1 Conservation Agriculture in Africa: An Overview

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1.1 What is Conservation Agriculture (CA)?

Conservation Agriculture (CA) is not a single technology but a systems approach to farming based on a set of three linked complementary practices formulated locally and based on the following interlinked principles as defined by the Food and Agriculture Organization of the United Nations (FAO) (www.fao.org/ag/ca):

- **Avoiding or minimizing mechanical soil disturbance**. Sow seed or plant crops directly into untilled soil in order to: maintain soil organic matter; promote soil biological processes; protect soil structure and porosity and overall soil health; and enhance productivity, system efficiency, resilience and ecosystem services.
- **Enhancing and maintaining a permanent mulch cover with organic matter on the soil surface.** Use crop residues (including stubble) and cover crops to: protect the soil surface; conserve water and nutrients; supply organic matter and carbon to the soil system; and promote soil biological activity to enhance and maintain soil health (including structure and aggregate stability), contribute to integrated weed, pest and nutrient management, and enhance productivity, system efficiency, resilience and ecosystem services.
- **Diversification of species.** Use diversified cropping systems with crops in associations, sequences or rotations that will contribute to: enhanced crop nutrition; crop protection; soil organic matter build-up; and productivity, system efficiency, resilience and ecosystem services. Crops can include annuals, trees, shrubs, nitrogen-fixing legumes and pasture, as appropriate.

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These three locally formulated practices should be implemented in combination with other good technologies and practices by the farmers in order to obtain full productivity, socio-economic and environmental benefits from CA. These practices cover a large range of expertise, from equipment and machinery to soil management, residue management and cover crops, to pest and diseases management, to nutrient and water management, including crop and cropping system management (FAO, 2011, 2016). In addition, each country and sub-region in Africa has its own unique resource endowment, socio-economic conditions, range of production and farming systems, and agricultural and economic development opportunities. Further, each country and sub-region has its particular level of adoption and spread of CA, depending on its national level of commitment towards CA.

This state of affairs calls for flexibility and adaptability according to the specific biophysical and socio-economic situation in each country and sub-region. Given this understanding, therefore, the CA principles need to be translated into a number of locally devised and adapted practices that can work simultaneously through contextualized crop–soil–water–nutrient–pest–ecosystem management at a variety of scales to address the major challenges in Africa and globally. These include: (i) pervasive food insecurity and poverty; (ii) high environmental impact of tillage-based agriculture; (iii) relatively high-cost tillage–seed–fertilizer–pesticide–credit approaches; (iv) absence of agroecologically-based production systems that are environmentally stable; and (v) natural and man-made disasters and crises.

CA has been shown to be relevant and appropriate for small- and large-scale farmers at all levels of farm power and mechanization, from manually operated hand tools to equipment drawn by animals to operations performed by heavy machinery. However, its spread in Africa has been slow compared with other continents, and the reasons for this lower-than-desired spread of CA can be attributed to include: (i) continued promotion and development support of tillage-based agricultural systems by national and international, public and private institutions and sector industries; (ii) weak policies and regulatory frameworks and institutional arrangements to support the promotion and mainstreaming of CA; (iii) inadequate awareness, knowledge and expertise of CA systems and the process of their adoption and spread among policymakers, academic, research, extension and technical staff; (iv) inappropriate CA technology packaging and dissemination; (v) inadequate CA-based enterprise diversification and integration in farming systems; (vi) inability of smallholders to diversify crop rotations, sequences and combinations; (vii) inadequate skills and competencies among farmers and other CA practitioners; (viii) farmers' inability to maintain year-round soil cover through the use of specially introduced cover crops, intercrops and crop residue; (ix) poor availability and access to the required CA equipment, machinery and inputs; and (x) absence of a strong continental body and strategic policy framework to guide the promotion and mainstreaming of CA across Africa.

