The drivers and systems of successful adoption of CA in different parts of the world

and the relation of CA to other sustainable farming concepts[1]

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The World Congress series for Conservation Agriculture (CA) has reached with this Congress its 9th repetition. This is a remarkable achievement in a world where the attention span of people is getting shorter and shorter, and the concept of change seems to be an end in itself and the driving force for programme planning of institutions and organizations. Like butterflies flying from flower to flower in search for the sweetest nectar, we seem to be constantly chasing new buzz words and terms. Even some from those who have shaped and promoted CA are changing this winning horse in the race against world hunger and degradation for allegedly "better ones" before even reaching the finish line.

Conservation Agriculture has gone through a remarkable and unprecedent development. When the term was defined by the Food and Agriculture Organization of the United Nations, FAO, it was still a fairly unknown and untested farming concept, just becoming popular in the Southern Cone of South America and being used by some few pioneers in other parts of the

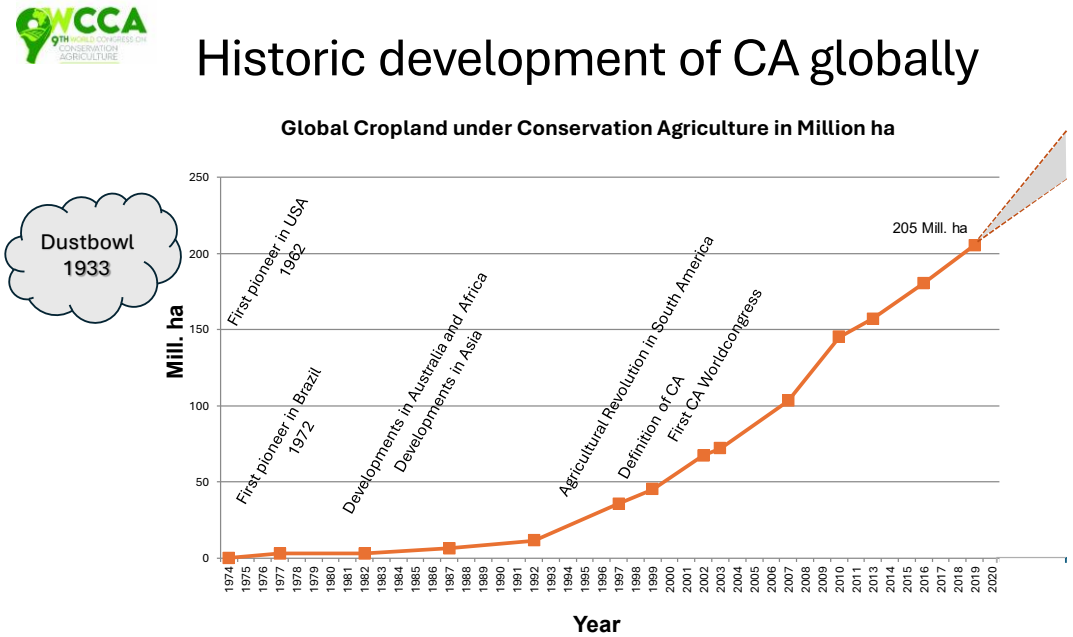

Fig. 1: Development of Conservation Agriculture on annual cropland as determined by global surveys until 2018/19 with projected area for the year 2024.

world. This changed with the first World Congress celebrated in 2001 in Madrid, when a global movement of Conservation Agriculture started. Some international agricultural research institutions and several national and international development organizations began working on Conservation Agriculture systems and promoting them in their projects, resulting in an exponential adoption worldwide. Extrapolating the adoption data

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of the last census from 2018/19 we should now have about 250-270 million hectares of annual cropland under CA, which is nearly 20% of the global cropland, with an additional growing area of orchards and plantation crops also adopting CA. Although CA came into practical farming much later than organic farming, it has by far outgrown organic farming globally. Yet, in the general population, contrary to organic farming, Conservation Agriculture is mostly unknown and despite the impressive growth rate we are still far from reaching the goal of 700 million ha by 2050, as it was postulated in the Declaration of the last World Congress on Conservation Agriculture in 2021 in Switzerland.

