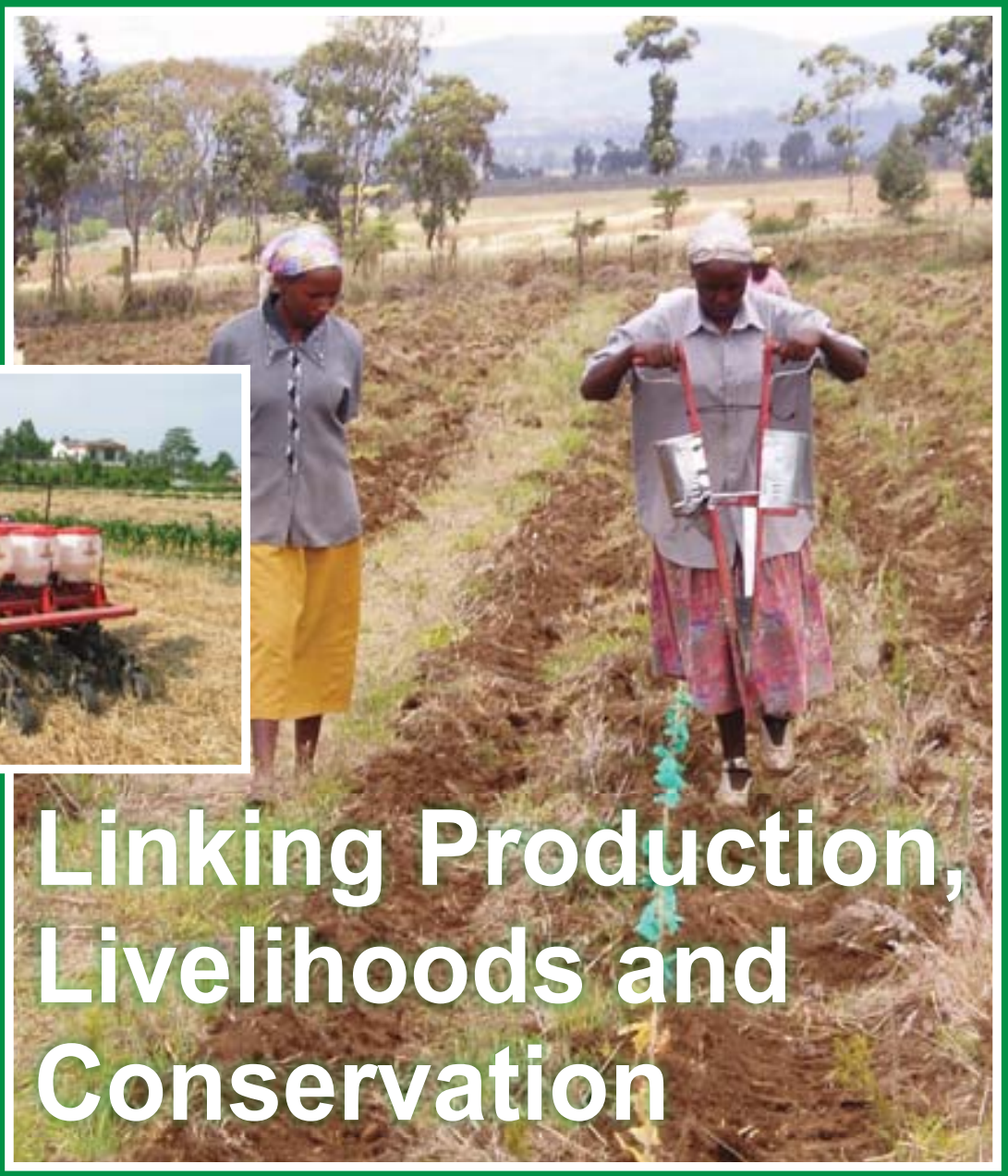
III WORLD CONGRESS ON CONSERVATION AGRICULTURE

ACT



Linking Production, Livelihoods and Conservation

PROCEEDINGS OF THE THIRD WORLD CONGRESS ON CONSERVATION AGRICULTURE

3 - 7 OCTOBER 2005 NAIROBI, KENYA

III WORLD CONGRESS ON CONSERVATION AGRICULTURE

Proceedings of the Third World Congress on Conservation Agriculture

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Foreword

Before presenting its bid to host the third World Congress on Conservation Agriculture at the global level, Kenya requested and was blessed by the support of other African colleagues, in its bid to host the Congress, during the Siavonga, Zambia forum. As part of the process for a collective African initiative to prepare for Africa's inputs to the 2nd World Congress on Conservation Agriculture (CA) in Brazil, an international forum was held from 19th to 23rd May 2003 in Siavonga, Zambia. The workshop endorsed the idea of Africa hosting the 3rd World Congress on Conservation Agriculture (CA) in 2005. The forum noted that Africa, as a continent, needs urgently to address the fight against poverty and food security through increased sustainable agricultural production.

Indeed it is probable that, famine, the impact of recurrent drought and the curtailed socio-economic development or even labour shortcomings due to the HIV/AIDS pandemic, can be mitigated through CA.

Each part of Africa has its unique and diverse characteristics, which would make hosting the Congress in the continent both interesting and appropriate in terms of realising the objectives and needs of the world CA community. Between strong contenders for South Africa and Ghana, the workshop endorsed Kenya as Africa's host for the World Congress on CA in 2005. Apart from being an important African tourist centre renowned for its hospitality, Kenya has much experience and capacity in hosting large international gatherings. I am glad that the participants and stakeholders sampled something of what the country had to offer during the Congress.

As a country, Kenya has the advantage of being host to a number of regional and other international organizations which the Congress was able to make use of in terms of logistical support, including equipment, personnel and finance, to make the Congress a success. Further, Kenya is one of the leading African countries in infrastructural development and has a wealth of experience in hosting international conferences in addition to having excellent internal and external communication networks with other African countries and the rest of the world. All this made Kenya an ideal choice for the conference.

Conservation Agriculture is about planting quality seed without ploughing, and reducing weeding labour by leaving the soil permanently covered with mulch or cover crops. Conservation agriculture brings together the principles of soil and water management, knowledge of crop rotations, agro-forestry and pest management. CA is an approach that reduces operational and input costs, including labour, while increasing yields and protecting our farm-land and its water resources.

I am happy to note that the Congress, which was officially opened by His Excellency, The Vice-President Dr. A A Moody Awori, was ably organized by: the African Conservation Tillage Network (ACT), the Ministry of Agriculture of the Republic of Kenya and the Kenya Conservation Tillage Initiative (KCTI) in association with the New Partnership for Africa's Development (NEPAD).

Since the organization of the Congress was global, the government contributed and participated in the following ways:-

- Provision of personnel through Ministry of Agriculture, KARI and other relevant Government Institutions to co-ordinate as hosts, assist in the organization in addition to serving as Congress liaison officers.
- Providing necessary support to the local delegates and Congress observers.
- Providing office accommodation, transport and pre-conference facilities; and hosting the Congress delegates' reception.

The overall objective of the World Congress was to bring together researchers, technicians, professors, farmers, students, environmentalists and others interested in exchanging experiences and knowledge on CA and its benefits and perspectives for sustainable development in different countries. This was achieved through discussing aspects related to CA over a wide spectrum and also charting the direction for future years. It was also achieved through promoting debate, scientific presentations and exchange of practical experiences about world advances in CA.

During the Congress, a CA Manual for Africa was launched. The main challenge now is to encourage the farming community, extension workers and other stakeholders to make use of the information contained in the manual. I am convinced that the true spirit of sharing of information evident during the conference will continue for the betterment of the entire world in making CA a reality not only in Africa but everywhere.

With the vigorous implementation of the valuable knowledge and lessons on experiences and advances in CA exchanged in the Congress, CA will contribute Africa's areas of concern and priorities such as food security, poverty reduction and the mitigation of the effects of HIV/AIDS.

Hon. William Ruto, E.B.S, MP.
Minister for Agriculture
Republic of Kenya

Nairobi, November 2008

Preface

In response to concerns about the perceived negative environmental impact of conventional farming practices, whether high or low-input, farmers and other stakeholders in the USA, Brazil, Australia and Argentina, have developed revolutionary farming practices usually labeled under the term “Conservation Agriculture”. They share an emphasis on applying three main principles for managing agro-ecosystems: minimizing soil disturbance (from reduced tillage to no tillage at all), providing permanent soil cover (through crop residues, cover crops, and agro forestry), and diversifying crop rotations. Conservation Agriculture in its different forms is currently practised on about 100 million ha worldwide, in more than 50 countries and the area is expanding as well as the types and number of farmers practising it. Depending on the situation, farmers are attracted primarily by either reduced production costs or by soil improvements and increased as well as stabilized yields.

As this Congress took place in Africa where agriculture is mainly in the hands of resource poor smallholder farmers, the introduction of CA practice is challenged by specific constraints, notably a poorly developed infrastructure and difficult access to information. Nevertheless, CA is expected to benefit African farmers, smallholders as well as larger commercial farmers, as it has benefited farmers in other parts of the world. There is great hope that CA will reduce labour requirements and will relieve especially women and children from drudgery. This will also be a means to mitigate the impact of HIV/AIDS, which has seriously affected the labour force of many farm households. CA is hoped, too, to stabilize and even improve yields on the vast areas of marginal land opened for crop production because of increasing land pressure and to mitigate the impact of the frequent droughts hitting the continent and causing hunger and malnutrition by a more efficient use of the scarce rainwater.

It is evident that a successful and lasting introduction of CA practices requires changes not only on the side of farmers but on the side of the other stakeholders in the agricultural sector, too, notably agricultural administration, extension services, education and training institutions and farm service providers. Major challenges farmers are facing, when adopting CA practice are the access to affordable and appropriate, high quality CA implements for different sources of farm power (manual, animal traction, tractors) and to specific herbicides, access to high quality advisory services and information. Adaptation and adoption of CA systems means learning anew, being patient, accepting set backs and paying learning costs, not listening to neighbours who “know already that this will fail”. A major obstacle to overcome, especially in semi-arid environments is the management of crop residues and covercrops, in the face of competition with livestock. Not only farmers are challenged but also politicians who need to create supportive framework conditions, such as secure rights of land use, incentives for manufacturers of CA implements and credit lines or subsidies for farmers wanting to purchase the implements.

Last but not least, local adaptation of CA principles requires the use of highly participatory and flexible approaches to innovation development involving multiple stakeholders interacting among themselves.

Under these circumstances, the III World Conservation Agriculture Congress was held in Nairobi (Kenya) on 3 to 7 October 2005 with the theme "Linking production, livelihoods and conservation". One of the objectives of the Congress was to offer knowledge and information to guide informed decisions on how to apply Conservation Agriculture in its bid to increase the extent to which the CA agenda is adopted among all stakeholders (farmers, researchers, input suppliers and development agencies).

These proceedings present a compilation of scientific papers, articles, keynote presentations and other contributions made by scientists, researchers, policy makers and farmers during the Congress period. They also synthesize the outputs of discussions held in small groups on key topics related to CA development and impact, as well as summaries of meetings held by special interests groups such as farmers and the agribusiness. The proceedings are available, too, on a CD together with all the papers and the posters presented during the Congress.

The existence of such diversified outputs clearly demonstrates the usefulness of the Congress to identify the need for pursuing adequate research and development efforts on aspects such as local adaptation of CA principles, creation of enabling policy and institutional environments; so that CA may spread more widely among farmers who need such practices in Africa and elsewhere to meet the ever-growing demand for food, for reduced rural poverty, and for utilizing natural and human resources in an environmentally, socially, and financially sustainable way.

Acknowledgements

The Congress Organizing Committee hereby wishes to thank all the participants of the III World Congress on Conservation Agriculture held from the 3rd to 7th October 2005 in Nairobi, Kenya for their active participation and involvement in the event. We thank the government representatives from Kenya, Zambia and Lesotho, representatives of the international organizations and development partners, the Africa Union New Partnership for African Development (NEPAD), farmer representatives, private sector players and civil society organisations present at the congress. In particular the committee wishes to recognize the active involvement of participants from the host country Kenya, and from Algeria, Australia, Austria, Bangladesh Belgium, Benin Botswana, Brazil, Burkina Faso, Cameroon, Chad, Congo Brazzaville, Czech Republic, Eritrea, Ethiopia, Finland, France, Georgia, Germany, Ghana, Guinea, India, Iran, Ireland, Italy, Kazakhstan, Laos, Lesotho, Madagascar, Malawi, Mali, Mexico, Mozambique, The Netherlands, Nigeria, Pakistan, Philippines, Portugal, Russia, Spain, South Africa, Sweden, Switzerland, Tanzania, Tunisia, Uganda, UK, Ukraine, USA, Vietnam, Zambia, and Zimbabwe.

The committee wishes also to recognize and appreciate the support from the Kenyan government through the Ministry of Agriculture, from the Food and Agriculture Organisation of the United Nations (FAO), French Centre for International Co-operation and Agricultural Research for Development (CIRAD), German Development Cooperation (GTZ), Agence Française de Développement (AFD) and Swedish International Development Cooperation Agency (SIDA). Their financial and material support was crucial for the success of the event.

These proceedings are the result of a writeshop held at the ACT Secretariat, Nairobi, from 10-21 November 2008, an activity within the Conservation Agriculture for Rural Development (CA-SARD) Trust-Fund project of the German Ministry of Food, Agriculture and Consumer Protection (BMELV). The writeshop comprised a team of eight editors from five institutions:

ACT: Saidi Mkomwa, Hamisi Mzoba, Tom Apina
FAO: Josef Kienzle, Brian Sims
CIRAD: Bernard Triomphe
GTZ: Kurt Steiner
Ministry of Agriculture, Kenya: Mwamzali Shiribwa

Finally we would like to recognize the role played by the Congress Organizing Committee (COC) in making the event a success. Members of the COC included the following:

1. Edward Chuma (Chairperson)
2. Martin Bwalya (Executive Secretary)
3. Soren Damgaard Larsen, RELMA-in-ICRAF
4. Kurt Steiner, GTZ
5. Bernard Triomphe, CIRAD
6. John Ashburner, FAO
7. Josef Kienzle, FAO
8. Pascal Kaumbutho, KENDAT
9. Timothy Simalenga, ARC, S.Africa
10. Frank Place, ICRAF
11. Jane Wamuongo, KARI
12. Charles Mwanda, MoA Kenya
13. Shiribwa Mwamzali, MoA, - Kenya
14. Gospel Omanya, ICRISAT
15. Jimmy Kiio, ICRAF
16. Kamuri Mumbi, GTZ Nairobi
17. Hottensiah Mwangi, KARI
18. P.T Gicheru, KARI
19. Torsten Andersson, Sida
20. Adolf Nyaki, MoA, Tanzania
21. Reynolds Shula, ASP, Zambia
22. Qureish Noordin, ICRAF
23. Nuhu Hatibu, SWMnet

It is our sincere hope that participation in this world Congress was a worthwhile investment of time and resources. We are hopeful that the collaboration with all participants and institutions will continue to ensure that this Congress does not become just another mark in the annals of history, but a significant step towards a fruitful cooperation aimed at a wider adoption of CA all over the world.

Saidi Mkomwa
Executive Secretary, ACT

Executive Summary

Following the 1st Conservation Agriculture World Congress in Europe (Spain, 2001), the 2nd in Latin-American (Brazil, 2003), Africa was chosen to host the 3rd Congress which was held in Nairobi, Kenya, 3-7 October, 2005. The Congress was organized by the African Conservation Tillage Network (ACT) with strong support from the Government of Kenya and technical and financial support from bi-and multilateral development and research organisations, particularly GTZ, SIDA, AFD, CIRAD, CIMMYT, ICRAF and FAO. The Congress, with the theme of "Linking Production, Livelihoods and Conservation", aimed at providing evidence that conservation agriculture is a means of not only sustainable agricultural production but also of improving the livelihood of rural households, especially farming families.

More than 500 experts from development agencies, research institutions, agricultural administration and extension, agribusiness players and farmers participated in the congress. The Congress organizers aimed at an event that differed from conventional scientific congresses, by providing enough space for thematic workshops, ad-hoc discussion groups, and meetings of interest groups like farmers and representatives of agribusinesses. This was only possible by limiting the number of oral presentations to 15 invited keynotes focusing on specific issues of conservation agriculture. All the other submitted papers were not orally presented but made available to participants on the Congress CD.

The Congress was to become a forum for exchange of experience and knowledge of conservation agriculture practices under the various agro-ecological and socio-economic circumstances on the five continents. The output of the Congress is captured and synthesized in a systematic manner and will be incorporated into the "Knowledge and Information Management Forum" managed by ACT. This forum makes knowledge and experience from all over the world available to members of the ACT network as well as other interested persons.

The keynote papers provide an overview on the status and achievements of conservation agriculture in different parts of the world. While some papers reported on achievements attained so far in particular countries like China, Kazakhstan, USA, Tanzania and South Africa, other papers focused on CA machinery, technical issues like weed control with herbicides; while some papers addressed key issues of global interest, in particular the achievement of the MDGs; the declining fresh water sources for food production; carbon emissions; or sustainable resource management in agriculture. All the papers emphasized the great potential of conservation agriculture to contribute to solving problems at the farm as well as at the global level. To make use of this potential, CA has to be disseminated on a broad scale. How to enhance this dissemination, identification of entry points, dissemination approaches, supportive policies; were all important questions addressed by the papers. A wider concern was the need for knowledge management, i.e. to make a systematic collection and synthesis of the experiences and knowledge gained with the view of making it available to a broad public.

The keynote papers were immediately discussed in small groups and the outcomes captured. Several thematic working groups as well as ad-hoc discussions groups allowed all participants to interact and exchange their experience with colleagues from other countries and continents. The outcome of these discussions was captured and synthesized in a systematic way. Nine major thematic areas were defined, regarded as key to conservation agriculture. For each theme the opportunities it provides to overcome certain constraints; the problems adoption is facing; challenges to meet; and the strategies required to facilitate a wide adoption and dissemination of CA systems were briefly summarized. Most extensively discussed were the socio-economic and cultural dimensions of adoption CA practices and its impacts. Major aspects discussed in more depth were CA as a response to food security needs and poverty; mainstreaming gender and HIV/AIDS related issues; labour demands; cost-benefit advantage of using CA compared to conventional practices. Related to this was the theme “dissemination of CA practices”. Strategies were discussed for efficient dissemination approaches, training and generation of broad impact; approaches and skills for facilitating farmer learning processes; farmer empowerment through strong farmer organizations; and supportive policies including land tenure security. Themes broadly discussed included the technical challenges and issues in CA adoption, especially the question of targeting CA technologies across agro-ecologies and farm types. This includes appropriate implements for the different situations as well as availability and access by farmers. Other important themes were the increase of rainwater productivity, i.e. efficient use of rainwater in drought prone regions; environmental services rendered by CA and compensation of farmers; combining CA and Agroforestry, especially the question of integrating CA and AF in a holistic manner into the farming system. Supportive policies were regarded as essential for CA adoption and dissemination, thus various aspects of this issue were discussed, amongst others the access to CA implements and other inputs like covercrop seeds and herbicides. Provision of market information, credit schemes or subsidies were proposed solutions. Government support to manufacturers of CA implements was considered necessary, as manufacturers hesitate to invest in production due to the uncertain demand. Research and development programmes are still required to provide answers to technical questions, like appropriate covercrops, and socio-economic issues like appropriate dissemination approaches; monitoring of impact; and documentation of impact, experience and knowledge generated.

Field visits to CA programmes in different regions of Kenya and Tanzania allowed participants to get an insight of the advances made and of the problems encountered by farmers due to environmental and socio-economic constraints.

As small farmers would have difficulties in following the oral presentations and actively participating in the Congress discussions, a farmers' forum was organized, where farmers could exchange their own experiences with farmer colleagues from other countries. Representatives of the private sector, mainly implement manufacturers from East Africa, and Brazil organized their own meeting and discussed, as well as technical issues and required government support, ways of cooperation including joint ventures.

In side events the way forward was discussed, especially international and global collaboration in promotion of CA; the development of the ACT network to a Pan-African CA Networking thrust, and in this context a closer cooperation with the francophone countries in West Africa.

At the end of the workshop the representative of the Indian Conservation Agriculture Network invited all participants to the IV World Congress on Conservation Agriculture to be held in February 2009 in New Dehli.