1.2 Global and Regional Level Environment for CA

CA is gaining acceptance in all continents and many countries of the world as an alternative to other forms of agriculture as a means to enable small and larger farmers to intensify production sustainably. Due to increased environmental concerns, there is renewed interest in the formulation of alternative strategies for enhancing development activities, including agriculture, that take cognizance of the needs of smallholder farmers and of long-term investment in environmental sustainability that is also affordable and accessible to smallholders. In recent times, CA has demonstrated its potential in addressing climate-change challenges and it has also been shown to contribute to climate-change adaptation and mitigation, biodiversity conservation and delivery of ecosystem and societal services such as clean water, carbon sequestration and control of soil erosion and degradation. Consequently, CA is referred to as being climate-smart and is included as being part of climate-smart agriculture (CSA) options (FAO, 2013; Gonsalves *et al*., 2015).

At the international level, CA relates directly to the United Nations Framework Convention on Climate Change, the International Convention on Biodiversity, the United Nations Convention to Combat Desertification and the various agreements on international waters. Under the Kyoto Protocol, various initiatives in national and international marketing of carbon offsets based on CA systems are currently operating that involve financial mechanisms that ensure environmental benefits provided by CA are recognized by society at large and that financial benefits accrue to CA practitioners. These and other future initiatives provide opportunities for environmental service payments on 'niche products' and have the potential to encourage farmers to shift to CA and other supporting sustainable agricultural practices.

As the next section shows, the challenges and constraints mentioned earlier are being surmounted across Africa for CA to be adopted by farmers in all regions. Most of these farmers in recent years are smallholders and such farmers offer opportunities for commercialization of agriculture and for service providers to provide services to support field operations with equipment and machinery that the smallholder farmer would be reluctant to invest in (Sims and Kienzle, 2015).

1.3 Where is CA Practised in Africa?

According to Kassam *et al*. (2015), based on the FAO AquaStat data (www.fao.org/ag/ca/6c.html), CA in 2013 was practised on nearly 157 million hectares of global cropland, and since 2008/09 it had increased at a rate of some 10 million hectares per annum. Africa has about 1.2 million hectares, an increase of some 750,000 ha since 2008/09. Most of this spread has been through smallholder farmers. Although latest figures for Africa are not available for all the countries where CA adoption is occurring, South Africa has the highest area (368,000 ha), followed by Zimbabwe (332,000 ha), Zambia (200,000 ha), Mozambique (152,000 ha) and Malawi (65,000 ha) (Fig. 1.1). Other notable

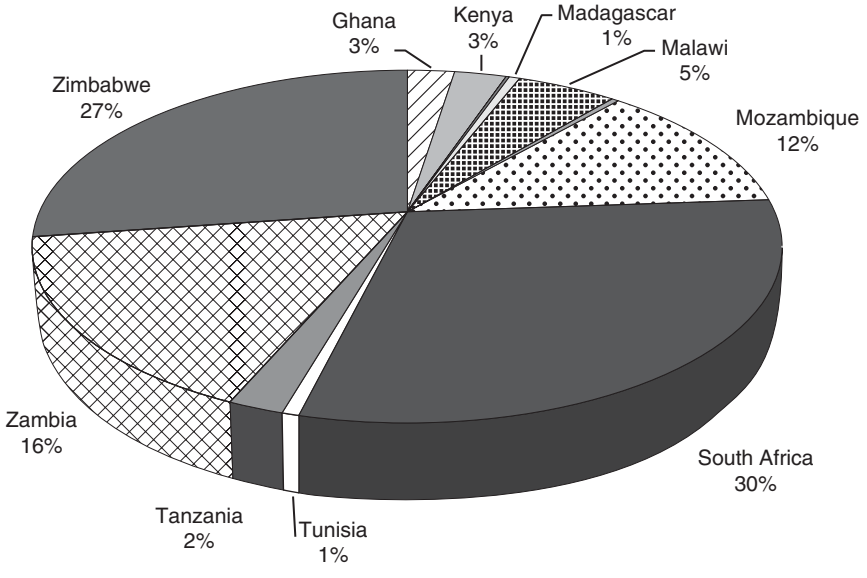

Fig. 1.1. Conservation Agriculture (CA) area in African countries as a percentage of the total 1.2 million hectares (Kassam *et al*., 2015).

countries include Kenya, Ghana, Tanzania, Tunisia, Madagascar, Morocco, Lesotho, Namibia, Sudan and Burkina Faso.