This forces us to reflect about the drivers and mechanisms for the successful adoption of CA so far and to discover ways to further enhance them for an accelerated adoption. As global soil and land degradation and deforestation is continuing and climate change with extreme weather conditions is accelerating, we have no time to lose to make our land management systems climate smart and sustainable.

We can trace back the origin of no-till farming as the core principle of CA to the Dust Bowl in North America in the 1930s. As a result of that devastating erosion, soil tillage was found to be a major contributor. Research started to find ways to protect a tilled soil and the easiest way was to cover the soil with crop residues. It was found that this could reduce the danger of soil erosion considerably, provided that more than 30% of the soil surface was covered. Below that 30% level the soil erosion increased exponentially. This led to the concept of conservation tillage with the definition we still use today. However, even under conservation tillage the soil erosion is still higher than the natural soil formation, making tillage farming in the long term unsustainable. In 1943 Edward Faulkner published the book Plowman's Folly where he stated:

"No one has ever advanced a scientific reason for plowing". "There is simply no need for plowing in the first instance. And most of the operations that customarily follow the plowing are entirely unnecessary, if the land has not been plowed". "There is nothing wrong with our soil, except our interference"; and "It can be said with considerable truth that the use of the plow has actually destroyed the productiveness of our soils."

All these statements from the early 1940s have proven true and were confirmed in the book "Dirt, the erosion of civilizations" by David Montgomery in 2007.

In the late 1940s the first no-till seed drill was developed by Purdue University and in the early 1950 commercially produced. But it was only in 1962 when the Young brothers in Kentucky started to farm their land without tillage. This farm today is the oldest farm that has not been tilled since then. Ten years later water erosion problems made crop farming in southern Brazil on recently cleared land impossible. And it was again a farmer, Herbert Bartz, who converted his farm to no-till when one night in a rainstorm he saw all his just seeded crops and topsoil flowing downhill. In southern Brazil this was the beginning of a farmers' movement slowly spreading also to neighbouring countries and reaching local research institutions to develop a cropping system without tillage which was later named Conservation Agriculture. We see that the drivers in those cases were erosion control, both from wind and from water. Also, in other parts of the world erosion control is still an important driver for adopting CA. In China, for example, CA was promoted in the Hebei province surrounding Beijing to protect the city from dust storms during the 2008 Olympic games, as they frequently hit Beijing. In 2009 the Chinese government adopted the promotion of CA as national policy.

Another driver for CA adoption was drought. As no-till technology became feasible, farmers from particularly dry areas started adopting no-till to save water, since each tillage operation causes water loss from the soil. This was a strong driver, for example in Western Australia, but also in the middle East, Canada, northern Kazakhstan and Mongolia, as well as in Sub-Saharan Africa. No-till systems were established in those countries, and after the first World Congress on CA many of these no-till systems were developed into CA by adding the other two CA principles of soil cover and crop diversity.

A third important motivation for farmers to investigate no-till systems was economics. This triggered for example the development of no-till in the USA and some European countries, such as the UK, where no-till was becoming popular as a technique, but not as a system. Unfortunately, this adoption of no-till practice did not consider the other two principles of CA and ended with the straw burning ban in the early 1990s. However, reduced tillage systems, combining operations, using PTO equipment for faster impact, or reducing the tillage intensity and depth became popular for their cost saving. But since these systems did not provide the benefits of a continuous long term CA system and created new problems which did not exist with full tillage using the plough while still presenting most of the tillage related soil problems, most of these developments were dead ends. Still today Europe is lagging behind in the adoption of CA. On the other hand, even in countries such as North Korea one of the strongest incentives mentioned by farmers to adopt CA was the significant cost reduction and reduction in fuel use, along with yield increases. Today, for farmers worldwide the strongest driver to adopt CA is the bottom line.