Acronyms

ACT	African Conservation Tillage Network
AEZ	Agro-ecological Zones
AF	Agroforestry
AFD	Agence Française de Développement
ARI	Agricultural Research Institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AU	African Union
CA	Conservation Agriculture
CAAPAS	La Confederación de Asociaciones Americanas para la Producción de la Agricultura Sustentable
CA-KIMF	Conservation Agriculture - Knowledge and Information Management Forum
CAP	Common Agricultural Policy
CBD	Convention on Bio-diversity
CBO	Community Based Organization
CCD	Convention for Combating Desertification
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CIMMYT	International Maize and Wheat Improvement Centre
COC	Congress Organizing Committee
COMESA	Common Market for Eastern and Southern Africa
CT	Conservation Tillage
ECAF	European Conservation Agriculture Federation
ECOWAS	Economic Community of West African States
EPAGRI	Empresa de Pesquisa Agropecuária e Difusão de Tecnologia de Santa Catarina (Brazil)
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GFAR	Global Forum for Agricultural Research and Development
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immuno Deficiency Syndrome
ICRAF	International Centre for Research in Agroforestry (World Agroforestry Centre)
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
IIIWCCA	Third World Congress on Conservation Agriculture
IMWI	International Water Management Institute
INRM	Integrated Natural Resource Management
ISFM	Integrated Soil Fertility Management
LAMP	Land Management Programme (Tanzania)
KARI	Kenya Agricultural Research Institute
KCTI	Kenya Conservation Tillage Initiative

M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
NAFTA	North America Free Trade Agreement
NEPAD	New Partnership for Africa's Development
NGO	Non Governmental Organization
NT	No-Till(age)
OM	Organic Matter
PRA	Participatory Rural Appraisal
PRS	Poverty Reduction Strategy Programme
R&D	Research and Development
SADC	Southern Africa Development Community
SARI	Selian Agricultural Research Institute (Tanzania)
SCAPA	Soil Conservation and Amelioration Project Arusha
RELMA	Regional Land Management Programme
SAKSS	Strategic Analysis and Knowledge Support System
SIDA	Swedish International Development Cooperation Agency
SOM	Soil Organic Matter
UK	United Kingdom
UN	United Nations
USA	United States of America
USD	United States Dollar
WFP	World Food Programme of the United Nations

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CONGRESS BACKGROUND

Background to the Congress

African Heads of State and government during The World Summit on Sustainable Development Meeting held in Johannesburg in August 2002 decided to put agriculture among their highest priorities in light of the sector being the largest contributor to GDP and employment in most of the African countries.

An ambitious target of 7% annual growth of GDP over the next 15 years through increased productivity and competitiveness of the agriculture sector was set, while focusing on six major constraints hindering progress in African agriculture:

- The problem faced by rural populations in getting access to the resources required for investment in agriculture, relative to people living in urban areas
- Inadequate and inefficient agricultural systems
- Low purchasing power of rural people
- Climate uncertainties and lack of access to irrigation
- Weak institutional support (research and extension services)
- Inadequate attention by donor and multilateral institutions to the agricultural sector
- High prices of inputs
- Conflict of demand for crop residue between livestock and the CA principle of permanent soil cover

In recognition of the benefits of CA practices, the opportunity to change the way the world farms and the new opportunity to build sustainable food security, FAO, EU, ECAF (European Conservation Agriculture Federation) and others organized the I World Congress on Conservation Agriculture in Madrid, Spain in October 2001. The II World Congress was held in August 2003 in Brazil after that country successfully bid to host it.

Brazil has millions of farmers now practising CA after 30 years of pioneering work that has proved that indeed CA can be beneficial for both crop yields and the environment. Under CA, Brazil has achieved maize yields of 9 tonnes while African maize yields are a mere 1 tonne per hectare.

It was against this background that it was believed that CA applications need to be focused and discussed for Africa's food security needs. African agriculture features unique peculiarities that need to be brought to the attention of the world. It is with this realization that Africa viewed itself as the best host for the forthcoming III World Congress on Congress on Conservation

Agriculture and this was the reason for bidding to host it. Conservation farming is not a totally new concept to Africa. Manual pitting systems for conserving soils and water (e.g. the *matengo* pits in Tanzania and z*ai* pits in Burkina Faso) have been practiced by farmers over centuries.These indigenous methods are the starting point for development of appropriate CA practices for the continent.

i Why Kenya

Kenya offers a representative cross- section of farming systems and agro-ecological zones, ranging from the grasslands to the hillside and hill-top agricultural communities and has both large-scale and smallholder farmers practicing CA. Kenya merged Congress hostingefforts with the northern Tanzania Arusha region where (like Kenya) CA pilot trials are being transformed into common practice with dramatic development impact. The post Congress tours visited CA sites in both Kenya and Tanzania (see chapter 4).

Kenya's efforts in the development and promotion of CA include the well established large-scale farming and upcoming smallholder farmers who have recently adopted CA practices. Indeed, the Congress participants received 'feet-on-the ground' exposure to the realities of CA in Africa. These offered a challenging context for the review and analysis of global trends on the issues and concerns revolving around the advancements of CA in Africa. In planning the Congress it was envisaged that the challenges of getting smallholder agriculture to contribute commercially to industrial demands and economically to national and international consumers would be prominent.

Kenya requested NEPAD to endorse the bid to host the III World Congress and to provide the operational Africa platform for the Congress. The Congress preparations and hosting was an excellent opportunity to bring food security issues to the fore, not just for Kenya but the entire African continent.

Kenya's justification and desire to host the Congress was further strengthened by the benefits that would be derived from the Congress namely:-

- Exchange of technological information on conservation agriculture, trade opportunities that will result from the Congress will lead to Kenya's improvement in agricultural production, increased foreign exchange earnings and exposure as a potential international conferences centre.
- The Congress would facilitate Kenya in hosting the African Conservation Tillage Network and its secretariat for the next two years. This would in effect attract grants for supporting the secretariat.
- The linkages Kenya would establish with other member countries about CA development during the Congress and through the ACT secretariat would enhance the country's future capacity to exchange information and knowledge on CA related activities.

The exposure and experience that ACT (and perhaps a rejuvenated KCTI) would gain from the Congress can assist the organizations to strengthen their membership and capacity to implement their objectives thus strengthening the agriculture industry in the region.

ii Congress Theme

The Congress was organized by a multi-partner team coordinated by the African Conservation Tillage Network (ACT). Key partners in the organizing team included Government of Kenya, FAO, GTZ, ICRAF-RELMA, CIRAD, CIMMYT, SADC, NEPAD, KCTI and CAAPAS.

The Congress brought together about 600 participants from over 62 countries worldwide. These were key stakeholders who included agricultural specialists, environmentalists, economists, farmers and farmer organizations, donors, private sector, training institutions, government and non-governmental organizations involved in agriculture and rural development. There was an active participation of two Ministers of Agriculture (from Zambia and Lesotho) and representation from the African Union's New Partnership for Africa's Development (AU-NEPAD) and the UN Hunger Task Force.

The III World Congress on Conservation Agriculture had the theme “Linking production, livelihoods and conservation”. One of the Congress objectives was to offer knowledge and information to guide informed decisions on how to increase the extent of CA adoption among all stakeholders (farmers, researchers, input suppliers and development agencies).

iii Congress Process

These Proceedings capture the synthesis of the discussions and outputs of 10 facilitated thematic sessions (cornerstones of the CA knowledge management Framework - (see Chapter 5), with a total of 17 mini-workshops. It is hoped that it will serve as the initial basis of a revitalized knowledge platform on CA. To achieve our objective all the 17 mini-workshops were facilitated in the following manner:

i. Keynote presentations gave an insight to a range of topics and generated discussions pertaining to the theme in question.
ii. Issues were quickly distilled in small groups after each presentation.
iii. At the end of all the presentations the facilitators facilitated summarizing the key issues that had emerged from the groups.
iv. Participants were divided into groups to discuss the emergent issues in the light of the questions below.

- What are the **implications** of these issues with regard to using CA as an approach to improving people's wellbeing in terms of productivity and environmental conservation?

- What are the **strategies** for dealing with these issues to promote CA as a way of improving people's wellbeing and environmental conservation?
- Where is the **knowledge** and experiences (e.g. case studies, examples) that we can tap into to deal with these issues?

v. All mini workshop outputs were captured electronically and given to theme rapporteurs who made an overall report of the discussion outputs and these provided the basis for this synthesis report.

These Proceedings address the issues and their implications in terms of opportunities, problems and therefore the challenges presented (see Chapter 3). The promising strategies to address the challenges are also presented. Areas of linkages between the issues have been highlighted as an initial step towards systematising the framework. What the Proceedings does not include are the possible ways of implementing the proposed strategies and the sources of knowledge; these were not adequately addressed in the mini-workshops.

iii Congress Preparation

The Congress Organizing Committee (COC) whose secretariat was based in the ACT Nairobi office was behind the success of the event. The structure of the committee was a two tier system with local and international staff operating in parallel but complementing each other. The members of the COC included international organizations, national governments, NGOs, private sector representatives and farmer organizations.

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CONGRESS OPENING AND KEY NOTE PRESENTATIONS

Opening speech by the Guest of Honour

Speech by His Excellency The Vice President and Minister for Home Affairs, Hon. Dr. A. A. Moody Awori, EGH, M.P., During the Official Opening of The Third World Congress on Conservation Agriculture on 3rd October, 2005.

Honourable Ministers, Members of Parliament, Senior Government Officials, Members of Diplomatic Corps, Sponsors, The Chairman of the Congress Organizing Committee, Chairman of The African Conservation Tillage Network, Distinguished Guests,

Ladies and Gentlemen,

It is my pleasure to welcome you to Kenya for the III World Congress on Conservation Agriculture. Kenya is a wonderful country and it is my belief that during your stay here, you will enjoy the hospitality of Kenyans and our rich national heritage.

Ladies and Gentlemen,

In recognition of the benefits of Conservation Agriculture (CA) practices and a new opportunity to build sustained food security, FAO, EU, ECAF (European Conservation Agriculture Federation) and other stakeholders organized the 1st World Congress on Conservation Agriculture in Madrid, Spain in October, 2001. Some 800 delegates met and exchanged experiences on the benefits of CA and came up with the FAO endorsed Declaration of Conservation Agriculture. The 2nd World Congress was held in August 2003 in Brazil where almost 800 delegates attended.

It was agreed in Madrid that farming with minimal soil disturbance, breaking hard pans that curtail rainwater infiltration and targeting permanent soil cover with the right crop rotations is the way to farm in the future.

Brazil has 30 million hectares of land under CA after 30 years of pioneering work that has indeed proved CA can advance to no-till levels with great benefits to all, and the environment. Under CA, Brazil has maize yields averaging 9 tonnes per hectare. Farmers who do not weed any more have more time for other activities such as poultry and pigs. In Africa, maize yields average a mere 1 tonne per hectare! It is expected that this movement will spearhead and continue to pioneer the future development of agriculture in the entire world.

Ladies and Gentlemen,

The bid for the III World Congress in Africa started with The Africa Platform at Siavonga, Zambia. As part of the process for a collective

African initiative to prepare for Africa's inputs to the 2nd World Congress on Conservation Agriculture (CA), an international forum was held from 19th to 23rd May 2003 in Siavonga, Zambia. In attendance were 38 participants drawn from concerned stakeholder institutions or individuals in 13 countries.

The forum noted that, as a continent, Africa needs urgent redress in the fight against poverty and food insecurity through agriculture. Indeed now, famine, the impact of recurrent drought and the curtailed socio-economic development or even labour shortcomings due to HIV/AIDS pandemic can be mitigated through CA.

The hosting of the World Conservation Agriculture Congress will help Africa articulate her own peculiar agricultural conditions, and define the entry point to food security. It will help contribute to the global thrust for a productive and at the same time environmentally friendly farming. I am pleased to note that the theme of this congress is "Linking Production, Livelihoods and Food Security".

Acknowledging that this forum has become of age, it is my conviction and that of the Government of Kenya that, time is now ripe for the Congress fraternity to come up with a Permanent Secretariat which I am reliably informed is the desire of many in this conservation agriculture fraternity.

Ladies and Gentlemen,

Each part of Africa has its unique and diverse characteristics, which could make hosting this Congress interesting and appropriate in terms of realising the objectives and needs of the World Congress. I am pleased that the workshop endorsed East Africa, specifically Kenya as Africa's host for this World Congress on CA. Apart from being Africa's tourism centre for African Hospitality, Kenya has much experience and capacity to host large international gatherings.

Kenya offers a representative cross-section of farming systems and agro-ecological zones, ranging from the grasslands to the mountaintop communities and has both CA practising large-scale and smallholder farmers. Kenya will present a cross-section of farming zones, typical of the rest of Africa. Kenya's many efforts in the development and promotion of conservation agriculture include the well established large-scale and upcoming smallholder farmers who have recently adopted CA practices.

Kenya will merge Congress hosting efforts with northern Tanzania Arusha region where (like Kenya) CA pilot trials are growing into common practice with dramatic development impact. The post Congress tours will cut across Kenya and Tanzania.

African agricultural features have unique and difficult peculiarities that need to be brought under the scooping eyes of the world. It is with this

realisation that Africa is viewed as the next best host for this World Congress.

Ladies and Gentlemen,

It is now believed that CA applications need to be focused and discussed for Africa's food security needs.

Conservation Agriculture is about planting quality seed without ploughing, and reducing weeding labour by leaving the soil permanently covered with mulch or cover crops. It brings together the efforts of soil and water management, knowledge of crop rotations, agro-forestry and pest management. CA is a win-win approach that reduces operational and input costs, including labour, while increasing yields and protecting our farm-land and its water resources.

Conservation Agriculture is attractive to farmers and other practitioners will adopt the practice because of:

Reduction in labour and time. The average total time required for conservation agriculture is less than that for conventional agriculture. The net effect of this is less tillage time and that farmers will be able to engage in other income generating activities, thus improving their livelihood.

***Less farm power required*.** Repeated tillage under smallholder farming systems has caused high drudgery to both draft animals and humans. This has delayed planting that shortened the length of the growing period available for a crop. The high draught power required for tillage forces farmers to keep large number of cattle for breeding purposes. Overstocking of cattle has in turn led to land degradation due to over grazing. The combined effect has been low crop production and poverty.

In the case of mechanised 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. Early crop growth and development can be adversely affected by inadequate soil warming and excessively dry conditions. Conservation agriculture with cover crop lowers soil temperatures especially in the tropics leading to improved seed emergence and early plant establishment. Early crop establishment depends not only on soil temperature but also on moisture stored in the soil during the growing season.

Cleaner water due to less erosion: This is beneficial even for the hydro-power stations that require dredging their waterways leading to reduced maintenance of power plants. For water supply systems, there is reduced cost in water treatment.

Less flooding: In the lowland areas resulting in reduced need for external food aid.

Better food security: Through getting a harvest, even in dry years. Farmers can store crops from good years to even out on the bad ones.

Recharge of aquifers: Through better water infiltration into the ground. This leads to steady flow in streams and rivers. Rivers that are steadily drying up are known to reverse the trend in areas where conservation agriculture has taken root. Boreholes that were drying up return to production after conservation agriculture is practised in catchment areas.

Increased profit: In some cases from the beginning of farmers practising conservation agriculture. In other cases profits are seen after a few years.

Ladies and Gentlemen,

Conservation Agriculture in Kenya was initiated by Kenya Conservation Tillage Initiative (KCTI) that has been working in five Districts in the country since 1998 and is now out to scale-up the farmer driven pilot work. In this, farmers have proved to themselves, on their own farms and through Farmer Field Schools. Even in drought years, benefits of CA are clear and with much to be exploited for food security and reduced poverty.

Recently the government of Kenya launched the Strategy for Revitalising Agriculture. The Strategy for Revitalizing Agriculture places emphasis on policies and institutional reforms that are necessary in attaining our national goals of wealth and employmentcreation. The practice of CA will be incorporated in this new strategy in order to mainstream and propagate the practice through our extension system. The presence of all our district extension officers in this Congress is a clear manifestation of the government'scommitment to the expansion of the area under CA in Kenya.

Ladies and Gentlemen,

I believe that this Congress will provide opportunity for farmers, traders, manufacturers, processors, marketing agents and other service providers to exchange information and technologies that are to their businesses. I have been impressed with the excellent displays and demonstrations staged by various exhibitors.

I encourage all stakeholders in this Congress to translate the information gathered to initiate actions that will promote CA in the world.

In conclusion, I thank the Congress organizing committee for organizing a magnificent Congress and wish you success during this event. May you all have a pleasant stay in Kenya and fruitful deliberations during the Congress. With these remarks, it is now my pleasure to declare the 2005 III World Congress on Conservation Agriculture officially open.

THANK YOU.

Key note presentations and discussions

There were 15 keynote presentations delivered by invited speakers in the course of the Congress. The presentations focused on particular aspects of CA considered to be of world-wide interest and the highlights are summarized below. The complete Power Point presentations are available on the CD accompanying this summary report and on the ACT web site.

Conservation tillage in China

Hongwen Li, China Agricultural University - Conservation Tillage Research Centre CA (or conservation tillage, CT as it is known in China) is a new concept for that country. The motivations for initiating a CA R&D and extension programme were fivefold:

Drought

Sixty percent of China's agricultural land is dryland without access to irrigation and in 15 northern provinces the annual rainfall is approximately 400mm.

Erosion by water

This is especially severe in the semi-arid regions with low annual rainfall.

Wind erosion and stubble burning

Both of these cause very serious atmospheric pollution in China.

Falling water table

Due to lack of aquifer recharge and excessive extraction.

Work on CA started with the importation and evaluation of imported, heavy machinery which has now been replaced with local production of no-till maize planters and wheat drills. Maize planters are from two to four rows and cost from US$400 to US$1600. No-till wheat drills are six and twelve row machines costing between US$500 and 2200. There is also local manufacture of subsoilers and shallow sweeps for surface weeding.

Trial plots have been set up in >300 counties with >4000 no-till seeders. Total costs for the programme have been US$15m with 50%coming from farmersand 25% each from national and provincial governments.

Yield increases of 0.6 to 32% have been recorded and net benefits have ranged from US$28-150 ha^{-1}. Erosion and stubble burning have been reduced and soil structure and earthworm counts improved.

China plans to apply CA to >80% of its agricultural land in Beijing province in time for the 2008 Olympics. Three more provinces plan to extend CA to 30% of their agricultural area by 2010.

Three point linkage no-till planters

Nelson Lauxen, Founder of Vence Tudo, Brazil

Vence Tudo was established in 1965 by Mr Nelson Lauxen. The planter models range from 7300 (3 rows for large seeds; 7 rows small seeds) to 14600 (6 and 14 rows). Large seeded crops include soya, corn, beans, sunflower and small seeded crops are wheat, rice and pasture.

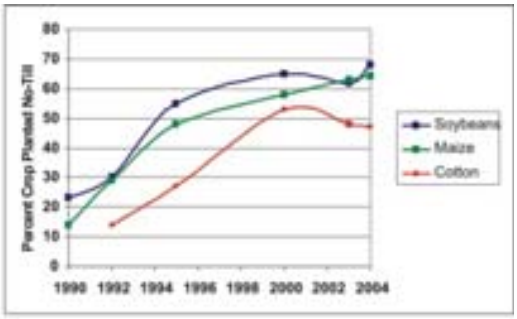
All machines come supplied with a wide range of sprocket sizes for the seed and fertilizer metering transmissions. Seed metering is by horizontal plate, there is also a fine (pasture) seed continuous flow option. The high quality of the products is due to long years of experience and practical field testing.

Development and Implementation of No-Till Systems in Tennessee in the South-eastern United States: 1960s to present

Forbes Walker, University of Tennessee Institute of Agriculture

The presentation was a description of the development and implementation of no-till systems in Tennessee (SE United States) from the 1960s. Tennessee has a humid temperate climate and highly erodible loess soils which can lose up to 250 t ha^{-1} yr^{-1} resulting in sediment degraded waters and eutrophication.

Conventional tillage leads to summer drought, low OM, poor soil structure, low water holding capacity and lower yields. NT is effective in controlling erosion and is economic in that it gives improved yields with less cost. NT crops are generally on the rise in the state and maize cost savings are US$22 ha^{-1}.



NT development in Tennessee comprised four main elements: weed control, equipment availability, soil fertility and pest management, and policy and extension service. Weed control costs have been reduced by the adoption of Round-up ready soybean, cotton and maize. High quality NT equipment is available on the market. The denial of state subsidies for erosion producing practices was an impetus for NT and extension efforts give a continual boost.