Some large-scale farmers have been able to adopt profitable mechanized CA in several countries, such as South Africa, Zambia, Zimbabwe, Kenya, Tanzania, Morocco and Tunisia. However, in much of Africa, agriculture is dominated by smallholder farmers. They have different sets of drivers and challenges compared with large-scale farmers and they need greater support to adopt and practise CA (Derpsch *et al*., 2015). They use manual labour, animal traction or tractor power. Several participatory approaches to CA adoption and scaling up have been tested successfully. These include Farmer Field Schools, Lead Farmer Networks and No-Till CA Associations. Where mechanization is introduced, a service provider model or a group ownership approach, or a combination, can be suitable depending on local constraints and the nature of the overall development support, including training and access to technical expertise, affordable supply chains and markets.

1.4 Key Stakeholders in the Evolution of CA in Africa

The introduction and promotion of CA for smallholder agricultural and livelihood development in Africa has been championed by the Food and Agriculture Organization (FAO) of the United Nations since the mid-1990s in partnership with non-governmental organizations (NGOs), national governments and research and development partners. Some of the earlier countries

where the FAO Technical Cooperation Projects (TCPs) were implemented in partnership with national governments are Burkina Faso, Kenya, Tanzania, Uganda, Ghana, Sudan, Zambia, Swaziland, South Africa, Mozambique, Lesotho, Eritrea and Egypt. The Soil Fertility Initiative launched by FAO and the World Bank in 1996 supported CA in several African countries.

Promotion and spread of CA in Africa has relied on funding mainly from donor support through specific time-bound projects. One of the exceptionally longer-term programmes, since 1996, has been the Royal Norwegian Government-initiated CA support programme in Zambia with the Conservation Farming Unit (CFU). The programme, which is ongoing and backed by government, has attained remarkable achievements. Other interventions include the Norwegian support to the South African Development Community (SADC) countries through FAO for a period of 4 years from 2008. The Norwegian Agency for Development Cooperation (NORAD), the UK's Department for International Development (DFID) and other donors backed the Common Market for Eastern and Southern Africa (COMESA) climate-change project efforts, extending from the SADC to the East African Community (EAC). Other projects include: support to the smallholder CA project in West Africa (Burkina Faso, Guinea and Niger) funded by the International Fund for Agricultural Development (IFAD) and implemented by the African Conservation Tillage network (ACT), the World Agroforestry Centre (ICRAF) and the Agricultural Research Centre for International Development (CIRAD); IFAD-funded support to CA in four SADC countries implemented by the International Maize and Wheat Improvement Centre (CIMMYT); and ACT's capacity-building to research workers and extension officers from SADC countries with support from SADC, European Union (EU), German Development Cooperation (GIZ), FAO, Regional Land Management Unit (RELMA) and LandCare South Africa.

ACT and partners organized the FAO-sponsored Third World Congress on Conservation Agriculture in Nairobi, Kenya, in 2005 (proceedings at http://www.fao.org/ag/ca/doc/IIIWCCA.pdf). The event created the much needed awareness about CA for policy makers, research and development practitioners, farmers and the private sector. Other prominent international NGOs and development organizations that are promoting CA in Africa include: CONCERN Worldwide, Canadian Food Grains Bank, CARE International, Total LandCare, Howard Buffett Foundation and Aga Khan Foundation. The Alliance for a Green Revolution in Africa (AGRA) sponsored by the Gates Foundation and the Rockefeller Foundation began supporting CA in partnership with ACT from 2012 through their Soil Health Projects in Kenya and Tanzania. In addition, there are several national-level NGOs that are promoting CA, namely: Kwa-Zulu Natal No-till Association in South Africa; Conservation Farming Unit (CFU) in Zambia; Foundation for Development in Zimbabwe; and Association pour la Promotion d'une Agriculture Durable (APAD) in Tunisia.