In all the successful cases of early adoption of CA it was driven by farmers, helping their fellow farmers, and getting organized around CA, such as the “Friends of the Earth” or “Earthworm-Clubs” in Brazil. As CA is a concept and not a ready-made recipe, it needs local adaptation of the practices, and farmers with their experience in local conditions and flora are the best developers and promoters. Many pioneer farmers did innovative on-farm research, learning from mistakes and improving the system while helping other farmers to avoid these mistakes. Research only joined at a later stage, and in some cases, researchers spent more effort in trying to prove that CA could not work, than in helping their farmers to adapt and optimize the system for their conditions. Unfortunately, this is still the case today in some countries, leading to general confusion also for policy makers. Some few researchers are still searching for “trade-offs” and down sides of CA, misinterpreting the definition of CA voluntarily or due to ignorance to obtain the desired negative results. Recently a researcher from a recognized official agricultural research institution even claimed that by deep ploughing and not by no-till soil carbon content could be increased. But when a researcher declares that CA in theory cannot work and a farmer proves that in practice it does work, who do you think is right? Definitely the promotion of CA through farmers is the most successful and safe way to achieve adoption. For this reason, it was also the concept of participatory learning, such as through the system of Farmer Field Schools or organized farmers’ groups, which worked best in development projects for the adoption of CA. However, this process is painfully slow. It took in Brazil about 20 years before CA developed into a significant cropping system spreading also to neighbouring countries.

Considering the alarming speed of global soil degradation, biodiversity decline and climate change, we have no time to wait for farmers’ movements only to bring about the large-scale adoption of CA worldwide. Looking at countries which show accelerated

national adoption, the policy support is becoming an important factor. Countries, where policy makers have become convinced to declare CA to be an important element of their agricultural development strategy, such as Paraguay, China, Kazakhstan, and several African countries, are showing accelerating and high adoption rates. While in other countries, such as in some European countries, even the growing number of interested farmers is hindered in adoption not only by the lack of support, but also by legislation that make CA adoption difficult or impossible. I have worked in countries, where farmers could lose their land if they did not plough.

Supportive national and local policies can motivate pioneer farmers to adopt CA. But more importantly, development policies can mainstream CA in education and vocational training systems, producing knowledgeable and skilled staff in national extension systems to support farmers in the transition. They can stimulate research programmes to concentrate on CA systems rather than spending research money and effort on tillage research and they can design supportive policies, for example by providing financial support such as credit schemes for investing in new CA equipment and technologies, changing subsidy schemes to pay for cover crop seeds or environmental services mediated through CA instead of paying by production area or for commodities. By doing this they can also stimulate a market for CA technologies and provide incentives to the machinery industry, to provide these technologies to their farmer clients. As the economics of CA are usually much better than in conventional tillage-based production systems, farmers in general do not need subsidies as direct payments. Instead, what is needed is some sort of incentive to overcome any possible initial risks in the transition to an unknown system, to help in case of unexpected yield dips which can happen during the learning curve or to just recognize the CA-farmers' efforts to not only efficiently and sustainably produce food and raw materials, but also for being good stewards of functioning ecosystems.

On the downside, the lack of supportive policies for CA not only does not accelerate the adoption, but it can also reverse successful adoption of CA as we have just seen happening in two of the leading CA pioneer countries in South America. In both cases misguided incentives to produce certain export crops, based on national policies that never understood or supported CA, has lured CA farmers into monocropping, facilitated by agroindustry promoting their production input packages and using only the no-till practice while forgetting the cover and diversity CA principles. The result is the creation of herbicide resistance, soil compaction, erosion and, in the absence of professional guidance, the return to inefficient and degrading tillage production systems which is more an action of desperation than a long-term solution, as we know. This example is a reminder that CA is not just Green Revolution agriculture without tillage.

While the above mentioned three reasons were the early drivers of CA adoption, several more can be added today, providing even more reasons for policy makers to support CA adoption. In the 5 decades of experience with CA systems worldwide and the 3 decades of intensive scientific research on these systems, some interesting results have surfaced, giving even more reasons for accelerated adoption of CA. In fact, CA was found not only to build and conserve the soil, but also to regenerate many ecosystem functions and resources, such as soil organic matter, soil structure and health, biodiversity below and above the soil surface, and clean freshwater resources. More recently it was even discovered that crops grown under CA would be richer in some vitamins, trace elements

and secondary ingredients, the lack of which in our actual food could be the reason for some of the non-transmittable diseases which are common in modern societies.