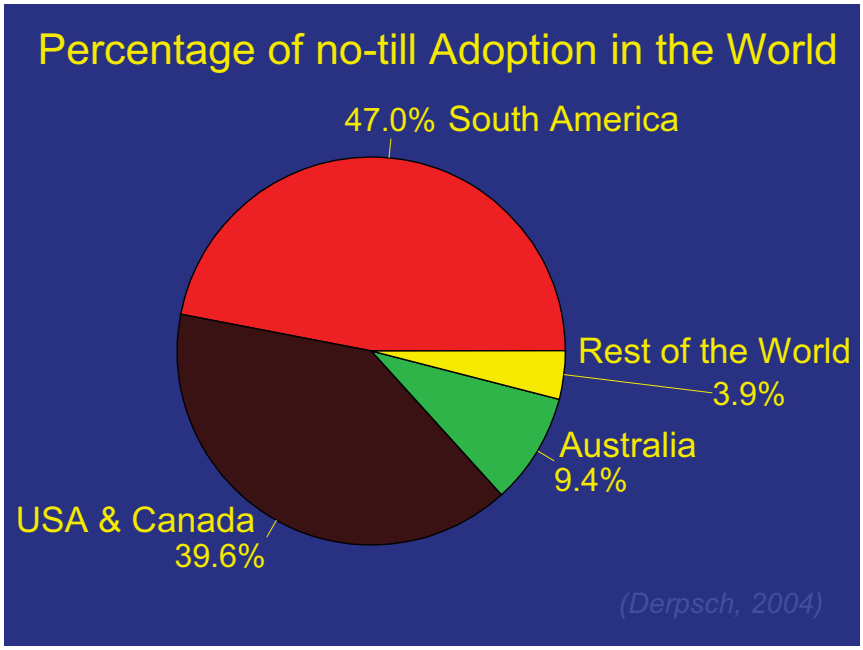
Extension to emphasize erosion control with NT. And NT transplanter development

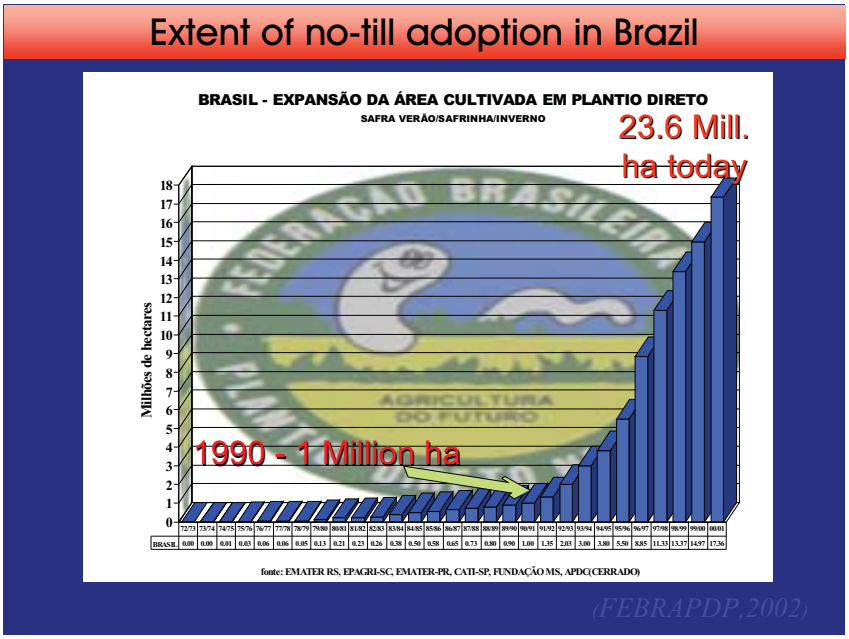
However barriers do remain, tillage is still sometimes seen as essential and residues continue to be burnt. There are also concerns over soil compaction, pest problems, N losses and residue management. Future challenges include NT tobacco, vegetables, small grains and forage crops. Transplanters are being developed and herbicide resistant weeds being tackled.

The extent of CA adoption worldwide: implications and impact

Rolf Derpsch, Ex GTZ consultant based in Paraguay

No tillage is a cornerstone of conservation agriculture which can be practised by both small and large scale farmers. Residue retention distinguishes conservation agriculture from conventional farming where soil is left bare. The total global area under no tillage stood at 95m ha with the South American countries of Brazil, Argentina and Paraguay leading in the rate of adoption of conservation agriculture.





Under rotational tillage (widely practised in the US) farmers never get to experience the full benefit of NT since it is only after about 20 years of continuous NT that they can reap the full benefits of the system. With respect to C sequestration, it is estimated that wide dissemination of conservation tillage could off-set as much as 16% of worldwide fossil fuel emissions. Research in the USA indicated that the cost of soil erosion arising from conventional farming amounted for up to US$100 ha^{-1} annually. Whilst in Brazil, NT has led to a doubling of grain production while increasing the area under cultivation by only 11%.

At the rate of only 0.51t ha^{-1} $year^{-1}$, Brazil has the potential to sequester about 12M tones of carbon annually. At the same time adoption of NT has led to a reduction of 80% in the cost of road maintenance.

In Argentina, grain production had increased by 164% in the last 13 years while in the same period the area under NT has increased to 12M ha from 100 000ha in 1988.In Australia, NT is vastly superior to conventional agriculture and soils where farmers could not establish crops are now some of their most productive, thanks to NT. An economic analysis in Australia showed that US52ha^{-1}$ advantage arose from adoption of NT.

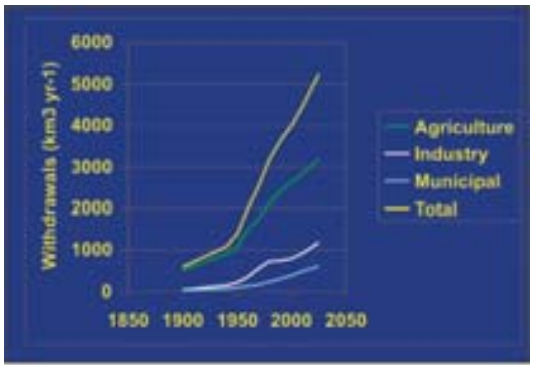
There has been a steady adoption rate of NT in Paraguay where up to 23t ha^{-1} $year^{-1}$ of soil was initially lost through conventional farming. This has also resulted in a reduction of 33% in tractor hours needed for crop production, leading to longer machine life and a national saving in diesel fuel of US$24M per year.

Small farmers, as well as large scale producers, are benefiting from NT. A global effort is needed to increase the adoption of NT farming practices and aid programmes should place greater emphasis in supporting a rapid diffusion of conservation agriculture especially in developing countries.

A key to solve the global and freshwater Crisis.

Johan Rockström, Stockholm Environment Institute

Food production requires huge volumes of freshwater and in terms of global water-use distribution; agriculture accounted for 69%, industry 23% and municipalities 8%. Freshwater is critical for the attainment of the Hunger alleviation MDG which requires 1300 m^3 $person^{-1}$ yr^{-1} for a balanced diet of 3000 kcal $person^{-1}$ yr^{-1}.

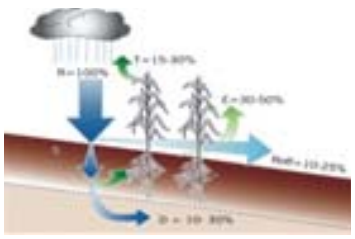


"*There is need for a blue revolution where more food is produced per unit of water, i.e. more crop per drop*" Kofi Annan former UN secretary general during Millennium Declaration in 2000.

A triply Green Revolution is needed:

- G1 Double production in one generation
- G2 Environmental sustainability
- G3 - Productivity gains in rainfed systems in water scarce regions.

The problem confronting the savanna regions is the extreme rainfall variability leading to yield gap (difference between potential and actual yields).



There is a need to upgrade rainfed agriculture by increasing crop water uptake capacity and crop water availability, currently only a small portion of current rainfall is used productively, often averaging 15% or less.Conservation tillage is an innovation contributing to water, soil and yield improvements; and is a key strategy to unlock a new G3 revolution in MDG hotspot countries.

CA principles present a strategy for dry spell mitigation especially due to water harvesting and non-inversion “wise” tillage. In order to achieve the MDG, there is need for a policy shift towards upgrading rainfed agriculture and CA presents an opportunity.

CA: knowledge and information management forum CA-KIMF

Martin Bwalya, Coordinator African Conservation Tillage Network (ACT)

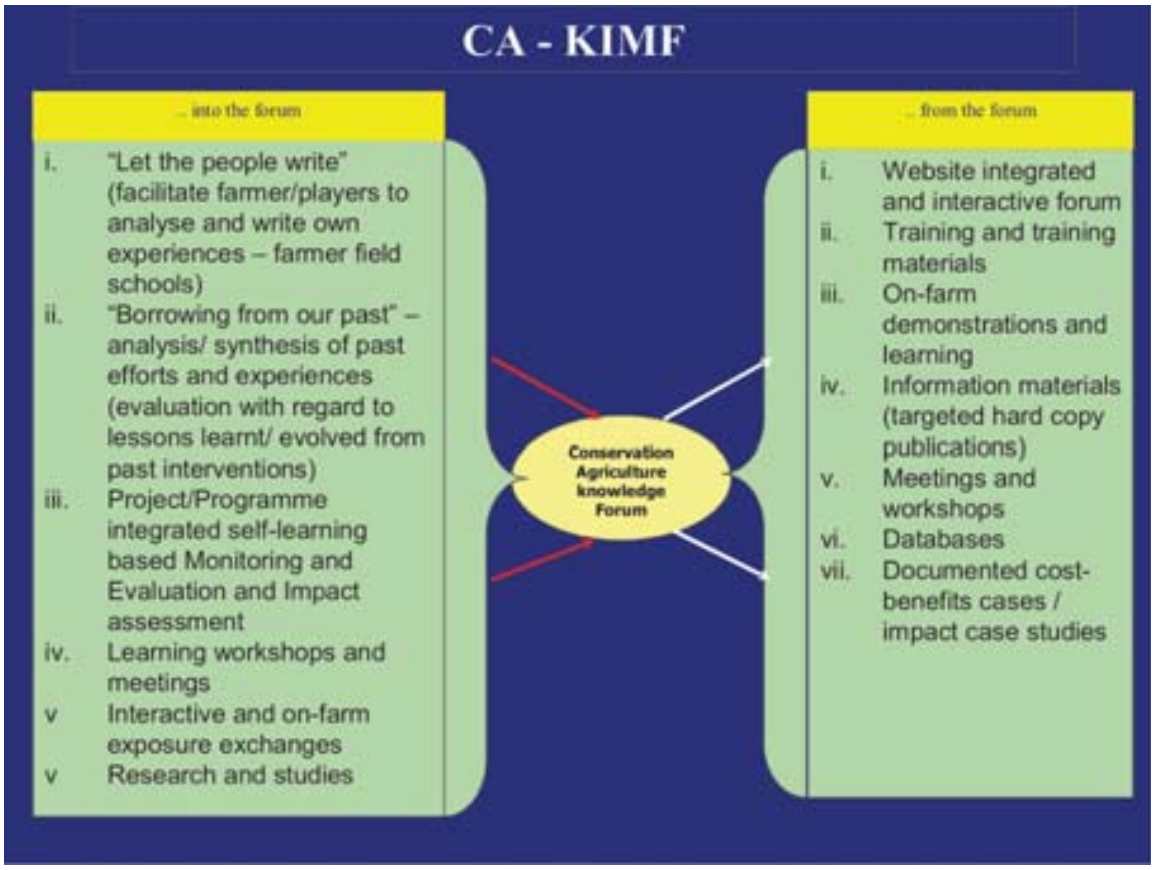
CA is not a 'fad' but a very eco-rational way of doing viable agriculture, sustaining livelihoods and supporting the resilience of agro-ecosystems. The IIIWCCA has the goal of facilitating and contributing to the initiation of a CA knowledge sharing forum. The forum will systematically receive and disseminate knowledge on CA and to that end will need the following characteristics:

- A systematic process of analyzing and integrating knowledge.
- Facilitation of dialogue leading to positive actions.

The characteristics of a CA-KIMF include:

- Procedures and tools that enable & facilitate analysis and integration of information and experiences.
- Facilitating dialogue for mutual empowerment to enable decisions that lead to action and desired outcomes.
- Enabling interaction and synergy to create outcomes that are more than the sum of their individual effects.
- Promoting dynamic evolution of knowledge based on lessons learned.

Promoting CA implies the integration of many development strands. The inputs and outputs of the proposed forum or platform are:



Why should the world be concerned about sustainable resource management in agriculture?

Theodor Friedrich, Food and Agriculture Organization of the United Nations

Agricultural production is the base for development of humanity. However 800 million people globally are still faced with starvation and at the same time population growth is higher than increases in agriculture production and in this regard Africa is the most affected. World food production has to double by 2030 if global starvation is to be contained. This already dismal situation is exacerbated by pressure leading to an increase of non-food production from renewable resources.

The resources available for agricultural production are reviewed, these include:

- Human resources (issues of rural-urban migration, drudgery, pandemics)
- Natural resources (issues of water, soil and land)
- Other production inputs (issues of farm power, equipment, agro-chemicals, fertilizers)

Climate change is tending to make extreme rainfall events and prolonged droughts more prevalent.

CA has many roles to play in alleviating the constraints discussed:

- Regarding climate change (issues of crop resilience, soil structure, water infiltration, SOM, C sequestration, reduced fuel use, greenhouse gas reductions).
- Input use (issues of lower energy demands, reduced use of agro-chemicals, less fertilizer lost, better nutrient recycling).
- Land (issues of conservation of available land, increased productivity, reduced pressure).
- Soil (issues of soil accumulation, OM increments, improved soil structure).
- Water (issues of water use efficiency, permanent soil cover, natural channels).
- Human resources (issues of reduced time spent, reduced drudgery, potential for enterprise diversity, gender and children).
- MDGs. Several MDGs are directly affected by CA: MDG 1? food security; MDG 7 sustainability; MDG 2? children freed for better education; MDG 3? women's rights enhanced; MDG 6? farmers weakened by HIV/AIDS can still be prosperous; MDG 8? partnerships for development strengthened as demonstrated by the IIIWCCA.

CA in theory vs. in practice; as a set of technologies vs. as an innovation process. Lessons, gaps & challenges from smallholder experiences around the world

Bernard Triomphe, CIRAD

Several 'simple' questions were posed:

- Are small holders actually practising CA?
- Why can't most of them achieve adequate soil cover?
- Does CA lead to savings in labour use?
- Why is it so difficult, so time-consuming and so rare to achieve large-scale, sustainable CA adoption?
- Many similar “burning” questions can be formulated

The aim of the presentation is:

- No pretension to provide answers!
- Qualitative, thought-provoking reflections about these questions & others
- Illustrated with preliminary findings from recent & on-going case studies in Africa and elsewhere.

The case studies compared were from: Tanzania, Kenya, Zambia, Ghana, Uganda, S. Brazil, Mexico, Indo-Gangetic plains; and the main topics discussed and compared were:

- Equipment
- Weed control
- Herbicide use
- Competition for crop residues
- CA adaptation and diffusion
- Entry points and pathways
- Innovators and leaders
- Farmer groups

The main conclusions drawn from the comparative analysis were:

- Most farmers in most places **are yet to apply "full" CA**
- Because they are just starting on the CA pathway?
- Because they are not likely to ever do it?
- **Herbicides** have a **crucial role** to play in initial phases…
- Without them, weeding might become a nightmare
- More efforts needed to identify suitable cover crops & to achieve soil cover if herbicide dependency is deemed undesirable
- Achieving **soil cover** either via CC or via crop residues is a major **technical** & **organizational** challenge, except perhaps in more humid climates
- Availability & access to **CA equipment** still a major hurdle / issue before large-scale adoption can take place.

Conservation agriculture for sustainable crop production in northern Kazakhstan (2002-2004)

Murat Karabayev, CIMMYT-Kazakhstan

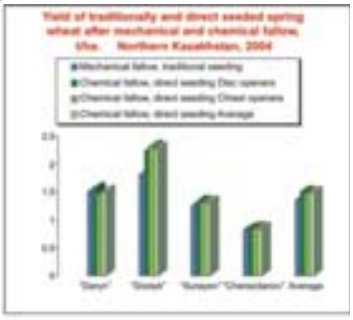
The FAO project for the introduction of CA for cereal production in north Kazakhstan is based on direct seeding and minimum tillage systems.

The key components include:

- On-farm trials and demonstrations of CA methods such as direct seeding systems, minimum tillage technologies and chemical fallow for cereal production;
- Modification, evaluation and introduction of suitable machinery (seeders and sprayers) for CA;
- Economic analysis of the introduced technologies and cropping systems;
- Human resources development and public awareness, training, workshops, field days, tours etc.

Local seeders were modified using Brazilian discs and furrow openers and these were later locally produced.

Local sprayers were modified with replacement parts from Hardi (Denmark) and used for chemical fallow. Yield data for traditionally and direct seeded spring wheat after mechanical and chemical fallow, and winter sown rye, are discussed.Economic analysis showed a US$30 ha^{-1} increase in net benefit for no-till wheat production.In addition to NT wheat, permanent bed systems are being promoted for cereals and other crops to reduce traffic and practise NT on uncompacted soil.



Herbicides as a weed management option in conservation agriculture: feasibility and benefits for smallholder farmers

Jim Findlay, Agricultural Resource Consultants, South Africa

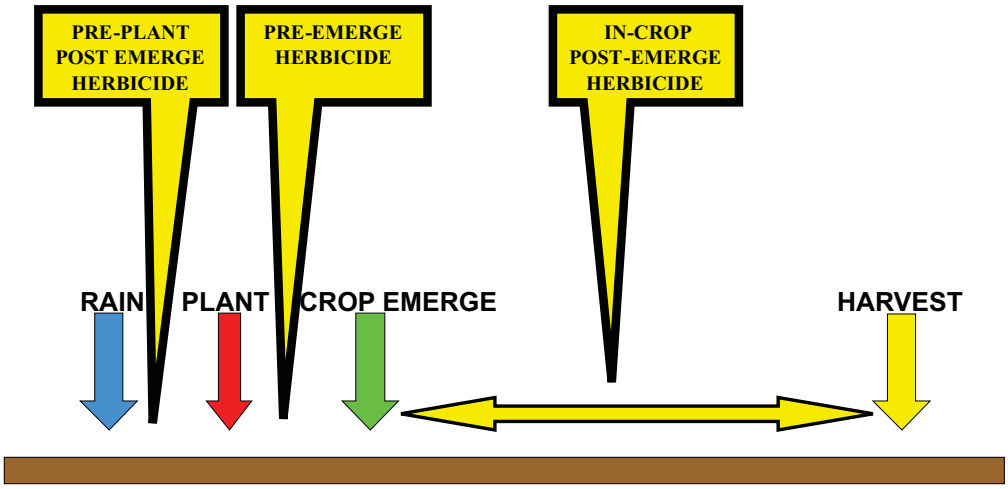
Africa feeds 2.5 people per cultivated ha while south-east Asia feeds 9.5 and USA and western Europe feeds 11. Why is Africa so far behind? Because of low technology adoption.

Smallholder farmer weed control methods include burning before planting (12%) hand pulling and hoeing (100%) slashing to prevent seeding (5%) mulching (<1%) crop density/shading (<1%) pre-plant post emergent herbicides (<2%) and post-plant pre emergent herbicides (<1%).

Hand labour for weed control is the most time consuming activity and can be dramatically reduced with NT. Weed control methods practised in Africa are described, together with weed control mechanisms, weed growth patterns, weed seed production, weed seed size and allelopathy. These have an influence on herbicide choice and use.

Herbicides can be: pre-emergence, post emergence, selective, non selective, residual or non residual and crop selective. Control should focus on economically important problem weeds.

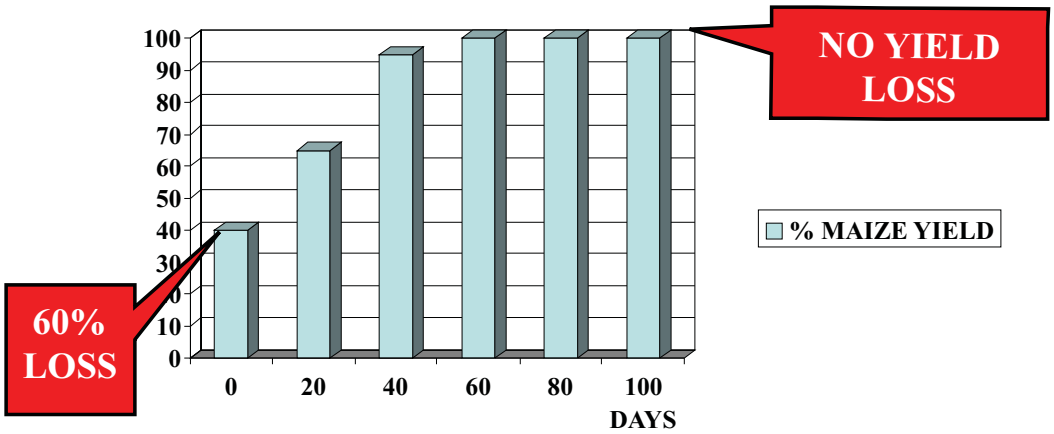
Explanations are given of weed control mechanisms through the use of herbicides; and how herbicides react on weeds at different stages of emergence is illustrated. The yield effect of weed competition in maize (% crop yield loss vs no. of weed free days) is shown.