The focus of most CA initiatives has been on: food security and livelihood development; participatory adaptive research with smallholder farmers for technology development for sustainable production; and advocacy for public

and private sector support. Such initiatives are bound to have significant implications for adoption and spread of CA in the region, and need to be supported and encouraged.

The private sector has also contributed significantly to the current status of CA in Africa. The main stakeholders include large-scale farmers (e.g. in South Africa, Kenya, Tanzania, Zambia and Zimbabwe), CA equipment manufacturers and distributors, and agricultural input suppliers. Their successful implementation of CA, especially in marginal and diverse conditions, has provided useful learning platforms for other farmers, policy makers and development organizations. Some large-scale farmers have even introduced outreach programmes to support smallholder neighbouring farmers.

Engagement of Regional Economic Communities (RECs) across Africa in the promotion and uptake of CA is considered to be essential but currently it is weak. RECs are expected to ensure the existence of a conducive development environment for all stakeholders to play their respective roles. Good policy environment, commitment of national governments, and public and private sector institutional support are key to successful implementation of CA and climate-smart agriculture (CSA) programmes in Africa. It is therefore necessary to have a regional platform where regional bodies can share evidence-based CA information to enable the formulation and implementation of policies and institutional strategies that can attract investments to support the introduction, adoption and spread of CA as a core component of CSA initiatives.

The importance and role of CA in sustainable agricultural growth and economic development has been clearly documented and can, therefore, be considered as the most appropriate entry point in transforming agricultural production in Africa. However, as noted already, the adoption and spread of CA in Africa has been slow, due to the challenges and constraints outlined above and in this book. Addressing these challenges and constraints requires interventions at higher levels to ensure development of appropriate policies and regulatory frameworks to support adaptation, adoption, scaling up and mainstreaming of CA and to attract the private sector to invest and develop CA supportive businesses around agricultural commodity value chains and input supply chains.

1.5 New Partnership for Africa's Development (NEPAD)

NEPAD is a programme of the African Union (AU). It was established in 2001 to create institutions and mechanisms that will work to achieve Africa's development objectives (Landsberg, 2008). Realizing that Africa as a region can only take its proper place in the international community if it gains economic strength, the AU Assembly of Heads of State and Government (HSG) set an ambitious target of 7% annual growth rate in gross domestic product (GDP) over the next 20 years to eradicate poverty, achieve food security and build the foundations of sustainable economic development on the continent. The AU and its NEPAD programme intend to mobilize domestic and external

resources and to establish new forms of partnership with domestic and international organizations, thus creating development opportunities for regional and sub-regional institutions.

At continental level, AU-NEPAD hopes to eradicate poverty in Africa and to place its countries on a path of sustainable growth for the next 15 years. It is a commitment of African countries, both individually and collectively, to the former Millennium Development Goals (MDGs) and the new Sustainable Development Goals (SDGs). NEPAD believes that improvement of the performance of the agricultural sector is a prerequisite in meeting its set targets for economic development. It further recognizes that improving the productivity of agriculture rests on dealing effectively with a number of critical constraints such as climate variability, poor rural infrastructure, unsupportive policies and weak institutional and regulatory frameworks. Regional and sub-regional institutions are expected to play a lead role in spearheading science and technology in the development of sustainable food and agriculture systems.

