facilitates the delivery of better ecosystem services initially at the farm level. When the effects are reproduced across farms in a contiguous landscape, the ecosystem services provided become more apparent and cumulative. At the landscape level, CA offers the advantages of better ecosystem services including: provision of clean water, regulation of climate and reduced pests/diseases, supporting nutrient cycles, pollination, cultural recreation, and conserving biodiversity and erosion control. To the community and society, CA offers public goods that include: less pollution, lower cost for water treatment, stable river flows with reduced flooding and maintenance, and cleaner air. At the global level, the public goods are: improvements in groundwater resources, soil resources, biodiversity and adaptation to and mitigation of climate change.

3. Climate change and Conservation Agriculture

Agricultural ecosystems can play a significant role in the production and consumption of GHGs, especially CO_2. Agriculture contributes approximately 10% to total EU GHG emissions. Fuel burning by agricultural machinery is often regarded as the main source of CO_2 emissions in the primary sector, neglecting the CO_2 fluxes derived from agricultural land caused by the “burning” of organic litter left after harvest and soil organic carbon (SOC) losses caused by intensive plough based tillage.

Soil organic matter (SOM) levels have decreased considerably due to agricultural land use. A 1% reduction of SOC in the 30 cm topsoil layer results in losses of approximately 45 t of carbon, or 166 t of CO_2/ha (3.7 t CO2/1 t carbon), to the atmosphere. This calculation clearly illustrates the impact that agriculture has on the release of CO_2 to the atmosphere where land use practices lead to a depletion of SOC. On the other hand, it also reveals the potential for carbon sequestration, which a change of the agricultural practice could have, if it succeeds in restoring at least some of the SOC lost over decades of traditional tillage. This would increase not only the levels of SOM but also soil fertility and the long-term sustainability of agriculture and food production. The reduction of CO_2 emissions would be due to the reduction in energy use through the manufacture and utilization of agricultural machinery and the adoption of CA to reduce CO_2 emissions from soils.

It is widely accepted that both emission reductions and an increase in potential sinks would have to occur if there is to be a positive effect on climate change. With regard to agricultural land, zero or no-tillage, coverage of the soil surface with straw residue, cover crops and rotations, and improved management practices, which result in increased crop and biomass productivity, are recognized as the main practices necessary to turn agricultural soil into a significant carbon sink.

The agronomic, environmental, and economic feasibility of CA systems has been proven under many soil and climatic conditions. It has been well established that SOM and SOC levels can reach a new higher equilibrium with the application of conservation practices, especially where crop residues are maintained on the field and permanent crop and soil cover is achieved. The adoption of these sustainable management practices on a substantial part of the EU arable land area could reverse the continuous decline of soil organic matter and soil fertility and contribute decisively to the necessary reduction in CO_2 emissions and CO_2 levels in the atmosphere as agreed under the international agreements on the subject, such as the COP21 Paris agreement in 2015.

4. Transition and risk management

CA-based farming systems provide economic benefits both on-farm and off-farm, which become more pronounced the longer they are practiced. However, the adoption of CA on a farm involves some additional initial costs due to the need for appropriate seeding equipment and some possible risks of initial drawbacks for those farmers who are not familiar with the new technology. The compensation for these additional costs and economic risks should be covered through initial but temporary incentives or support, corresponding to a real investment in the improvement of competitiveness and farm income, and in longer-term positive effects on a range of ecosystem services and the delivery of public goods which could be assessed and valued based measurable results or performance indicators.

5. Structural diversity of rural areas and natural constraints

To ensure sustainable and integrated rural development, thus maintaining the structural diversity of predominantly rural areas, a functioning and active agricultural sector is required. However, this goal cannot be achieved without substantially improving the competitiveness of an agricultural sector that is subject to a more competitive environment. A contribution to balanced territorial development of rural areas in the EU can be achieved, not only through the establishment of links between rural and urban areas, but also, through the reduction of the effects of natural constraints in agriculture. Natural constraints, or Less Favoured Areas, suffering from climate, soil, and terrain induced constraints, will always lag behind regions with favourable natural conditions in terms of agricultural activity and competitiveness. Nonetheless, the use of CA can counteract and alleviate the effects of some of these constraints and help reduce the risk associated with them.

In regions with pronounced seasonal water scarcity or low and erratic rainfall water use efficiency can be dramatically improved by the practice of CA, mainly through the adoption of low soil disturbance with and soil organic matter cover, both of which contribute to increased infiltration and the reduction of unproductive water loss through soil evaporation. Higher and more stable crop yields have frequently been observed under CA, in dryland areas and in drought affected years. CA has proven to be the most promising practice capable of reversing SOM decline and the associated loss of soil fertility. Therefore, the continuous payment of 'unproductive' compensation for production difficulties in areas with specific natural constraints could be replaced by an investment in incentives to improve natural soil resources through the increase of SOM, providing both a physical and economic return in the medium to longer term.

The slope of land terrain can also present an impediment for agricultural land use, either through increased difficulty with mechanized field operations, or through an increased rate of surface runoff combined with the risk of soil erosion or landslides. Regarding the latter, the practice of CA is capable of reducing the risk of soil erosion and landslides even on heavily undulated land, thus allowing for crop production instead of marginal or extensive land use through permanent pastures.

CA allows farm traffic almost continuously thereby allowing for the optimal use of inputs such as fertilizers and plant protection products.

6. The European agri-environmental policy framework

The European Commission wants CAP to contribute to the Smart Growth by increasing resource efficiency and improving competitiveness, to Sustainable Growth by maintaining the food, feed and renewable production base and to Inclusive Growth by unlocking economic potential in rural areas.

How can EU address the above challenge? New knowledge and scientific understanding of the principles and practices that underpin sustainable production intensification have been formulated and applied over the past 40 years in many countries outside Europe. There is strong empirical evidence from many parts of the world including in temperate areas that farmers can successfully harness increased production with greater profit and fewer inputs and at the same time deliver a range of ecosystem services needed by society, as well as by the producers to maintain and improve the productive capacity of their soils. There are now a growing number of production systems with a predominantly 'ecosystem approach' which seek to enhance ecosystem functions as well as productivity. These systems are underpinned by healthy soils, and characterised as CA that are not only efficient in producing food and other raw materials but also more sustainable in terms of ecosystem services. Their further development and spread in Europe merit deeper support with the development of suitable policies, funding, research, technologies, knowledge-diffusion, and institutional arrangements.

7. Conclusions and key learnings from ECAF

There is a wealth of evidence that appoint CA as one of the smarter approaches to sustainability in Europe as well as elsewhere. Some concluding remarks on good strategies for supporting the adoption of CA in Europe follow:

- Effective knowledge and technology transfer for the farming community on CA using a combination of scientific and practical expertise.
- Active involvement of key stakeholders including environment agencies, local authorities,

government ministries, farmer organizations and the food industry.

- Incentive programmes to encourage the adoption of CA under existing agri-environmental measures in Member States.
- Long-term agronomic research projects on Conservation Agriculture systems at both farm and research levels throughout the EU.
- Establish an opportunity market for carbon credit trading based on soil carbon sequestration where farmers could participate.