HERBICIDES MUST ALWAYS BE COMBINED WITH ALL OTHER WEED CONTROL MEASURES

THE EFFECT OF WEED CONTROL ON MAIZE YIELD

THE NUMBER OF WEED FREE DAYS AFTER EMERGENCE



The profitability of CA (using examples from South Africa and Ghana) is discussed together with the benefits of CA for small scale farmers.

Conservation agriculture in Tanzania: an overview on initiatives, achievements, challenges and opportunities

Richard Shetto,Ministry of Agriculture and Food Security, Tanzania

Eighty percent of Tanzania's 35M people earn their living from agriculture in rural areas and contribute to >50% of the GDP. Smallholder farmers dominate, cultivating 85% of the arable land with holdings of 0.2-2ha. Over 60% of the land is semi-arid and degradation is a growing problem. Conventional tillage with soil pulverization and straw burning is the cause of soil degradation. Conventional tillage increases land preparation and weeding costs. The labour force is declining and debilitated, so CA becomes an attractive option.

Indigenous soil conservation measures include: bunds, mixed cropping, tied-ridging and pitting, mulching. The conservation system collapsed and has been replaced by programmes such as LAMP and SCAPA. Several institutes are involved in CA transfer, implement and cover crop development: SARI; ARIs Ilonga, Mlingano, Uyole. The MAFS is collaborating with FAO in a CA piloting project in three districts. The approach uses farmer field schools as a group motivating measure.

The constraints encountered are discussed and include:

inadequate awareness of CA, weed management, maintenance and management of cover, limited availability of implements, free grazing of livestock, limited policy report, limited purchasing power and CA knowledge and skills.

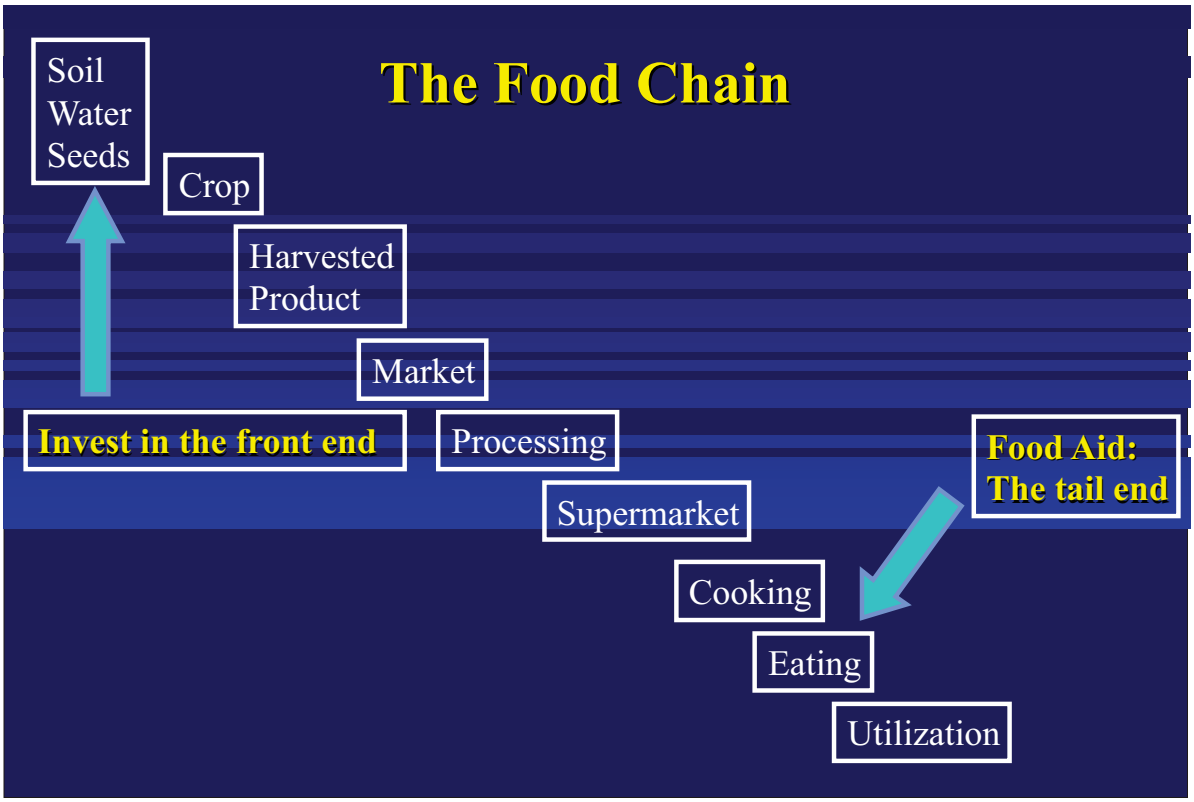
MAFS is committed to promotion of CA and is expanding the number of districts involved. Implements will be provided to FFS and soft loans provided for input purchase. CA will feature in research, policy and mechanization strategies.

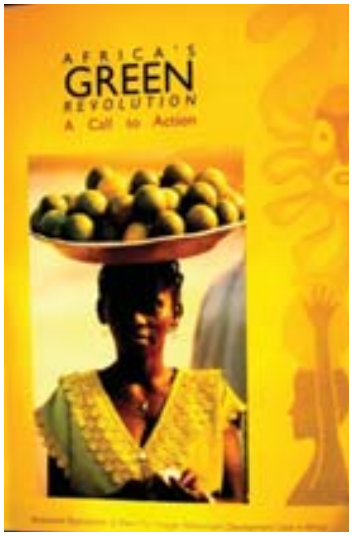
Achieving the MDGs and CA

Pedro Sanchez, Director of tropical agriculture, the Earth Institute, Columbia University

There are 852M hungry people in the world (92% chronically and 8% from extreme events). There are many hunger spots (especially in SSA) where children under five are under weight. It is estimated that achievement of the MDGs will cost US$110/head/yr. We need to work at global (UN MDGs) national/regional (e.g. NEPAD) and community level (e.g. with Millennium Villages).

Apparently there is global commitment (especially from the UN) with calls for a 21st Century African Green Revolution. This would have the following components: agriculture, nutrition, markets, environment, politics and policies. The overarching problem is unhealthy soils and untamed water.





The food chain runs from soil and seed to plate. With a focus on investment in food production, there are several soil health investments; access to low cost nutrients, working with input retailers, returning crop residues to the soil, CA, soil erosion control. Nutrients can be derived from fertilizers, trees and cover crops.

Reduce transport costs by local sourcing. Integrate livestock into the residue return system, practice CA, re-shape the landscape to hold soil and water, control erosion.

Millennium villages: empowerment and capacity building. Hunger elimination, medical care provided, water and sanitation installed, gender issues addressed, school education assured.

Socio-economic and political justification for investing in conservation agriculture. Experiences and views of ECAF

Gottlieb Basch, European Conservation Agricultural Federation

The paper introduces the importance of CA from a European perspective. NT started in the mid 1950s (in the UK). By the early 1980s this grew to 300 000 ha when straw burning was banned and caused problems with residues, weeds and volunteer crops. Elsewhere in Europe there was little uptake until the 2000s, despite R&D efforts. The reasons for poor adoption are:

- Cultural entrenchment of tillage
- Favourable natural conditions (water conservation and rainfall distribution are not big problems)
- Common Agricultural Policy
- Low economic pressure
- Crop residue management
- Lack of specific drilling equipment
- Lack of problem oriented research

Soil organic matter is declining in Europe and soil erosion is increasing (both wind and water). The CAP is production, not conservation oriented. Neither is there an incentive to conserve as welfare is guaranteed through subsidies.

Crop residue management makes direct drilling difficult because of excessive quantities and the high moisture content of straw. There are few manufacturers of specific NT planters and drills, *reduced* tillage is preferred to NT.

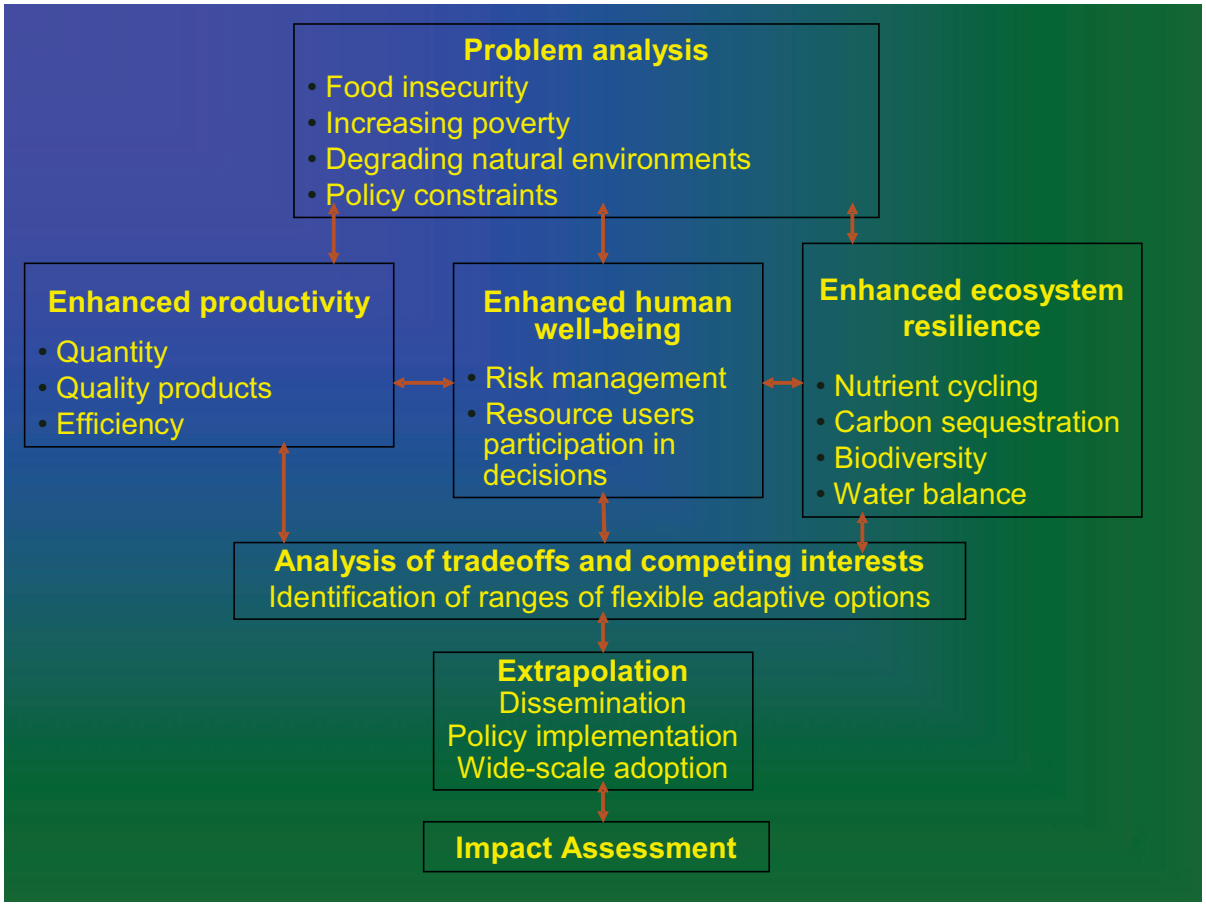
At the moment there is <10% of the agricultural area in Europe under NT.In the future there will be increased awareness on the part of farmers and pioneer farmers will become role models. Public opinion and international bodies will exert a bigger influence and R&D will provide local answers. This will lead to better machines and a bigger body of technical expertise. Revision of the CAP and directives for soil protection will also help.

There are still some constraints to be overcome: reduction of herbicide use, crop rotations and soil cover, provision of scientific and practical evidence, resolution of technical problems (toxins, compaction, straw), economic justification, effective technology transfer. More lobbying is required.

Three decades of Natural Resource Management Research in the CGIAR: lessons and challenges for the future

Dennis Garrity, ICRAF

The presentation gives a description of integrated natural resource management (INRM) as a multidisciplinary stakeholder-driven process to improve livelihoods. It has evolved from a range of participatory development paradigms. The five key elements are; learning together, cross-temporal and cross-spatial R&D, practical promises, scaling up and out, and evaluation of the impacts.



Successful INRM would result in: improvements in livelihoods, system resilience, system productivity and environmental services that benefit many people over a large area.

Four case studies are presented:

Case Study 1: The Rice-Wheat System of the Indo-Gangetic Plains

The rice-wheat system covers 12M ha in Pakistan, India, Nepal and Bangladesh, home to 600 million people. Rice is grown in the summer; wheat in the winter season. The problem: late planting of wheat crop and irrigation water shortages.

In 1997 there were < 500ha of zero-tilled wheat; by 2005 nearly 2M ha. It is not yet a conservation agriculture system: rice is still sown with traditional land preparation, including puddling. Work is now to establish rice into standing wheat stubble, permanent raised beds, direct seeding.

Case Study 2: Conservation Agriculture in Central Asia and the Caucasus

Wheat and cotton growing lands are degraded, while rangelands are affected by both severe degradation.

There is a need for crop diversification and the introduction of resource-use efficient crop rotations to replace traditional summer fallowing, inefficient water use, salinization. NT in the fall is more suitable and more economical than conventional deep tillage. No-tillage is applied on 100 000ha.

Case Study 3: Low-input precision system for smallholders in southern Zimbabwe

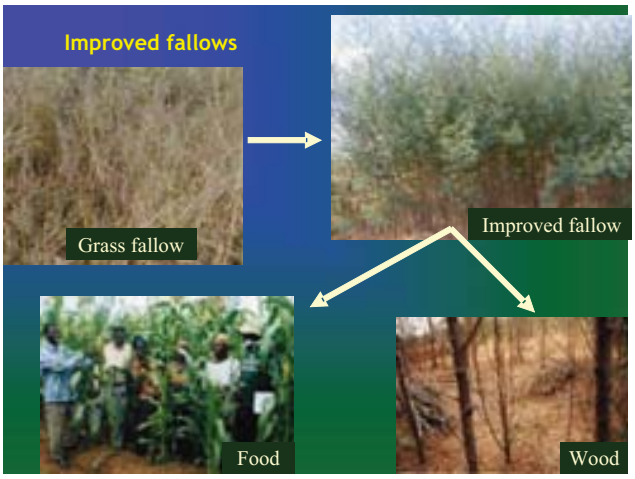
Vulnerable households have limited access to farm power (human, animal and mechanical), so they plant cereal crops late and miss the earlier planting rains. They are reluctant to risk investments in soil fertility amendments or improved crop husbandry. Lack of investment exacerbates yield decline and leads to unsustainable cropping systems due to declining soil fertility.

25 kg of fertilizer was distributed to each of 170 000 farmers with a pamphlet on how best to apply it.

This was linked with 1200 farmer-run demonstration trials. The result was 40 000t increased production with a local market value of US$4M or US$7M in savings for the WFP.

Case Study 4: Conservation Agroforestry in maize-based systems in eastern and southern Africa

The problem was severe soil fertility decline; land degradation; intensifying fuelwood scarcity. The strategy was to network participatory research across 6 countries selecting species and agronomic practices for fertilizer tree systems through several cycles of adaptive learning.



The result was a portfolio of 16 types of fertilizer tree systems. These can supply 100-150kg N ha^{-1}; typically double maize yields and supply household fuel needs. Scaling up is through an 8-pronged strategy; 200 000 households are now using fertilizer trees.

The biggest challenges are scaling out and up. For scaling up the focus is on strengthening institutions, changing their modes of action. Without stable institutions markets are not likely to be able to offer incentives for investment in things such as soil conservation.

Development, diffusion and evaluation of direct-seeded mulch-based cropping systems (DMC) by Cirad and partners

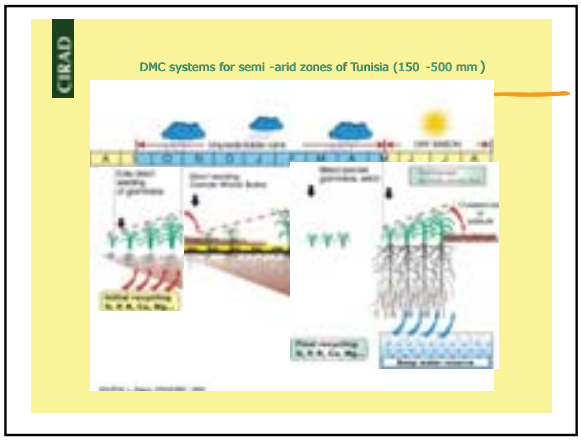
Marco Wopereis, CIRAD

Promising productive and resilient production systems are DMC, CA, agroforestry, ISFM. Issues to be addressed on the different levels of interventions:

- Field - Restoring soil fertility and SOM, improved water storage, enhanced efficiency of external inputs
- Farm - Improved recycling, decreasing labor & capital constraints, introducing flexibility, improving livelihoods, etc.
- Village, watershed and beyond - Improved NRM (soil, water, biodiversity); equity issues

DMC research sites were installed in Brazil, West Africa and Madagascar, Laos
DMC research themes were:

- Creating new DMC options for diverse agro-climatic & socioeconomic conditions
- Developing systems approaches to understand the biophysical mechanisms underlying CA; decision support tools
- Developing participatory approaches to DMC adaptation and diffusion
- Knowledge and information exchange



The impact on soil erosion, water balance, nutrient balance and carbon sequestration was monitored and data used for modeling. Participatory approaches helped to identify the adequate entry points, Create an enabling environment for fast individual and collective learning and for minimizing risks of early failures to be flexible and to adapt plans to unforeseen situations and opportunities.

Major lessons learned were:

- DMC systems are knowledge and management intensive; require participatory learning and action research and 'assemblers'
- DMC development and diffusion requires a holistic approach (beyond agronomy; looking at gender issues, land tenure, market access…)

- Simulation modeling tools help to interpret data, but are not yet used for ex-ante evaluation and extrapolation

Principal challenges are

- Development of DMC options for semi-arid environments, herbicide-free DMC, crop-livestock integration, …
- Building multiple stakeholder partnerships, required for accelerating the learning process, and farmer empowerment pertinent for DMC adoption.

3

SYNTHESIS OF THE THEMATIC WORKSHOPS

SYNTHESIS OF THE THEMATIC WORKSHOPS

This section presents the synthesis of key outputs of the IIIWCCA. The information provided by the various presentations, discussions and group work was synthesized in a systematic way, with a view to enabling an easier overview of the actual status of conservation agriculture. Nine major *thematic areas* were defined, regarded as key to conservation agriculture.

- Socio-Economic & Cultural Dimensions in CA Adoption & Impacts
- Efficient use of rainwater in drought prone regions increase of rainwater productivity
- Combining CA and Agroforestry: Options and Impacts
- Strategies towards efficient dissemination approaches, training and generation of broad impact
- Technical Challenges and Issues in CA Adoption
- Enhancing environmental quality and resilience: Role of CA in mitigating adverse environmental impacts caused by agricultural activities
- Policies, Infrastructure Support and Private Sector Involvement in Enhancing CA Adoption
- Science and Supportive Research: Enhancing Impact: Research Approaches and Methodologies
- Mechanisation in CA: Access to Appropriate Tools and Equipment

For each theme the *opportunities* it provides to overcome certain constraints, the *problems* adoption is facing, *challenges* to meet, and the *strategies* required to facilitate a wide adoption and dissemination of CA systems are briefly summarized.

Socio-Economic & Cultural Dimensions in CA Adoption & Impacts

This theme covers a wide range of social, economic and cultural issues that influence adoption of CA related technologies to create impact in the community. The issues under this theme include: the appropriateness of CA as a response to the immediate basic needs of food and income; coping with the social effects of HIV/AIDS and gender related issues in agriculture; the economic aspects of CA including labour requirements; fitness of CA in a multicultural context and the wider application of CA across diverse categories of farmers. These are discussed below in more detail:

CA as a response to food security needs and poverty

One of the major challenges of meeting food security and poverty alleviation in communities that rely on farming, is the inability to harness nature for sustainable production and productivity. In this regard, CA can significantly contribute to enhancing productivity through conservation of soils and other natural resources. To bring this under the spotlight, CA has to be considered as an option for pursuance of the MDGs and PRSPs particularly in addressing the critical situation of food security and incomes of those depending on farming. In view of the declining soil productivity due to various reasons, CA is one way of ensuring sustainable agricultural production while at the same time contributing significantly to environmental conservation under changing weather patterns.