1.6 Comprehensive African Agriculture Development Programme (CAADP)

CAADP was established by AU-NEPAD in July 2003 as the highest-level policy framework for the coordinated transformation and development of agriculture in Africa, as well as for wealth creation, food security and nutrition, economic growth and prosperity for all. The overall goal of CAADP is to 'help African countries reach a higher path of economic growth through agriculture-led development which eliminates hunger, reduces poverty and food insecurity, and enables expansion of exports'. CAADP is a growth-oriented agriculture development agenda aimed at increasing agricultural growth rates to 6% per year to create the wealth needed for rural communities and households in Africa to prosper. To achieve this goal, CAADP focuses its interventions in four key pillars to achieve measurable outcomes:

- Pillar 1: extending the area under sustainable land management and reliable water control systems;
- Pillar 2: improving rural infrastructure and trade-related capacities for market access;
- Pillar 3: increasing food supply, reducing hunger and improving responses to food emergency crises; and
- Pillar 4: improving agriculture research, technology dissemination and adoption.

CA, as a climate-smart concept and approach to sustainable agricultural intensification and land management, has a major contribution to make to all four CAADP pillars. At the continental level CA has been incorporated into the regional agricultural policies of NEPAD as part of the responses to food insecurity and rising food prices, as well as embracing climate-change adaptation and mitigation measures, in sustainable land management practices.

The AU Assembly meeting in June 2014, in Malabo, Equatorial Guinea, adopted the Malabo Declaration on CAADP and commitment to accelerate 'Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods' (AU Assembly, 2014a). The Declaration included: (i) commitment to ending hunger by 2025; (ii) commitment to halving poverty by 2025 through inclusive agricultural growth and transformation; and (iii) commitment to enhancing resilience in livelihoods and production systems to climate variability and other shocks. A decision from the same meeting on the report of the chairperson of the NEPAD Heads of State and Government Orientation Committee (HSGOC) endorsed the NEPAD Programme on Agriculture Climate Change, with its components on gender empowerment, support to smallholder farmers and the establishment of an African Climate-Smart Agriculture Coordination Platform (AU Assembly, 2014b). It is through the Platform that the Planning and Coordinating Agency (NPCA) will collaborate with partners, including RECs and NGOs, targeting 25 million households by 2025, branded as Vision 25 × 25.

Around a common set of standards, the AU-NEPAD Agriculture Climate Change Programme will rally and coordinate efforts in four interrelated impact and action areas. These are: (i) training, nurturing and skills development (formal and informal) in both technological knowledge and skills as well as management; (ii) improved availability and accessibility to relevant and appropriate CSA practices and CSA support technologies for enhanced community-level adaptive capacity in the face of climate variability, shocks as well as long-term changes; (iii) strengthening and aligning evidence-based policies and institutions to foster enabling environment for CSA development and scaling up, to be pursued through, among others (a) data and analytical support to policy processes, (b) strengthening and informed public voice, (c) local farmer/practitioners associations and purpose-clubs, and (d) champions in various constituencies; and (iv) markets and trade facilitation – from determining the commodities through to marketing and possibly local processing. This dimension is intended to facilitate examination of the viability of the farm production systems in which CSA practices are applied.

The Africa Climate-Smart Agriculture Alliance is Africa's leading initiative to catalyse and foster championing of result-oriented, on-the-ground implementation support towards the attainment of the Africa Union Vision. Operationalized within National Agriculture and Food Security Investment Plans (CAADP NAIPs), National Adaptation Programmes of Action (NAPA) and Nationally Appropriate Mitigation Actions (NAMAs), the Alliance aims to rally public, political, technical and financial action to catalyse and support local systems for expanded and accelerated scaling up of CSA. The 1st Africa CSA Alliance Forum took place in May 2015 in Addis Ababa, Ethiopia.

All CA stakeholders in the public, private and civil sectors, and particularly ACT, who are promoting the adoption and spread of CA in Africa for sustainable production intensification have a major contribution to make to the achievement of the agricultural growth and transformation commitment of the Malabo Declaration on CAADP as well as to the NEPAD Agriculture Climate Change Programme.

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