Complemented with other modern technologies for crop production CA can be highly productive, helping to fight global hunger, while at the same time regenerating natural resources and ecosystems. This was the reason why FAO decided in 2009 to make the "sustainable intensification of crop production" its first strategic objective. With CA it was possible, to have a highly productive and yet fully sustainable agricultural production at the same time. CA also proved to be the best strategy to respond to the challenges of climate change: it makes cropping systems resilient against drought and torrential rains, against heat and cold and all this without having to prepare for these events. At the same time CA increases the soil carbon pool and reduces greenhouse gas emissions from agriculture, so that it could be called "climate smart agriculture". Those two terms were directly derived from the experience with CA cropping systems and are synonymous with CA, not alternative. In fact, CA is so far the only known and operational concept for productive, sustainable, climate smart agriculture. No wonder, in 2011, FAO published its Save and Grow guide for policy makers to help support smallholders to adopt CA systems for sustainable livelihood development.

Despite this, there have been many attempts to so-called think "beyond" CA, or to look for alternatives and to search for sustainable farming systems as reflected by terms such as "Ecoagriculture", "Agroecology", or more recently "Regenerative Agriculture". Many of these terms are not clearly defined, allowing everyone to use them with a different interpretation. In fact, in many cases of such "ecological" farming systems they are nothing more than organic farming, not using synthetic inputs but still degrading the environment with tillage. And if in fact they are reflecting sustainable farming systems, they do so by including CA. This is, for example, the case with Regenerative Agriculture. The term was originally created in the 1980s by Robert Rodale, who researched in the USA on organic farming systems without tillage. Therefore, in some literature of Rodale on Regenerative Agriculture we find reference to the principles, which are the base for CA, since Regenerative Organic Agriculture is different from just organic agriculture as it uses no tillage. Rodale is also adding two more principles, such as permanent living roots and crop livestock integration preferably with mob grazing. Rodale more specifically mentions the reduction and avoidance of synthetic inputs for "*Regenerative Organic Agriculture*". But also, the original CA definition refers to that point, stating that "*external inputs such as agrochemicals and nutrients of mineral or organic origin are applied at an optimum level and in a way and quantity that does not interfere with, or disrupt, the biological processes*". Experience with CA has shown that it is well compatible with organic farming, as the regeneration of the natural processes and control mechanisms reduces the need for synthetic inputs over time. Again, regenerative agriculture is no "alternative" to CA, but a complementary system optimized for those agroecological zones, where the climate allows for permanent living roots and livestock integration.

The three principles of CA remain the universally valid concept for sustainable land management. They are the foundation and structural elements for the sustainability of any production system, while all the other elements and concepts are complementary to improve the performance of the production system and provide for higher production intensity in terms of biological and environmental outputs. Also, the social components,