Opportunities

- CA can increase profitability and competitiveness of farming by reducing the production costs associated with seed bed preparation and weed control.
- CA aims at maintaining a soil cover, which protects the soil from the erosion by wind and water, increases rainwater infiltration, reduces water losses through evaporation, suppresses weed growth, improves soil quality, thus ensuring the sustainable productivity of land.
- CA can improve soil fertility and secure production even in marginal areas that have been seriously degraded, or in years of drought.
- Through its contribution to natural resource conservation, CA enhances the robustness and resilience of the farming system and thus contributes to sustainable livelihoods.

Problems

- It usually takes a long time to realize the benefits of CA, therefore it might not be an immediate solution to short term food needs. In areas that are critically hit by food shortage, other means to provide food may be required while CA is developed as a long-term solution to food security.
- Benefits are long term and some are of a public good nature (e.g. environmental conservation). It therefore requires patience, persistence and appreciation of strategic long-term goals to practise CA.
- Changing from conventional farming to CA requires investment in equipment, tools and agro-chemicals, which is often a constraint for poor farmers.

Challenges

- How to mitigate short term food security and income needs while pursuing CA as a long-term but sustainable solution.
- How to access funds for investment in CA practices to enhance its adoption among poor and vulnerable communities.

Strategies

- Target CA to crops that make a significant contribution to food security and/or have high commercial value. This will allow realization of benefits that could encourage investment in CA implements and long-term practising of CA.
- In situations of crisis or disaster (e.g. extreme weather), CA needs to be pursued alongside alternative approaches for the quick provision of food e.g. emergency food aid.
- Link farmers to support service providers especially financial institutions (e.g. microfinance) and markets. Vulnerable communities may require strong advocacy for government support (e.g. through subsidies) to encourage adoption of CA as a way of sustainable farming.

Mainstreaming gender and HIV/AIDS related issues in CA

The importance of addressing gender in agricultural production is widely appreciated. The roles of men and women in food security and income generation in various cultures have been extensively discussed and documented. Therefore, like any other farming practice, promotion of CA requires clear gender targeting. Similarly the impact of HIV/AIDS and other health pandemics on the agricultural labour force cannot be overemphasized. The high mortality and morbidity due to HIV/AIDS make populations moribund which significantly reduces the labour force available for agriculture. This has led to increased vulnerability and dependence, especially in fragile communities with weak social structures. CA as a labour saving practice could be a plausible strategy to deal with labour constraints.

Opportunities

- There is general awareness of gender and HIV/AIDS issues. Nearly all development programmes attempt to address these issues within their various contexts.
- Policies and frameworks for mainstreaming gender and HIV/AIDS related issues exist in most countries.
- With proper gender targeting and consideration of HIV/AIDS related effects, there could be high potential for adoption of CA technologies.

Problems

- Mainstreaming gender is often influenced by the cultural prescriptions of gender roles and entitlements. Sometimes concepts of gender equity, especially in the sharing of benefits, conflicts with cultural norms, which may constrain gender mainstreaming.
- While gender is not a new concept, there are still inadequate skills for conceptualising and implementing gender issues in development activities, including CA. Often, gender is understood to refer only to sex (male and female) thereby ignoring the other important aspects of gender such as age and disability.
- The integration of cross-cutting issues such as gender and HIV/AIDS issues in programmes and projects often increases the cost of such programmes. The partnerships required for effective integration take resources that would have otherwise gone into CA activities.
- The effects and impacts of HIV/AIDS are both short and long term. Coping with them requires substantial resources and there is a danger that the focus may shift from CA to HIV/AIDS related activities.

Challenges

- How to appropriately mainstream gender into CA programmes and activities to enhance adoption in a cost-efficient way.
- How to meet the labour requirements for CA given the devastating effects of HIV/AIDS on labour availability and productivity.

Strategies

- Equip professionals and practitioners involved in promoting CA with the skills needed for mainstreaming gender related issues in their activities and programmes to enhance adoption of CA.
- Integrate HIV/AIDS awareness and prevention activities in CA programmes through partnerships with other agencies.

Cost-benefit advantage of using CA compared to alternative practices

New technologies will be adopted to a large extent only if they increase incomes significantly. Similarly, adoption of CA will be influenced by the returns to investment in CA compared to alternative practices; the time it takes to realize the benefits as well as the opportunity costs (including the social cost) of abandoning conventional farming practices. This implies that promotion of CA has also to address the issues that go beyond production, such as access to markets (local and external) and product value addition chains to justify the investment in CA.

Opportunities

- CA has been proven to reduce labour costs.
- No-tillage and maintenance of soil cover stabilizes yields and improves soil properties, even in situations were other practices have failed.
- CA has demonstrated positive impacts on soil health and environmental conservation through controlling soil erosion.

Problems

- The required initial investment in equipment and agrochemicals are often not affordable to poor farmers.
- CA may be incompatible with some agricultural technologies, e.g., some improved varieties require clean weeding.
- There is a risk of build up of pests and diseases due to maintaining crop residues on the ground.
- Promotion of CA may not necessarily address the entire value addition chain, and hence reduce the motivation for its uptake.

Challenges

- How to increase productivity of land under CA practices given current evidence that, in comparison to conventional farming, CA does not necessarily increase production but may only increase profitability through a reduction of production costs.
- How to make the benefits of CA more visible given the opportunity cost of alternative farming practices.
- How to develop a holistic approach for promoting CA by integrating with other disciplines and services (such as pest management, sociology, economics, etc.) to enhance its acceptability and profitability.

Strategies

- Develop technological options for increasing the productivity of land under CA to cope with the ever increasing food and income needs even without external inputs.
- Develop a multidisciplinary approach to CA to include different perspectives making it suitable to the diverse farming systems.

Labour demands for CA

Labour is one of the factors limiting the uptake of agricultural technologies. Even in developing countries with high unemployment rates, labour can no longer be assumed to be unlimited. It has to be taken into consideration that HIV/AIDS (and other pandemics such as malaria) has adversely affected the agricultural labour force. Agriculture is not the only source of livelihoods even in rural communities, there are others competing for the same available labour. There is further depletion of the available labour pool due to the migration of young adults to urban areas in search of better opportunities outside farming, and for education.

With regard to availability of labour in the rural areas, there is need to appreciate the way farmers value the opportunity costs of their farm labour, which may not necessarily be in terms of monetary values. Therefore promoting CA requires developing appropriate technologies which reduce labour in terms of time (hours), time of the year (season), gender (who has to do the operation?) and drudgery. Appropriate technologies take into account the availability, accessibility, gender adaptation and health considerations with the ultimate goal of enhancing labour productivity.

Opportunities

- Data from research and practice prove that CA reduces labour costs by stopping ploughing and controlling weeds with groundcover and herbicides.
- Because of the labour saving advantage, CA is suitable for vulnerable communities, e.g., those affected by labour shortages either due to HIV/AIDS and other diseases, or through outmigration.
- The reduction of labour requirements for farm operations can be used for other income generating activities, e.g. crop processing for value addition.

Problems

- For poor smallholder farmers, some operations can be more labour intensive (e.g. weeding or pitting) as they may not be able to afford to mechanize these operations.
- The high cost of agro-chemicals (e.g. herbicides) could be a serious limiting factor especially among resource-poor farmers.
- Difficult access to appropriate and affordable CA equipment for poor smallholder farmers.
- Small farmers are reluctant to invest in agriculture, as it is not a priority for them. Thus they hesitate to purchase relatively low-cost implements like jab planters which would be amortised within one or two seasons.

Challenges

- How to reduce the weed pressure and time required for weeding in smallholder farming.
- How to make profitable use of saved labour.

Strategies

- Develop innovative participatory research programmes for the adaptation, and commercial production of appropriate CA technologies for smallholder farmers.
- Promote food processing and marketing in smallholder communities.

Cultural aspects of CA adoption

In most developing countries the integration of livestock and crops is not only a common practice but it is also a cultural norm. Such cultural norms conflict with the CA practice of maintaining a soil cover with crop residues which are otherwise used as fodder for livestock. In addition, cultural values seriously conflict with CA by way of perceptions of what good farming looks like. In most cultures, a good farm is synonymous with clean farm, which is the exact opposite of CA. Further, the core benefits of CA (i.e. conservation of the environment for sustainability) may be complicated by the land tenure systems that do not grant individual ownership of land (land is common property).

Opportunities

- All cultures aspire to preserve the environment and sustain the present and future generations.

Problems

- Ca may conflict with traditional mixed farming systems where crop residues are used as fodder for livestock.
- Reconciling the perceptions of good farming (such as ploughing, weeding, burning, getting rid of poisonous plants and snakes, etc.) with the benefits of ca.

Challenge

- How to make CA acceptable as a viable practice where cultural norms conflict with its basic principles.

Strategy

- Enable communities to analyze their own situation taking into account actual and future challenges and opportunities and to define where and how CA systems could overcome certain production constraints.

Suitability and application of CA across diverse categories of farmers

Correct targeting is likely to increase the adoption of CA. While it is acceptable that CA can in work almost every situation, it is important to identify situations where it would have the highest impact and hence acceptability. Several scenarios could emerge here, for example, should CA target the vulnerable communities (with labour shortages) or marginal areas (with serious soil degradation)? Is it better to target small, medium or large scale farmers? Could it best be used as an environmental management strategy or tool, or as a strategy for enhancing production? All these options are possible but would probably give different impacts under different situations. It is also important to know who will benefit from CA and who will not, in order to target interventions.

Opportunities

- There is evidence that CA can be applied across the entire range of farm sizes, agro-ecological zones (AEZs) and farming systems.
- High potential benefits to vulnerable communities (low fertility areas, drought prone areas, HIV/AIDS affected communities) are likely to increase the relevance of CA.

Problems

- CA may not be an attractive commercial farming practice compared to conventional farming practices given its sometimes low impact on productivity.
- Smallholder farmers are risk averse and therefore reluctant to change the well known conventional practice, even they are aware of the shortcomings and realise the benefits of the proposed new practices.
- CA farmers contribute to environmental conservation, especially of soils and soil biodiversity, which are public goods but they are not compensated for this service.

Challenges

- How to prioritize and appropriately target farmers and areas that are likely to demonstrate the high impact of CA.
- How to appropriately package CA technologies to bring quick benefits to a wide range of farmer categories.

Strategy

- Involving farmers in the development of CA innovations relevant for different situations and needs.

Efficient use of rainwater in drought prone regions Increase of rainwater productivity

Water is a key element of agricultural production, especially in semi-arid regions. The improvement of rainwater productivity is therefore a key issue in conservation agriculture. Several papers referring to rainwater harvesting and water management in general were presented at the Congress. However, only some of the papers were related to CA. The following section refers only to those papers which focused on CA.

CA practices increase rainwater productivity or use-efficiency in various ways. No-tillage reduces losses of soil moisture which occur when the soil is inverted and the moist lower layers dry out at the surface. No-tillage combined with dry or early planting allows the entire rainy season to be exploited. Groundcover increases rainwater infiltration and reduces losses by evaporation. Increased soil organic matter content improves porosity and thus infiltration and storage Direct planting, best with planters that just cut a slot in the ground for seed placement, further reduce evaporation losses. Efficient weed control, dense planting and species with a dense and deep root system further reduce losses and improve water uptake. The best practice integrates all these elements.

Opportunities

- There are appropriate practices such as retention of crop residues, cover crops and in some case mulching with off-site materials that enhance water use efficiency by increasing water infiltration, retention and reducing evaporation losses.
- Breaking hard pans (plough pans) and avoiding re-compaction by appropriate cropping systems allows for deeper infiltration of rain water, storage of more water and also deeper rooting of crops.
- High yielding crop varieties are on the market (and could be propagated) that provide a fast and good ground cover, have a dense and deep root system and thus use soil moisture efficiently.

- Increased rainwater productivity should be propagated as a means to assure food security.

Problems

- The concept of water use-efficiency is not yet understood by all farmers and extension staff.
- There are many crop residues that could be used for mulching but have competing alternative uses such as forage, fuel, or construction material (thatch, fences). Such needs impede the adoption of crop residues for ground cover.
- Growing cover crops just for soil cover and long-term soil improvement is regarded as too costly by most smallholder farmers.
- Breaking hard pans is costly. Subsoiling by tractor is more effective than subsoiling with oxen, however, it costs more and services are not always available.

Challenges

- How to adapt technologies to fit in with the limitations of small holder farmers? This challenge involves showing ways in which smallholder farmers share crop residues between the requirements of CA and the requirements for feeding livestock or for other uses (fuel, thatching, fencing).
- How to adapt technologies to fit different environments (mainly soil types, topography), farming systems and farm types.
- How to effectively promote rainwater use-efficient practices within the agricultural extension programmes.

Strategies

- Develop participatory R & D approaches to enhance innovation and adoption of appropriate water use-efficient practices.
- Integrate CA and water use-efficiency in the training of extension professionals.

Combining CA and Agroforestry: Options and Impacts

Conservation Agriculture embraces a range of sustainable soil management practices. The question of whether AF is a certain way of CA or not is often raised and difficult to answer. The same is valid for the reverse, i.e., the question whether CA is a certain way of practising AF. The answer often depends on the specific posing the question. Probably the only sensible answer is that both have common objectives, i.e., sustainable land management.

The issues discussed in this theme included the efficient dissemination and adoption of AF technologies which closely relate with integrating CA and AF in a holistic manner into the farming system of different agro-ecological zones.

Integrating CA and AF in a holistic manner into the farming system

The issue of integrating CA and AF in a holistic manner into the farming system requires multi-disciplinarity, diversification of AF enterprises, such as integrated nutrient management for biomass production, nutrient recycling and production of fuel and construction material.

Opportunities

- Reasonable awareness of sustainable land management exists among farmers.
- Some AF technologies, such as short-term fallows with leguminous shrubs, can be easily integrated into the already promoted CA practices.
- There are many NGOs promoting AF that could also promote integrated systems.

Problems

- CA and AF are complementary in ensuring integrated natural resource management. The independent promotion of CA and FA instead of seeing them as integral components of sustainable land management is hampering the adoption and scaling up of the technologies. In addition, the common social and biophysical aspects of CA and AF have not been taken into account sufficiently.

Challenge

- How to build compatibility and synergies between CA and AF as a component of INRM.

Strategies

- Create platforms for sharing and learning from experiences among the various stakeholders, and forge synergies and complementarity, rather than competition, among the various agencies involved in promoting AF or CA.
- Design mechanisms for promoting the integration of CA and AF in a livelihoods framework (approach) through:

- Analysing livelihoods
- Defining the contribution of integrated CA and AF to livelihoods
- Joint planning with stakeholders

Strategies towards efficient dissemination approaches, training and generation of broad impact

This theme addresses the consequences of the change of development paradigms towards approaches inducing and managing change in communities. This is a shift from focusing on adoption of technologies towards creating impact within broader and complex development frameworks like the *Millennium Development Goals* (MDGs) and *Poverty Reduction Strategy Programmes* (PRSPs). Creating such impact implies different issues that are more comprehensively elaborated in the following sections.

Approaches and skills for facilitating farmer learning processes

The old linear top-down approach to dissemination of agricultural knowledge and technologies has been widely criticised for failing to transform farming communities. The learning approach where farmers explore different options and exchange knowledge and experiences is more promising for enhancing the adoption of agricultural innovations. Thus adoption of CA can be greatly improved if farmers engage themselves in analyzing their situation and exploring opportunities for overcoming existing constraints. Through on-farm experimentation they will be enabled to adapt CA technologies to their own environment. This approach, however, requires skills for facilitating farmer learning processes which are not common among extension professionals. Building the competence of extension professionals to support farmer learning and innovation processes is the way to enhance adoption of CA practices.

Opportunities

- A variety of participatory approaches such as Participatory Rural Appraisal (PRA), Farmer Field Schools (FFS), farmer-to-farmer extension have been promoted in extension for a long time to encourage farmer participation and learning. This is a good basis for building the competence for facilitating farmer learning processes.
- There are many case studies where farmer participatory approaches and farmer innovation have worked well. These can provide lessons.
- Farmer empowerment is now the key concept in agricultural development. Farmer empowerment is an outcome of experiences from farmer learning processes.

- The large scale implementation of participatory approaches that promote farmer learning, e.g., FFS is quite costly.
- The competences for facilitating farmer learning processes are still limited among extension professionals.
- The national extension services in developing countries are often ineffective partly due to inadequate funding and training. This is in contrast to the increased support which participatory approaches require.
- The private sector has been little involved in delivery of agricultural advisory services despite its significant role in input delivery services. Partnership with the private sector could increase the effectiveness of advisory services delivery and enhance adoption of CA.

Challenges

- How to design and implement effective farmer participatory approaches in a multi-cultural, multi-stakeholder and often political environment.
- How to develop and implement partnerships that forge synergies and complementarity between private and public sector in delivery of CA related advisory services.
- How to design farmer learning approaches that integrate different sources of knowledge (e.g. scientific and local knowledge) and support farmer innovation to speed up the uptake of CA technologies.

Strategies

- Involve a wide spectrum of stakeholders in designing and implementing.
  innovative approaches towards the adaptation of CA practices to farmers' diverse environmental and socio-economic circumstances.
- Develop a comprehensive and multi-stakeholder participatory M&E framework that provides feed back for continuous learning and adaptation.

Farming as a business and not just as a way of life

Subsistence farming, characteristic of most developing countries, is one of the bottlenecks for technology adoption. Adoption of innovations, especially those involving additional costs, can only be motivated by an entrepreneurial spirit. Developing such entrepreneurial orientation is one strategy to enhance adoption of CA. This also means besides good farming practices linking with markets and financial services, and value addition by processing or transformation (e.g. animal production).

Farmers will adopt and continue to use CA only if it assures a reasonable income increase.

Opportunities

- Many farmers solely depend on farming for a livelihood. They are therefore likely to be receptive of farming practices that increase their incomes.
- The market for many agricultural commodities already exists. Africa for example is a big market for food products given the prevalence of famine and food shortages on the continent.
- Farming as business stimulates investments in other profitable agricultural production practices (including CA).

Problems

- Many smallholder farmers have other sources of income and farming may not be their sole (or even main) interest.
- Unreliable markets and/or low prices for agricultural products discourage investments in farming.
- Lack of agricultural finance services to support investment in agriculture (e.g. CA equipment and agrochemicals).
- Poor infrastructure and facilities for value addition and linking farmers to markets.
- Inadequate market information and advisory services to enable farmers to take advantage of market opportunities.

Challenges

- How to identify those farmers really interested in farming and new farming practices and how to concentrate the limited available resources on those farms.
- How to make CA profitable enough to encourage its adoption.
- How to integrate CA related knowledge in the existing advisory services systems without creating confusion.
- How to create incentives for investment in and uptake of CA, e.g. buffering farmer losses due to unreliable market dynamics through insurance services or compensation systems.

Strategies

- Integrate CA related knowledge in the general advisory services as an option for coping with natural resource degradation.
- Link organized farmers to markets where they can negotiate contractual and/or price guarantee arrangements. CA could be one of the premises around which farmers are organized.

- Build the capacity of farmers to negotiate with different service providers such as marketing agents, input suppliers, etc., to realize the full benefits from their efforts.

Addressing the entire value addition chain

To increase farmer incomes and ensure food security, we have to go beyond promoting technologies for production towards the value addition chain. This cannot be a responsibility for a single agent but it calls for linkages, collaboration and coordination with different players in the chain, hence a holistic approach to agricultural development. CA products do not necessarily have a niche market and therefore a holistic approach is essential for its sustainable application.

Opportunities

- Many countries are pursuing policies that support holistic and integrated approaches to agricultural development.
- Value addition will enhance collaboration and partnerships with the private sector to guarantee higher incomes to the farmers. Higher income will in turn stimulate investment in sustainable production practices like CA.
- Addressing the entire value addition chain provides opportunities for using labour set free by CA practices for processing and transformation. These new activities will in turn create new demand for relevant services such as research, extension and input supplies.

Problems

- Infrastructure and incentives for investment in value addition are limited.
- Disconnected agricultural development activities cannot create the synergies required for holistic development.
- Lack of multi-stakeholder platforms for dialogue and collective bargaining to support development of the entire value addition chain.
- CA practices free up labour which, however, is hardly used for other income generating activities, due to a lack of opportunities. Thus it provides no incentive for investing in CA implements.

Challenges

- How to design or develop and implement coordinated value addition that increases the marketability of agricultural products, so that CA gets a comparative advantage over the conventional farming practices.

Strategies

- Create partnerships that promote value addition through processing and transformation in farming communities, making use of the labour freed by CA practices.
- Build capacity among agencies promoting CA to facilitate farmer organization processes that empower farmers to define strategic development goals and pursue them with determination while sourcing for the relevant services. If this is done in an action learning mode, the lessons generated can help to create a common understanding of farmer empowerment and how to achieve it. In short, farmer organizational development should be an integral part of CA programmes to enable farmers to take charge of their own development initiatives.
- Design farmer learning initiatives that enhance their analytical capacities to identify their opportunities and challenges and enable them to articulate their demands to relevant agencies with confidence.

Policies supporting farmer empowerment and assured security of land use

Security of land use is a precondition for investments in sustainable land management, like CA. Land tenure is embedded within the national policy frameworks. Policies that guarantee security of land use are likely to encourage uptake of CA. Promoting CA, therefore, may also involve lobbying to influence such supportive policies. Chapter 3.8. addresses more profoundly more policy issues relating to CA

In addition to land tenure systems, policies that emphasize decentralization and citizen participation in decision making may also favour uptake of CA. Farmers appreciating the value of CA, and being involved in participatory planning processes will urge for its gaining priority in agricultural programmes.

Opportunities

- All governments wish to be seen to be democratic and giving “power” to the people. The tendency towards democratic governance encourages grassroots participation, thereby opening a window of opportunity for farmers' interests to be taken into consideration. Policies such as decentralization support this kind of participation and hence the opportunity for farmers to articulate and prioritize their interests, which could include CA.
- All countries have land policies. As strengths and weaknesses of

such policies on the livelihood of people are well known this can be used to argue for their review as a strategy for achieving broader development goals such as MDGs and PSRSPs. Within this context CA can be appropriately articulated.

- With the proven positive environmental impacts of CA, it is possible to argue and lobby for recognition of CA as a component of environmental policies. This would justify its support from various development agencies.

Problems

- Policy development and implementation usually takes a long time. This may consequently delay all anticipated impacts of policy advocacy.
- Farmers are not yet emancipated enough to influence policies in their favour.
- Weak implementation of existing policies, for example the lack of enforcement of bylaws related to sustainable land management, impede uptake of practices like CA.

Challenges

- How to influence policies to support and prioritize sustainable production practices like CA through lobbying and pressure groups. Farmer organizations could strategically be well placed to lobby as a pressure group.
- How to increase farmer representation in the relevant policy formulation and implementation organs with a view to strengthening their voice and articulation of interests at the decision making levels.
- How to integrate CA in national environmental management policies as an option for natural resource conservation.

Strategies

- Lobby for policy reforms through farmer organizations as pressure groups to create incentives for uptake of sustainable agricultural production systems like CA.
- Involve policy makers in the inception, development and implementation of CA practices to get their support, commitment and appreciation of the contribution of CA to rural livelihoods.
- Identify and work through local champions to defend farmers' interests in policy and development decisions thereby creating opportunities for wider recognition of CA in agricultural development programmes.

Orientation of extension agents towards change management and facilitation

The issues discussed earlier under this theme emphasized the need to re-orient the extension staff towards ways of facilitating change in communities. Moving from the linear technology transfer model to innovation processes requires learning new skills. Facilitating farmer learning and innovation processes is a paradigm shift that alters power relations between the farmers and extension agents. This is a challenge for the training of extension agents. However, training institutions such as agricultural colleges and universities do not adjust their curricula regularly in order to meet the changed demands in agricultural and rural development. It is, therefore, imperative that programmes for continuous exposure, update and competence building of the extension staff and other professionals involved in CA are pursued by development agencies in partnership with training institutions.

Opportunities

- The obvious failure of the technology transfer approach to generate impact among the farming community opens space for new alternative approaches and skills. For example, the shift from farmer training to farmer learning requires facilitation skills.
- The tendency in the curricula of agricultural training institutions to focus on technical skills leaves out the critical social/soft skills being which are important in facilitating change processes. These obvious gaps in professional training call for updating curricula and integrating required new knowledge and skills.

Problems

- Limited availability of competences within the training institutions to appropriately integrate the technical and social skills required by today's agricultural professionals.
- The paradigm shift is not only a shift in knowledge and skills but also of mindsets towards more professional practice. Changing mindsets is, however, a long process.

Challenge

- How to design and implement capacity building for agricultural professionals to equip them with the technical and social skills required for facilitating change in communities and identifying appropriate entry points for CA.

Strategies

- Develop partnerships and or consortia to design and implement relevant learning programmes as part of the continuous professional development of staff. In-built mechanisms for reflection and sharing of experiences with a wide range of stakeholders can greatly enrich such programmes.
- Advocate for a review of curricula for agricultural training institutions to respond to the changed demands in agricultural development and an adequate preparation of the academic staff.

Technical Challenges and Issues in CA Adoption

This theme focuses on challenges that impede successful CA adoption. The outcomes from two sub-thematic workshops were clustered into four areas. These are presented and discussed below.

Targeting of CA across agro-ecologies and farmer types

This addresses the following issues:

- **Scale of farming**: Farm types vary even within the same agro-ecology. Thus development of technologies suitable for various end-users is a challenge to manufacturers as well as to advisory and extension services.
- **Promoting buy-in**: Promoting CA requires demonstration of high impact. CA is applicable for most soil types, and there is proven evidence of success. However, to promote buy-in, especially by policy makers, there may be a need to focus activities on areas where soils are severely degraded and could be ameliorated by CA practices. However as a general rule it is usually best to initiate CA activities on the best land I order to realize its maximum potential.
- **Capital investment**: Practising CA requires new types of equipment; labour inputs (timing and quantity) will change and opportunity costs may arise during the learning and transition process. The question is, 'are farmers willing to invest in the new technology and to what extent'; and 'how smallholder farmers can be supported in absorbing the arising costs?'

Opportunities

- It has been demonstrated that CA is applicable to a wide range of farming systems, e.g., from the small-scale systems in Zambia, the Indo-Gangetic plains, and Latin America to large scale, industrial

farms in Europe and the USA.
- It has been demonstrated that CA is applicable in a wide range of soil types and across agro-ecologies.

Problems

- While CA assures sustainable productivity and has a marked effect especially under water stress conditions, it may not have a marked yield advantage over conventional farming practices under normal weather conditions ? especially in the short term. This affects farmers' interest in adopting CA.
- CA may not be very attractive in situations where soils are not adversely stressed as the high investment costs may not be compensated by increases in yields and revenues (but best returns are more likely form un-degraded soils).
- Initial capital investment may be too high especially for resource poor farmers.

Challenge

- How to target interventions to achieve quick impact of CA on livelihoods.
  This addresses the need to enhance adoption by focusing activities on high impact areas such as environmentally high-risk prone areas or highly degraded soils (but see the previous comment). It also addresses the need to develop mechanisms for impact assessment of the CA adoption.

Strategies

- Target CA to environmentally high-risk prone areas or highly degraded soils especially farmed by vulnerable farming communities where the impact will be glaring to promote CA as a viable livelihood enhancement option. This strategy is rather contentious as the best results will be achieved by practicing CA on fertile soils.
- Design participatory monitoring and assessment processes that track changes and impacts over a long period.

Management of CA related technologies for sustainable production

Agronomy: Adoption of CA requires changes of cropping systems. The success of the adoption process will depend on the use of the right combinations of practices. The permanent presence of soil cover under CA will also change the modalities of managing weeds, fertiliser application, crop residues, etc.

Opportunities

- Over the years many promising CA technologies and combinations of agronomic practices have been developed and tested.
- In many areas where CA has been adopted, farmers are interested in trying new ways of farming.

Problems

- Crop rotation, essential to CA, often conflicts with marked preferences for one dominant crop, like maize.
- Some technologies commonly used in CA such as herbicides and pesticides are expensive, especially for resource poor farmers.
- Permanent soil cover from previous crop debris may promote pest and disease incidence over the years.
- Some technologies are environment sensitive and may not be suitable for scaling up activities.

Challenges

- How to engage users of CA technologies in R&D processes that facilitate generation of more efficient practices.
- How to develop CA technologies in a holistic manner that promote soil productivity while mitigating biotic (pests and diseases) and abiotic stresses (e.g. drought).

Strategies

- Adapt CA practices to the needs of different farm types and different agro-ecological zones through participatory R&D activities.
- Engage more in the learning process around CA rather than focusing on farmer training and technology transfer so as to capture farmers' knowledge and integrate this in the R&D process.

Enhanced adoption of CA implements

Please refer to the discussion in page 34

Research to address limitation of CA technologies

This sub-theme addresses two important issues related to research for development in CA.

- **Examination of alternative options**: There is need to address the environmental dangers of agrochemicals widely used in farming. This requires the application of sound agronomic practices (e.g. crop rotations) as well as the selection of compatible agro-chemicals (e.g. ecological herbicides, pesticides extracted from neem or pyrethrum).
- **Holistic adoption studies**: There is need for holistic R&D approaches (technical, social, economic) in order to adapt CA to the requirements of different agro-ecologies and farming communities.

Opportunities

- There are already ongoing research programmes in many countries.
- Development partners are willing to invest in CA R&D processes.
- There is interest and commitment by farmers to participate in on-farm research.

Problems

- It is often difficult to show the relevance of agricultural research to the diverse categories of farm types.
- Conducting multidisciplinary and participatory research is very expensive and time consuming.
- The impact of CA is long term which may lead to burn-out of the participating farmers who want to see immediate gains.

Challenges

- How to develop appropriate technologies that are suitable to a wide spectrum of farmers, farm types and agro-ecological zones at affordable costs.
- How to develop and implement effective partnerships for multidisciplinary CA research that assures a holistic R&D process and products.

Strategy

- Use an innovation systems approach in R&D to engage multiple stakeholders in the process.

Enhancing environmental quality and resilience: Role of CA in mitigating adverse environmental impacts caused by agricultural activities

This theme focuses on challenges that need to be addressed in order to enhance utilization of CA as a remedial strategy to support farming in marginal environments. The outcomes from the thematic workshop were clustered into two sub-thematic areas and are discussed below.

Environmental services rendered by CA

This sub-theme focuses on issues that describe the contribution of CA to mitigation of adverse environmental effects caused by plough-based agriculture. This includes improvement in soil structure and related properties such as water quality, recharging of ground water, below ground biodiversity, reduced erosion and carbon sequestration.

Opportunities

- There is proven evidence that CA can enhance the resilience of soils degraded by inappropriate agricultural practices.
- CA (no-tillage plus cover crops and crop residues) improves soil biodiversity, especially increases the activities of earthworm and other OM recycling fauna. This enhances various processes including water infiltration and storage, nutrient recycling and availability.
- CA improves soil properties such as soil fertility, increases water use-efficiency through higher infiltration and storage, and reduces evaporation and soil temperature due to permanent soil cover.
- CA improves, or at least stabilizes, crop production even in harsh environments (drought prone regions).

Problems

- It is difficult to quantify the beneficial contributions of CA to environment
  due to the compounded effects of the various technologies applied.
- Environmental benefits accruing from CA tend to be long term.
- CA can be a high input system especially when herbicides are used. This may contribute to environmental pollution.
- The environmental contribution of CA is a public good that is not compensated for by the public through premium prices for products produce using CA. This may be a disincentive for adoption.

Challenge

- How to manage and integrate CA into agricultural production systems
  in a manner that clearly illustrates its contribution to environmental resilience in regions adversely affected by agricultural activities.

Strategies

- Establishment of a monitoring system to empirically determine the contribution of CA to environmental resilience.
- Integration of CA technologies with other practices that contribute to sustainable production, e.g. integrated weed, pest and disease management.

The recognition of CA as a component of environmental policies

This sub-theme addresses issues related to the integration of CA into national environmental policies, addressed more in-depth in page 54 and 55.

Policies, Infrastructure Support and Private Sector Involvement in Enhancing CA Adoption

This theme focuses on policy issues and programme implementation frameworks including partnerships required to enhance the adoption of CA. The outcomes from the thematic workshop were clustered into two sub-thematic areas which reflect the issues being addressed.

Policy and advocacy in enhancing support to CA adoption

This sub-theme addresses four important policy and advocacy issues related to CA adoption. These issues are also addressed in sections 3.4.5. and 3.6.2. They are outlined below.

- **Integrating CA in environmental management policies**: CA is an effective approach for restoration of degraded lands and the sustained use of natural resources. It should thus be promoted as a strategy for sustainable management of a country's natural resources, primarily soils and water. This will enhance its visibility within national natural resources management policies and increases the chance of obtaining financial support.
- **Lobbying and advocacy for investment in CA**: There is need to lobby and promote CA among policy makers and implementers to invest in CA. This can be done by demonstrating CA as an environmentally sustainable farming practice that guarantees

productivity even in marginal areas, and contributes to improving livelihoods.

- **Promoting proactive community involvement**: Farming communities, as users of CA technologies, need to be more involved in R&D processes as well as other activities within the value addition chain.

Opportunities

- Improving livelihoods is the most important focus of development efforts as embodied in the MDGs, NEPAD declarations, etc. CA is one of the strategies that can contribute to attain food security, in particular.
- Global development policies such as MDGs unite all actors in development. Thus harmonisation of policies to promote issues related to agriculture becomes easier due to a common focus.
- At national level, livelihood enhancement policies have been enacted and CA could contribute to their implementation.
- In many countries there are policies on privatization and liberalization that promote private sector and civil society participation in development processes and practices.

Problems

- Isolated implementation of development policies that are interrelated impedes their effectiveness.
- Improving livelihoods in an agrarian based society requires multi-sectoral interventions which are expensive and difficult to implement.
- Many national policies for natural resource management, such as land or soils policies, are not implemented, or are hardly known, and thus do not attract the required support actions by the private sector.

Challenge

- How to package CA's contribution to agricultural and rural development in a manner that attracts government and donor support.
- How to commit governments to deliver the outputs articulated in the agricultural development policies including those where CA is an integral component.

Strategies

- Demonstrate the impact of CA on economic growth to policy makers, e.g., use of *Strategic Analysis and Knowledge Support System* (SAKSS) models.
- Develop CA programmes on the basis of existing farming systems, bearing in mind the existing market opportunities.
  Appropriately package and communicate CA to policy makers to appreciate its relevance and contribution to development.

Private sector and NGOs involvement in CA promotion

This sub-theme addresses issue related to private sector and NGO involvement in CA promotion. These issues are also addressed in sections 3.4. and 3.5.

Creation of partnerships: This is essential for CA achieving impact. It includes involvement of civil society, private sector and other stakeholders in activity implementation as well as cost sharing and taking over of projects after the end of donor funding

Opportunities

- Private sector and civil society is increasingly engaging in service delivery in various national development activities.
- CA falls within the domain of civil society activities in environmental conservation.
- CA makes use of equipment and agrochemicals that may be attractive to private sector participation.

Problems

- There are hardly any private-public partnership programmes for rural development in developing countries.
- Private sector involvement may be limited by low demand of services.
- Continuity of civil programmes and activities is affected by intermittent funding arrangements.

Challenge

- How to embrace private and public sector needs in policies that deliver the social benefits of accruing to environmental protection

Strategy

- Involve private sector partners in policy development to take into account their needs and enhance their participation, e.g. as was done in South America.

Science and supportive research, enhancing impact, research approaches and methodologies

This theme focuses on the how to effectively conduct R&D in a manner that ensures relevance and effectiveness in the value addition chain. The outcomes from the thematic workshop were clustered into two sub-thematic areas which share similar challenges, problems and strategies as those in themes four and five.

Mechanisation in CA: access to Appropriate Tools and Equipment

This theme focuses on challenges that need to be addressed to enhance mechanization of CA in order to reduce the drudgery associated with farming and promote economies of scale and scope. The outcomes from the thematic workshop were clustered into two sub-thematic areas which reflect the issues being addressed.

Provision of suitable implements to support CA adoption

This sub-theme addresses three important issues related to technical challenges and issues in CA adoption discussed already in section 3.5.3. *Equipment to enhance application of CA.* They are outlined below:

- **Availability of implements**: This is determined by the supply side, and in particular, issues related to local manufacture and distribution channels.
- **Access to implements**: This addresses the affordability of implements including availability and access to financial support.
- **Appropriateness of implements**: This includes factors affecting adoption and use of implements such as gender issues, soil types, compatibility with other farming practices etc.).

Opportunities

- There are appropriate implements available that can be used by different farm types and in different environments.
- Several prototypes of implements have been already developed and 'only' require commercial production.
- There is goodwill by governments to support practices of sustainable

agriculture.
- Farmers are eager to mechanize their farm operations.
- There are some ongoing research activities to develop appropriate CA implements.
- There is a big potential market for appropriate and affordable implements.
- Farmer groups and organizations could enable smallholder farmers to purchase or lease expensive implements, currently out of the reach of individual farmers.
- There is a vibrant manufacturing sector to develop and produce the implements.
- Technical capacity to produce the implements and tools exists locally.
- Existence of collaborators for partnerships to enhance technology acquisition.

Problems

- Limited investments by local manufacturers to scale-up production linked with uncertain demands.
- The great number of poor smallholder farmers is not an attractive potential client group of implement manufacturers.
- Inaccessibility to agricultural finance in some countries reduces consumption.
- There is limited investment in R&D for mechanization of agriculture particularly in Africa.
- The low prices of agricultural produce discourage investments in agriculture, including machines and tools.
- Manufacturing infrastructure and distribution channels of products are little developed.

Challenges
- How to encourage private sector investment in producing CA implements for various farm types and categories.
- How to make available appropriate CA implements and tools at an affordable price to farmers

Strategies
- Promote production of relevant implements and tools for CA. This may involve lobbying for favourable polices, investing and creating incentives for local manufacture by:
    - Provision of subsidies on raw materials such as tax waivers
    - Subsidies on utilities such as electricity & water.
- Support farmer groups and organizations to access agricultural finance in order to enable purchase or leasing of implements

- Forge public-private-civil society partnerships to lower transaction costs in knowledge sharing, dissemination and technology diffusion processes.

Knowledge and skills to utilise the implements and mechanize CA

This sub-theme addresses three important issues discussed in section 3.4. *Strategies and approaches in CA extension-dissemination, training and impacts*. Other issues and strategies are linked to section 3.8.1 on *Policy and advocacy*. The issues discussed under this sub-theme include:

Inadequacy of advisory services: This addresses services focusing on technology transfer rather than on shared learning and knowledge utilization, needed to assure the appropriateness of new implements.
Awareness of alternatives in the market: Many farmers are not aware of alternative CA implements available on the market. There is therefore a need for relevant information.

Opportunities

- The capacity to supply relevant advisory services on implements and tools exists both in the public and private sectors.
- Foreign and local manufacturers provide a wide range of CA implements to farmers.
- Farmer organizations offer an opportunity for purchasing CA implements beyond the reach of individual farmers.

Problems

- Public advisory services do not necessarily provide effective support to farming communities using CA.
- Technology design and manufacture usually does not involve end-user farmers and this leads to inappropriateness of implements.
- High transaction costs are a disincentive to importers and local manufacturers of CA implements.
- Farmer organizations are not sufficiently empowered to articulate real demand for CA implements.

Challenges

- How to link private and public advisory services to enhance proper use of CA implements.
- How to involve and include farmer perspectives and views in the design of implements and tools.

- How to encourage private sector investment in the production of CA implements for various farm types and categories.

Strategies

- Link advisory services to suppliers to order to ensure relevance and minimize losses due to inappropriate use.
- Engage multi-stakeholders in development of CA technologies to ensure appropriateness.
- Encourage private sector investment in the production of CA implements for various farm types and categories through deliberate government policies.

4

FIELD VISITS AND FARMERS' FORUM

Congress field visits

The IIIWCCA was unique in the sense that it had in-Congress and post-Congress field visits to different parts of Kenya and the region. The former were meant to expose the participants to the farming practice in Kenya and the extent of adoption of conservation agriculture while the latter was to give participants who were also visiting the region for the first time, an opportunity to tour the national game parks and other tourist sites. The following are the highlights.

Congress field visits

In the course of the Congress, one day was set aside for field visits to CA sites in Kenya. There were four main sites visited by a total of seven groups, two each to Machakos, Nakuro, Laikipia and KARI's National Agricultural Research Laboratory in Nairobi. This section includes summaries of the first three field visits, but not for NARL for which no report was made.

Machakos

The first stop was at **KARI Katumani Agricultural Research Station** where, after a welcoming address by the Director, Dr C W Kariuki, the visit comprised two components:

Dryland Seeds and Crop Utilisation: The Kari Seed Unit is producing open pollinated varieties of basic food crops suitable for dry climatic conditions (~ 700 mm/yr) to stimulate local demand and then to satisfy local dealers' demand for seeds to sell. The crop seeds displayed were: dolichos; yellow and green gram; pearl millet; pigeon pea; finger millet; maize; sorghum and beans.