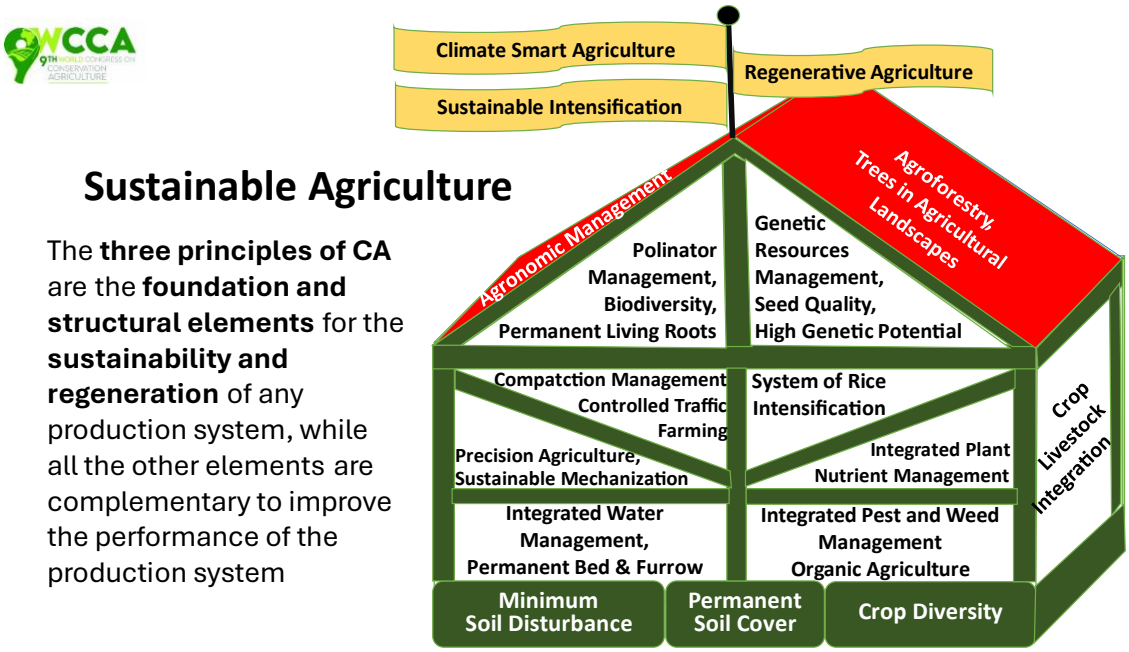

Fig. 2: Relationship of agricultural practices and CA principles in sustainable crop production with the three principles of CA forming the foundation of sustainability and the all practices complementing for performance.

which are an important element of the Agroecology movement, are not an alternative to CA but an intrinsic element. While the empowerment of subsistence farmers without CA as a farming concept has rarely improved the livelihoods of those farmers and the sustainability of their production systems, the adoption of CA has in many cases, for example in Paraguay, but also in several African countries, improved the livelihood,

making the farming sustainable and resilient and with this empowering the small-scale farmers.

CA is definitely not a “panacea” as it does not resolve all the existing problems of mankind. But in agriculture and development, it is certainly a magic “silver bullet” hitting multiple targets in one shot. In fact, of the 17 sustainable development goals of the United Nations, CA contributes directly and indirectly to 11. This should be reason enough to concentrate our efforts to promote CA and accelerate the adoption everywhere where land is managed by agriculture. Instead of creating new buzz words and inventing new

Fig. 3: Sustainable Development Goals; the circled ones are directly or indirectly supported by CA.

concepts, still searching for the ultimate sustainable agriculture, hoping for the "betters" while already having the "good" at hand, we should use the "good" we already have, and accept that with CA we have a feasible, operational, readily available, and universally applicable concept for sustainable land management which can at the same time feed the world, protect the environment and help achieve the desirable social goals. But it is also not useful to be satisfied with the concept of "sustainable land management practices", wasting time and resources with approaches that only look at single good or best practices which in isolation are far from ever reaching real sustainability. The actual confusion created by the scientific world is neither helping the planet resolve its alarmingly growing problems, nor is it providing clear guidance on which way to go for policy makers and farmers. Let's now more than ever mainstream CA in all our efforts to make the world a better place. There is no such thing as a sustainable land management practice. We need the three principles of CA applied together to reach real sustainability. And there are also no alternatives to these three principles, which are derived from nature and conform to Conservation Agriculture.

Before ending, let me remind you of the 6 enabling conditions, which were proposed in the last World Congress on Conservation Agriculture and which, to reach the proposed goal of 700 million hectare under CA cropland by 2050, are now more urgent then three years ago:

1. Catalysing the formation of additional farmer-run CA groups in countries and regions in which they do not yet exist.

2. Greatly speeding up the invention and mainstreaming of a growing array of truly sustainable locally adapted CA-based technologies.

3. Embedding the CA Community in the main global efforts to shift to sustainable food management and governance systems also at local levels.

4. Assuring that CA farmers are justly rewarded for their generation of public goods and environmental services.

5. Mobilizing recognition, institutional support and additional funding from governments and international development institutions to support good quality CA programme expansion.

6. Building global public awareness of the steps being taken by our CA Community to make food production and consumption sustainable.

With this I wish us all a fruitful and stimulating Congress, with discussions and dialogue, but at the end converging towards a common way ahead with CA!

Thank you very much for your kind attention.