The Station also produces fruit tree seedlings for sale (avocado, mango and citrus) as well as improved banana varieties.

New crops are analysed and novel processing method are evaluated. Various types of foods and flour have been made from sorghum cassava, pigeon pea, banana, cowpea leaves, pumpkin and paw paw juice. It is said that many of these foods are good for HIV/AIDS patients, especially when goats' milk is also included in the diet.

Dryland implements
Traditional practice is to plough after the onset of the rains and so the first week's rain is under utilized. Two locally-made implements were shown which will plant into un-ploughed soil. These were:

The chisel dry planter which comprises a chisel point with wings to augment soil disturbance. Seed is hand-fed down a seeding tube, and covered by a drag chain. The planter is pulled by draught animals (oxen or donkeys) and controlled by the farmer at the rear. And,

Scraper dry planter for black cotton soils. Black cotton soils are self cultivating and do not require ploughing. This planter introduces the seed into the soil surface and two rear angled plates drag the loose soil over the seed. Again the seed is hand-fed into a funnel and vertical seed tube.

In the discussion it became clear that maintaining crop residues for soil cover is a problem in these dry regions. Stover has a high value as a livestock forage source. This has, of course, important implications for CA. A further discussion point was that this equipment is not specifically for CA and that superior planters have been on the market in West Africa for many years.

scene that welcomed the CA group to Katumani.

Two manually controlled, animal drawn dryland planters

Cover crop farm 1 (Mr Muzoka)

Two *Dolichos lablab* cover crop plots were examined and discussed, one sown in March 2005 and the other in October 2004. The dolichos has produced excellent cover and abundant seeds. The subsequent crop (maize) will be established by ripping planting lines in the dolichos and hand seeding. It would, of course, be possible to use the animal-drawn planters that we had already inspected. Maize will be planted in mid-October, and thereafter a second cover crop should be relay-planted to maintain soil cover until the next rainy season (in March).

As a cover crop dolichos has the following attributes:

- ⊗ Drought tolerant.
- ⊗ Produces good cover and abundant seeds which have a ready market.
- ⊗ It quickly smothers weeds. And if grown as a relay crop with the main cereal, should not require weeding.

And some deficiencies:

- ⊗ It was subject to severe insect attack and had to be sprayed with insecticide.
- ⊗ It is very attractive to livestock and will need to be protected during the dry season.

On the left, good cover left by dolichos stover. On the right, grazing cattle are fierce competitors for dolichos, particularly in the dry season

Ripped soil in machakos. It can be appreciated That residue cover is Practically zero.

Locally made ripper/ridger

Since 2001 the adoption of ripping has risen from 5 to 80 families. The ripper is made in Machakos but the quality is reported to be poor, probably because mild steel is used for the wearing parts, rather than carbon steel.

Yields are said to have doubled under the ripping regime and this can be attributed to the following factors:

- ⊗ Ripping is done *before* the rains and so concentrates *all* the rainwater in the ripped planting lines.
- ⊗ Fertilizer is applied *only* to the planting lines
- ⊗ Hybrid maize is used (Dekalb DK8031).

Kalama donkey user group

The Kalama donkey users group, is promoting the use of donkeys for transport and draught power. Some of them use the donkey-drawn ripper as a form of soil and water conservation, resulting in increased yields. Actually, the ripper demonstrated by the farmers is a combined ripper/ridger, the ridging part having no apparent use. Some of the farmers also experimented with dolichos lablab as a cover crop. They are facing problems with livestock and termites. The aim of the farmers is to venture into dairy farming. The visitors questioned the wisdom of this, as there seems to be a severe shortage of fodder and water in the area.

Katua

At Katua we were introduced to women farmers experimenting with various cover crops, including mucuna, dolichos lablab and desmodium. This was their first season and the cover crop was not yet fully integrated in the farming system. The farmers will need close monitoring and support to realize real benefits from their CA efforts.

Conclusion: The Machakos area has impressive physical soil conservation and an enterprising farming community. CA activities are still at an experimental stage and mainly limited to conservation tillage (ripping). More attention should be paid to permanent productive soil cover, both on farmer's fields and on the banks of terraces and other soil conservation structures.

Brian Sims and Jan Venema.

Laikipia

The field trip went to **Lengetia Farm** of Mr. and Mrs. Sessions in Naro Moru, Laikipia district. The farm has 9000 acres of which 5000 are planted, mainly with wheat.

The Sessions took over the farm in 1999 after having farmed in Naro Moru since 1984 with variable results. During the drought years 1999 and 2000 three crops were lost. When a neighbour bought a zero-till planter, Mr. Sessions got interested and started zero till in the 2001/2002 crop. He continues successfully with zero tillage.

So far the main crop is wheat monoculture. The crop establishment requires on average two applications of herbicide per crop with an approximate cost of 630 Ksh/acre (US$8) and the seeding with similar cost. The seed rate has come down from 40-50 kg/acre under conventional farming to 18-23 kg/acre under no till, fuel consumption has gone down from 20-25 l/acre under conventional to 4-5 l/acre under no till. Sessions' labour force has been able to reduced from 100m to 50 people.

The farmer is now expanding into a more varied crop rotation including, besides wheat, also barley, sorghum and canola (rapeseed). In addition to this he is experimenting with no-till maize and cover crops like *Dolichos lablab*, mainly for the communal work with small farmers to whom he rents services for no-till planting.

The equipment used for the commercial farm is a 6 m Australian airseeder with chisel tines and three boom sprayers (12, 18 and 24 m). Some of the tractors are equipped with GPS guidance systems and the farm uses tramlines, which in future will become permanent tramlines

for controlled traffic farming. In addition a Brazilian no-till planter for row crops (from the FAO CA-SARD project) is used for local community work with a 35 hp tractor.

Planting maize for local small farmers with the 3 row no-till Brazilian planter is actually done at 300 Ks/acre (US$3.8). A commercial rate for full cost recovery would be 600 Ksh/acre (US$7.7). This is still cheaper than hiring a tractor for ploughing or doing the planting work with manual labour which would have a cost of 1000 Ksh/acre (US$12.8).

Impact:

The most striking fact is that the farm has, since the introduction of no-till, always had profitable crops with good yields of at least 1350 kg/acre wheat, while the surrounding farmers (small and large scale) sometimes haven't had a single crop and are depending on food aid.

In addition the farmer reported to have halved his production cost, mainly due to less fuel use, less seed use, less machinery.

The farmer is highly motivated and convinced about conservation agriculture as the only sustainable way of farming. He confessed that he has “wasted 25 years of his life ploughing” before he converted to no tillage.

Challenges and issues:

- So far the weed control still mainly depends on herbicides, but yet this is much cheaper than tillage. In one recent case the farmer reverted back to tillage due to heavy *Cynodon dactylon* infestation which could not be controlled by herbicides. The actual herbicide application rates are still fairly high. This is due to delays in the timely application due to strong winds which results in fairly large weeds to control. Nevertheless the weed pressure has already been reduced and the trend is towards reduction in herbicide use.
- The suspected build up of herbicide resistance or the quality of the herbicides are creating potential problems.
- Residue cover is not very high and could be improved by cover-cropping or introducing a double crop. Improved soil cover would also improve weed management.
- A more varied crop rotation will improve pest, disease and weed problems and is envisaged by the farmer.
- Nitrogen requirements: the rotation would probably benefit from an introduction of a legume; however, Sessions has not needed to increase the nitrogen fertilizer rates and still has a visibly healthy crop.
- More support is still needed for the work with the local community. So far many farmers are still reluctant to take the services of no-till planting despite the visible success.
- More equipment, for example small no-till wheat seeders for the communal work would be required.
- It was demonstrated that the same concept of conservation agriculture as applied on the large scale with tractor power can be done by hand with the jab planter and a knapsack sprayer. Even so smallholder farmers remain timid with respect to adoption.

In general the visit was very impressive. The participants concluded that Conservation Agriculture is a viable and promising solution to achieve food security under the difficult climatic situations of Laikipia district.

Theodor Friedrich

Nakuru

Farmer Field School Group in Kikapu

CA activities started in the FFS in 2003, with 8 participating members. Membership has grown to 25 (with 14 women and 11 men). There have been additions and withdrawals as some expectations have not always been fulfilled. The communal demonstration plot measures 80 x 65m is subdivided into four sub-plots:

- Maize under CA (third CA crop)
- Maize under CA (first crop)
- Control (conventional tillage)
- CA with a legume (lablab) as a cover crop.

Some observations:

- Inputs are not a constraint to the group as these are provided by the FAO Project (seed, fertilizer, herbicides and jab planter) for the purpose of supporting the demonstration plot.
- Labour is in abundance given that 25 farmers are working on a small plot.
- CA is in its initial stages with the third crop still standing in the field.

Positive points:

‡ Good yields compared to rest of the fields in the area as observed through:
  - Large cob sizes
  - Multiple cobs especially in the plot with 3 years under CA.
  - Good crop stand in terms of size of plants and plant population.

- Herbicide usage by smallholder farmers.
- Farmer participation in field demonstration, very positive in terms of knowledge sharing
- Gender balance

Negative points:

- Poor agronomic practices as shown by:
  - High plant population.
  - Too much fertilizer use resulting in excessive vegetative growth.
  - Poor plant population of the cover crop.
  - No crop rotation practised possibly giving rise to maize pests e.g. the maize stem-borer attack was evident.
- Cover crop planted too soon after the maize resulting in heavy competition.
- Jab planter had not been used to give good spacing.
- Crop was harvested late as some farmers in the area had started harvesting and marketing their crops. Planting was done a month after the start of the rainy season.
- They was no true comparison with control plot.

Why this case was interesting

- Farmer participation at demonstration plot level provided them with an opportunity to learn the best CA practices through learning-by-doing.
- Risk transfer. The fact that a project was providing inputs to farmers for demonstration purposes, removed the risks associated with venturing into the unknown. These same farmers should be recruited as development facilitators to seek to change the other farmers' perceptions.
- Profit incentives. While the plots were demonstration plots, farmers shared profits from the sale of the grain (maize). This encourages the farmers to participate with guaranteed compensation for lost time.

Challenges

- The free inputs support could lead to the creation of a dependence syndrome. Farmers should be encouraged to use some of the money generated from the sale of the demonstration plot harvest to purchase inputs. Such a set up would enable more FFS to be created with limited resources.
- The packaging of extension messages has not been comprehensive given the incidence of poor practices like mono-cropping. It's dangerous to promote one concept i.e. CA, and neglect others, as gains made by CA use may be eroded by crop pests, diseases etc.

Opportunities

- FFS is a good model for scaling out and up. The participating farmers indicated that they are using the concept in their own fields (due to time constraints this could not be verified).
- Packaging of CA with other agricultural inputs is a good initiative but needs to be complemented with extension, marketing etc.

Conclusion

The CA results were very positive, while farmers acknowledged marginal yield differences between CA plots and control plots, input application i.e. weeding labour and land preparations was lower on CA compared to CT and conventional tillage.

Francis Dube
Post Congress field visit

Two post-Congress tours were organized, one to western Kenya and one to northern Tanzania. Only one post-Congress field visit report wasmade. This was for four days to **northern Tanzania** to visit CA adopting farmers and CA projects.

Day 1

Selian Agricultural Research Institute (SARI)

Exhibition of hand-operated, draught animal and tractor powered equipment suitable for practising CA. There was also a display of goods and services offered to farmers by different stakeholders. All exhibits were well explained by the exhibitors.

Cover crop field trial site with plots of *Dolichos lablab, Mucuna pruriens*, radish and cowpea.

Day 2

Farm of Maria Erro, Rhotia-Kati village, Karatu

Maria Erro features on page 2 of the CA Manual. She has very little land (some 3000 m^2) and yet has achieved remarkable success since adopting CA using a jab planter. Her yields have doubled or even tripled and she now has increased her crop diversity to include many different legumes. Importantly, as a widow, she is now able to manage her smallholding with recourse to much less labour.

Interestingly, she has also managed to protect her fields from free grazing animals without erecting fences (she spread the word at a village meeting that she had sprayed her plots with a chemical, toxic to animals!) She had previously also rented another field to expand her CA practices but when the landowner noticed it looked “dirty” with trash and residues on the surface, he ploughed it up. She successfully sued him in court and was recompensed for her crop “loss”.

This indomitable lady is now constructing her brick house to replace her hut. Despite the fact it had not rained for the past 6 months, she had ripe cherry tomatoes in abundance and green dolichos and mucuna on parts of her land.

Farm of Alfred Daati, Kilimatembo village

Alfred has a larger farm, some 6ha. He has a basic rotation of wheat, legumes and forage (he has livestock too). Although the wheat is sole planted, the legumes and forage are usually intercropped or relay cropped. Early on, he subsoiled his fields and established contour bunds, now stabilised with trees of *Gliricidia* which he prunes for firewood (some for off-farm sale). Amongst cash crops he counts on pigeon pea (*Cajanus cajan*) and the stalks are also a valuable firewood resource. Life is so much easier now for him with reduced labour requirements and yet increased yields.

Kinara Farmer's Field School, Tloma village

This group of 34 united farmers demonstrated their bonding with a reception featuring drums, dance and song. Then it was down to business to visit the five comparative sites. The FFS is barely one year old and the learning experience is still being undergone but many results were of great interest to the group and it is clear that they will move forward in the future. There are a total of 30 similar groups in the region of similar size (perhaps 1000 farmers in total?). And each farmer also is charged with sending the message to at least one of his or her neighbours.

Day 3

Ngorongoro crater

No visitor to Karatu can leave without visiting the World Heritage site of this crater, 610m deep and with a diameter of 19km. But in fact such a visit is intimately connected with the theme of the Congress and of the Study Tour. The lakes within the crater are drying up, perhaps due to climate change. And outside, Lake Manyara is already heavily

sedimented and reduced in surface area due to the intensive tillage practices taking place on the slopes above, including in Karatu District. This was a strong message and lesson learnt by the Study Tour participants.

Enhancing equipment distribution in eastern Africa

The Trust Fund (TF) project GCP/RAF/390/GER also sponsored the participation of Ms. Carla Kühn from Brazil, a specialist Consultant in Export and Import supplies for small-scale Brazilian manufacturers and the air ticket of Mr. Jair Bottega, the Export Sales Manager of Vence Tudo, the manufacturer of tractor-mounted direct drills and planters introduced and demonstrated by many FAO projects worldwide. The objective was to stimulate the establishment of a network of dealers for the supply of proven Brazilian CA equipment to the continent. It was also hoped to foment a number of partnership agreements to assist in the local manufacture of this type of equipment. The importance given to the spread of CA practices expressed by the Ministers of Agriculture from Zambia and Lesotho, coupled with the urgent instruction in Tanzania to revise budget requests for 2006 to include greater emphasis on CA expansion, are just a handful of the reasons underlining the importance of the missions of Ms. Kühn and Mr. Bottega. Ms. Kühn will be reporting separately on her discussions in Kenya and her participation in the Kiosk exhibits during the Congress. She joined the Study Tour to Tanzania so as to better appreciate the serious attitude now adopted in this country. On Tuesday, 11 October, the reporting officer (John Ashburner) and Wilfred Mariki from SARI, the key field research officer guiding the trust fund activities in Arusha, accompanied Ms. Kühn on a visit to Nandra Engineering Works, Moshi. This initially small fabrication plant is now growing rapidly under new ownership and management. They have a staff of about 50, a tool shop, a small foundry, a fabrication shop one might also add that the general scene is quite well organized chaos! Wheel barrows, truck bodies, machinery and equipment repairs, a run on metal chairs almost any job can be accepted. And so it was that when approached as a potential local fabricator to reproduce copies of a Brazilian jab planter, an animal traction planter and a knife roller, the Managing Director, Frank Lesiriam, accepted the challenge. The results were on display at the SARI exhibition on Saturday, 8 October. Of course there were problems the closing of the “beaks” on the jab planter was not “soil-tight” (and so could clog), he had difficulty reproducing the seeding mechanism on the animal-drawn planter (this is made by a highly specialised manufacturer in Brazil, supplying all the smaller fabricators so not surprising).

Discussions during the visit to Nandra centred around three themes. Eventual follow-up must rely upon the build-up of the necessary private

sector relationships. However, the reporting officer requested that non-confidential discussion matters be copied to him in the event that the correspondents thought that he may be able to suggest useful ideas.

The themes of the discussions were as follows:

a. The brazilian manufacturers are very anxious to ensure that there can be no confusion on the part of the farmer client as to whether the equipment is imported complete or partially locally manufactured. paint colour could play a major role but also perhaps product markings and the shape of easily modified parts (seed hoppers, handles, structural components, etc.)
b. Nandra engineering of moshi represents a typical potential local fabricator. they have difficulty in manufacturing certain components. the possibility of importing (initially) small amounts of the “spare parts” needs to be investigated firstly by the brazilians to see if they are in agreement and secondly in tanzania to see if these relatively small deliveries could not be slipped into current regular shipments to arusha (for example as being done currently with trio hardware).
c. The reporting officer raised the matter of technical assistance for the local manufacturing process. he emphasised that it was vital that farmers' confidence be maintained by making sure that only top quality equipment reached their hands as they struggled with the new ca technology approach. the ro promised to emphasize this aspect in his report and to urge that related development projects fund this type of activity as a matter or priority once the local manufacture of ca equipment begins to pick up.

A most positive evening interview was also arranged on Tuesday, 11 October with Manfred Lieke, Managing Director, Tanzania Farmers Service Centre Ltd in Arusha (TFSC). Mainly involved with the large-scale farmers in the region, Mr. Lieke had worked with both GTZ and FAO on a number of Conservation Tillage initiatives in the past. TSFC regularly imports tractor-operated equipment, often from Brazil. He had previously been approached to ascertain if he would be willing to also stock and arrange for local distribution of hand-operated and animal drawn equipment. The reaction then was one of small markets, the hassle of such interventions, etc. Serious discussion that evening revealed that he could reconsider his previous opinions. After all, the potential market could be growing very rapidly.

John Ashburner

Farmers' Forum

With the participation of over 100 farmers, the IIIWCCA evolved as an event which did not only consider farmers as critical players in the sector but they were indeed in the driving seat in the entire synthesis process. Farmers from various backgrounds were given opportunities to make presentation in plenary. They conveyed their messages through poems, role plays, drama, and songs among others. The following report highlights the participation of the farmers in the Congress.

Report of the Farmers' Forum

The Farmers' Forum at the Congress on Conservation Agriculture was attended by over 75 farmers, and their facilitators / extensionists, from at least 10 Anglophone and 3 Francophone African countries, as well as Pakistan from Asia and Brazil, Paraguay and Argentina from Latin America.
The Farmers' Forum aimed:

i) To bring farmers perspectives into the Congress and give those attending the opportunity to express their views and exchange their experiences of the adoption of CA;
ii) To inspire and motivate farmers to continue testing and adapting CA, to help others in their community and to network to continue sharing experiences; and,
iii) To consult among themselves to offer farmers' recommendations for post-Congress follow up.

Participating farmers had the following **expectations from the Congress**:

1) To see increased recognition of the efforts of small-scale farmers, and participation of farmers in such events and forums.
2) To get to know each other and share experiences on CA, especially from other countries and those who started earlier to adopt CA, in order to learn about CA practices and sustainable resources management.
3) To acquire knowledge, information and skills on CA: especially on what CA clearly is and different approaches to its implementation in the field.
4) To gain the ability to disseminate CA technology to others: to train other farmers to adopt after the Congress, to extend the know-how to farmers in remote areas, and in this way eradicate hunger.
5) To obtain technical and financial support to promote CA in farmer field schools (FFS).
6) To learn how CA can be scaled up through FFS groups.
Two brief video films of smallholder farmers' experiences in adopting CA in Zambia and Zimbabwe were shown to stimulate discussion.

Farmers were organized into five groups, one French speaking, to allow farmers to discuss and answer four questions while referring to their own experience and raising issues of importance to them and suggestions to overcome problems and improve adoption.

The discussions in groups and farmers' plenary focused on four key questions regarding farmers' experience in practising CA and led to a set of farmers' recommendations.

Question 1: What are the strengths and benefits of CA in your farm?
Main issues indicated as benefits derived from CA adoption were:

- Creates good relations and exposure among the farmers (through FFS, projects, training)
- Increase in yields
- Reduction of labour and other input costs
- Saves time that can be used for other activities
- Contributes to soil conservation - prevents soil erosion and improves soil properties
- Conserves water

Question 2: What are the problems in adopting CA in your farm?
Main problems pointed out by the farmers were:

- There are insufficient CA facilitators to train farmers, and a lack of knowledge on CA
- CA implements are often not available and they are costly
- Issues of land tenure and farm size affect the adoption of CA, e.g. due to insecurity of tenure on leased land
- Insufficient tested planting materials of a range of cover crops
- Initial high demand for labour (e.g. mulching is time consuming and costly)
- Conflict of use of crop residues and uncontrolled grazing
- Problems of pest and disease control, particularly termites
- Difficult to change other peoples' attitudes towards CA adoption
- Insufficient farm labour due to the impact of HIV/AIDS on able-bodied persons, leaving many aged women and children to farm

Question 3: What are the external constraints hindering CA adoption?
Main constraints identified by farmers were:

- Socio-cultural constraints such as jealousy
- Illiteracy and lack of awareness of opportunities
- Inadequate information and facilitation

- Inadequate land tenure policy
- Lack of credit for inputs
- Unpredictable weather conditions

Question 4: What are your suggestions, wishes and opportunities

- Establish competitions / prizes for CA adopters / practitioners
- Government to provide subsidised but high quality inputs for CA farmers
- Strengthen cooperatives to achieve economies of scale
- Better management of water through catchment approaches
- Farmer to farmer learning / training tours / exchange visits / networking
- Develop appropriate technologies adapted to each situation
- Integration of organic farming and CA
- Make CA attractive to all, irrespective of gender, age and physical ability
- Create supportive micro-credit schemes
- Strengthen training of farmers through TOT programmes
- Mobilise farmers to be trained jointly / more FFS groups
- Facilitate access to markets and marketing information
- Active involvement of policy makers in CA promotion
- Promote community sensitization for wider adoption of CA

The Way Forward after the Congress Recommendations from the farmers

1. Increase the acreage under CA;
2. Encourage the entire community to adopt CA by training, by talking to our local leaders and by living as examples;
3. Set up of other farmers' groups as a way of promoting CA;
4. Encourage farmer-to-farmer exchange visits for easy adoption of CA;
5. Continue practicing CA for sustainability and improvement of livelihoods;
6. Donors and all stakeholders should try to help farmers to exchange information and technologies through networking;
7. Credit facilities to be given to farmers in order to help them acquire farm inputs and equipment to enable them to implement CA; and,
   Establish a global farmers' forum, building on regional and national farmers' fora, and organize meetings for farmers to exchange experiences and learn from one another.

Private Sector Forum

A private sector forum debated the issues surrounding their vital and synergistic participation in the development of CA in Africa. The purpose was to clarify the position of the private sector representatives regarding their role in promoting CA, especially in the case of equipment supply. The forum looked at the role of the private sector both within CA and in the broader agricultural sector. In particular the forum debated aspects of the mechanisms of synergy building with other actors, points of success, hindrances and suggested remedies.

The forum debated a series of themes in small working groups and the results of their deliberations were summarized as follows:

It is clear that CA has a big role in revitalizing our agriculture in Africa. There are a number of challenges which are facing agriculture and in particular CA. These include the following:

- Declining soil fertility
- The need to increase yields
- The need to have a robust, resilient agricultural system which can survive a bad season

For CA to work we need equipment and other inputs which are provided by the private sector and it important that the latter should be viewed as an important partner in the dissemination, adoption and implementation of CA.

Some **key issues in CA adoption** and development and the supply of equipment (especially resource-poor farmers) are:

1. High taxes are a disincentive.
2. Government policy to stimulate involvement is often deficient.
3. Empowerment of farmers and farmer organizations adds purchasing power to resource-poor farmers.
4. There is low demand for CA equipment and related inputs at the initiation of the adoption curve.
5. Supply chain issues which affect steel supply, repair and maintenance of equipment and technical assistance on CA implementation.
6. Building partnerships, in the same way the farmers' groups add power to the sector, manufacturers are better off when working in harmony with each other.
7. Extension and training and skills development are vital elements in promoting the CA message and CA expertise which will then create demand.

The **role of the private sector** is seen to involve:

- The supply of CA tools and equipment, cover crop seed, chemicals etc
- Training promotion and extension
- Marketing of produce
- Promotion of CA related equipment

The **challenges** to be overcome required to address the above issues include:

1. There is a challenge which relates to the cost of operations. Taxes, duties and language problems among other things increase the cost of operation incurred by the private sector in the provision of inputs and equipment for CA.
2. It is important to note that CA does a public good in that it addresses various environmental issues, it therefore qualifies for government subsidies in line with similar initiatives that address environmental issues. Because CA is part of the environment protection programme, companies that engage in deliberate efforts to promote CA should also get subsidies from government for their initiatives.
3. CA is responding directly to a huge development plan (food security) and it needs to be embedded as one of the poverty reduction strategies to allow the private sector to access funding for its implementation.
4. The private sector is involved in the extension, training and general promotion of CA and responds quickly to demand whereas the slow response of Government compromises the implementation process.

It seems clear that the private sector views venturing into the CA input supply chain market as fraught with uncertainty. Naturally manufacturers and suppliers are loath to invest in production for inputs that do not, yet, seem to have a high demand. The sector is aware that they are key players in the promotion pf CA, in concert with other stakeholders, notably the government in the form of the MoA and the extension services offered to smallholder farmers.

5

CONCLUSIONS AND THE WAY FORWARD

Below are some follow-up issues, we would like to bring to your attention

Next steps

Based on 'systemic intervention', each of the themes will need to be addressed; otherwise the weakest one becomes a threat to the whole approach. They however, do not have to all be actively addressed; some might be in place already, others which are identified as gaps can be addressed through linkages and partnerships.

The gaps in existing knowledge and experience can be defined and then specifically explored in different places by different people in future actions. Their insights, lessons and experiences can then be integrated after some time into the overall umbrella approach.

1 The Conservation Agriculture Knowledge and Information Management Forum (CA-KIMF)

Experience has proven that access to information alone is not sufficient to induce change, but that different sources of information need to be connected and coupled with experience to become knowledge. Only knowledge allows making sound decisions, and knowledge allows making judicious use of the vast amount of information which is accessible today thanks to the internet.

ACT has, therefore, decided to set up a “Knowledge and Information Management Forum” (KIMF) which facilitates collection and assembly of information and experience on various aspects of CA in a systematic way, and which can be built up and extended over time.

The Congress was seen as a welcome opportunity to collect information and experience on CA, and use it as nucleus of the KIMF. The original idea to organize the Congress according to the structure of the KIMF proved to be unfeasible, due to the large number of stakeholders with their varied interests.

The compromise was to take the output of the mini-workshops and discussion groups as input for KIMF. Thus the Congress managed to bring out critical and rich information and knowledge on experiences and impact of CA in conservation agriculture in different circumstances and regions.

The further development of this KIMF will become a major activity of the African Conservation Tillage Network in the coming years. The electronic format allows for constant updating and adding of information and case studies. Original papers, relating to certain chapters are in an annex to these Proceedings and are made accessible through the ACT website.

This forum is expected to

- enable systematic and on-going capture and storage
- organize and synthesize knowledge evolving from the Congress deliberations and thereafter
- allow systematic access to knowledge
- help assess relevant knowledge for different users
- enable updating, i.e., allow a knowledge base that "moves with the times"
- facilitate sharing and exchange of knowledge
- dynamically respond to demand for CA knowledge and information

In this regard, the KIMF should be understood as simply a tool for systematically and holistically capturing, synthesizing and making available knowledge to various users. The KIMF is structured in:

- Cornerstones, as primary benchmarks on the way to achieving the goals of the intervention
- Factors or issues of the cornerstones which are area or circumstance specific and give an indication of the action areas for that particular cornerstone
- Problems that need to be overcome
- Strategies, processes and approaches for managing the set activity elements
- Cases and links providing possibility for access to original source for the information or knowledge

Enhancing dissemination of CA requires the simultaneous interaction of the various cornerstones, as illustrated in the graphic next page:

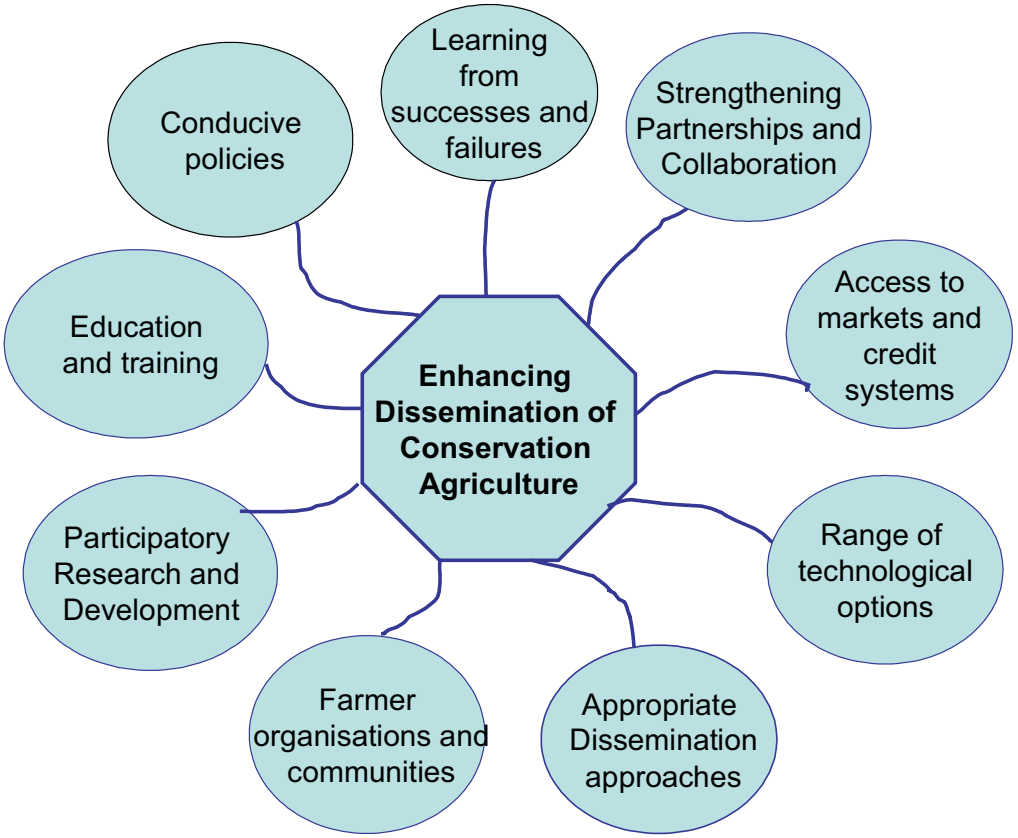


Table of cornerstones and important issues for enhancing the dissemination of CA

1. Strengthening partnerships and collaboration for CA
- Local, national, global level
- Public / private partnerships
- Collaboration between larger and smaller scale farmers
- Stakeholder mapping
- Effective institutional partnerships

2. Access to input and output markets and to credit systems
- Information about CA implements, seeds and agro-chemicals
- Information on prices, costs, credit systems
- Experiences with CA tools / implements for different cropping systems (e.g. performance, application, cost, assessment,)
- Local service providers and manufacturers
- Local processing opportunities

3. Technological options for different agro-ecological zones and production systems

- Minimum- and no-tillage technologies
- Cover crop management, including agro-forestry
- Weed management
- In-situ rainwater harvesting
- Water savings in irrigation agriculture
- Crop-livestock integration and crop residue management
- Production costs, labour requirement, risks

4. Appropriate extension and dissemination approaches

- Integration into existing production systems
- Building on indigenous practices and adaptation to local context
- Principles for the promotion of CA, e. g. definition of CA entry points
- Gender aspects, labour aspects
- Mitigation of the impact of HIV/AIDS
- Experiences with different dissemination approaches (on-farm demonstrations, farmers' field schools, CA clubs)
- National CA networks

5. Role of farmers, farmer organizations and communities in the promotion of CA

- Fostering ownership in adaptation and adoption of CA practices
- Farmer-based extension services
- Collective action, decisions, arrangements, lobbying, e. g. Joint market access
- Local by-laws and grazing arrangements

6. Participatory research and development of CA technologies

- Interdisciplinary approach
- Farmer experimentation
- Supporting innovative farmers using indigenous and scientific knowledge
- Developing links between researchers, manufacturers and farmers
- Incentives and subsidies for technology development
- Credit schemes for participatory technology development
- Patents and ownership

7. Education and training

- Incorporation of CA in curricula for academic colleges and schools
- Training of extension staff and farmers
- Development of training materials

8. Policy aspects at various levels

- Land tenure, land use rights
- Policies for supporting the promotion of CA (tax, duty, levy, subsidies

and incentives), e.g. implements import and CA practices
- Mainstreaming CA in national policies (Agric. policies, Poverty Reduction Strategies (PRSPs)
- Contribution to MDGs and UN Conventions (CCD, CBD); Food security, Improved livelihood, Natural resources management

9. Continuous learning from success and failures
- M&E and impact assessment
- Capturing important lessons by various levels of actors
- Self reflection and regular self evaluation systems

Towards a Global CA Facility

Building on the outcomes and challenges of the Global partnership program on **D**irect-Seeding, Mulch based and **C**onservation Agriculture (DMC) operated under the umbrella of the Global Forum for Agricultural Research and Development (GFAR) from 2002 to 2005, the Third Congress held a session attended by CA experts from around the world to discuss how a future global CA Facility could operate

Participants basically agreed on the need for the proposed facility or global Community of Practice. Reasons cited were:

- Many active, mostly dispersed CA activities, projects and programs worldwide.
- The CA "community" boasts of increasing, dynamic adoption and wide stakeholder interest for the CA agenda. This situation might be further enhanced by the close attention being increasingly paid to the climate change agenda, the recent sharp increase of world cereal prices, and the ever-increasing price hikes of fossil energy.
- The circumstances could not be more suitable for establishing a well-structured, highly efficient international CA Network, global CA Facility, or Community of Practice.

Proposed activities of a CA Facility were:

- Contributing to organizing world or international events on conservation agriculture (such as the upcoming fourth World Congress on Conservation Agriculture);
- Developing case studies & lesson sharing on specific experiences / topics;
- Organizing cross-site visits & exchanges between countries or continents;
- Organizing training on CA, including mobilizing the needed expertise for doing it;
- Developing and maintaining an active web-based knowledge base; Contributing to strengthening regional CA networks such as ACT for Africa.

A 'Community of Practice' (CoP) would help to formalize and strengthen the connections among likeminded persons who work in a variety of circumstances and seek collectively to improve both knowledge and practice. A number of interconnected CoPs could be established.

Actions that the CoPs, when organized, could embark upon could include:

- Establishment of a multi-functional presence on the internet that can both provide information on CA and support interactive exchanges among CoP participants. Maintenance of a register of professionals and practitioners, from a variety of disciplines and organizations.
- Development of a network of CoPs that provide opportunities for greater contributions and outputs from participants in the overall CA-CoP. Possible focuses of specific CoPs would be:
    - Knowledge for CA research agenda and priorities available to all persons interested; documentation on CA and evaluation of CA experience; exchange of research outputs, etc.
    - Advocacy for CA public and professional communication; policy dialogue with decision-makers, etc.
    - CA application field support of CA initiatives, such as training modules; cumulative experience on participatory approaches, etc.
    - Education for CA curriculum improvement in primary and secondary schools; enrichment of university and professional education.

Support for these CoPs might be worked out with several different institutions which are becoming higher-level stakeholders in CA such as GFAR, UNEP, international farmer organizations, and UNESCO, universities and NGOs. FAO is the international organization with the broadest interest and stake in CA and has indicated its willingness to provide the administrative support base for the overall CA-CoP.

Pan-African CA Networking Thrust (ACT)

A Special Interest Group meeting discussed re-casting ACT to ensure that it continued to be a valuable “element” in the promotion of CA in Africa. With a stronger focus on facilitation functions in CA knowledge and information management, the meeting made a number of recommendations including strengthening and formalizing links of the Network to regional and continental initiatives such as NEPAD, SADC, ASERACA, FARA and others. Work is underway to formulate proposals also for ACT's financing and taking on board initiatives in the West Africa Francophone initiative. Contact: Saidi Mkomwa (saidi.mkomwa@act-africa.org) or Tom Apina (info@act-africa.org).

West African Francophone CA Initiative

Within the Pan-African networking framework, there are ideas to build on the successful outcomes of the brainstorming session undertaken as preparation of input to the Congress from the experiences of West Africa Francophone countries. Contact Francis Forest (francis.forest@cirad.fr) and/or Florent Maraux, (f.maraux@ifad.org)

Mainstreaming CA into Integrated Watershed Management

This issue was brought up by IWMI, one of the Congress stakeholders. As integrated management of watersheds proved to be a successful strategy for soil and water conservation, it was proposed as strategy for broad adoption CA systems. While it is evident that CA is a means to slow down run-off and control soil erosion, and that the adoption of CA practices in watersheds could further increase the efficiency of watershed management, the other way round proposed by participants to integrated watershed management in CA systems seems to be very ambitious and difficult to achieve.

Integrated watershed management requires joint action of the various stakeholders in a watershed, starting with planning, setting up of organizational structures, joint actions for implementation, etc. Adoption of CA, on the other hand, does not necessarily require joint actions. CA can be successfully practised on an individual basis, which is often the case with commercial farms. It can be applied even on single fields, without losing efficiency.

Statement from the 3rd World Congress on Conservation Agriculture to the Conference of the Parties to the Convention on Combating Desertification (UNCCD), Nairobi, 17 - 26 October 2005

The Third World Congress on Conservation Agriculture (IIIWCCA) was held in Nairobi from 3-7 October 2005 and attended by some 600 participants from 62 countries, including over 75 farmers, the private sector, various technical sectors, policy makers and 2 Ministers of Agriculture (Lesotho and Zambia). This 3rd global congress clearly demonstrated the importance of CA for increased food security and poverty alleviation, increased agricultural productivity and sustainability of agricultural land use in a wide range of environments.

Conservation Agriculture (CA) today is a worldwide farming phenomenon that is being driven by farmers in partnership with many other stakeholders. The increase in its application has been dramatic worldwide in both developed and developing countries because of the multiple benefits that are generated at farm, community and wider environmental levels. Since the 1st WCCA the expansion of no-tillage has increased by 33.5 million hectares from 62 million hectares in 2001 to 95.5 million hectares in 2005.

Conservation Agriculture is being adapted and taken up by smallholder, subsistence farmers and by large commercial farmers in a wide range of agricultural ecosystems in semi-arid, sub-humid and humid tropical and temperate environments. Conservation Agriculture is shown to contribute to several of the GEF Operational Programmes (OP) that support the implementation of the Multilateral Environmental Agreements, as well as contributing directly to the Millennium Development Goals. CA deserves wider support through mainstreaming in national programmes and policies and through support of the Global Environment Facility (GEF) for promoting its wide uptake. The newly launched Terrafrica initiative on sustainable land management could be a great opportunity for investment and capacity building for CA promotion in Africa.

Conservation Agriculture makes a major contribution to reversing land degradation and ensuring sustainability of agricultural land use through its principles of zero or minimum tillage, permanent soil cover by crop residues and cover crops, improved crop rotations / associations, in some cases crop-livestock integration. The Congress demonstrated that these CA principles can be applied in many different ways depending on the local farming and socioeconomic context. CA systems in diverse agro-ecosystems have been shown to restore healthy living soils, to increase the infiltration and retention of rainwater and alleviate drought, and to minimize runoff and erosion and enhance the hydrological regime. CA deserves wide support through GEF OP-15 (Sustainable land management), to ensure widespread capacity building and awareness raising on CA and to promote local adaptation and diffusion of CA approaches and practices that build on innovative and sustainable indigenous management practices.

The improved rainwater management through permanent soil cover and improved soil structure (avoiding evaporation, runoff and leaching losses of commonly 15% and up to 40% on compacted, crusted soils), has proven to be effective in reducing vulnerability of farming populations to drought and food insecurity in semi-arid and sub-humid environments and vulnerability to climate variability and change. Zambia, for example, avoided a severe crisis from food shortage and famine in the recent drought years through a widely supported emergency programme that promoted CA practices. Studies on CA systems have shown that it makes substantial savings in farmers' labour, as well as in the use of fuel and energy, due to reduced weeding and tillage requirements. CA also contributes to soil organic matter restoration and has the potential for

significant increases in carbon sequestration. At an average conservative carbon sequestration rate of 0.51t/ha/year, the world could sequester 48.7 million tons of carbon per year on the 95.5 million hectares of no-till being adopted worldwide. CA allows substantial water savings, producing more crop per drop of water through increased water use efficiency. It is estimated to potentially save 1,200km^3/year by the year 2030 (equivalent to 50 Aswan dams). Thus CA is of high relevance to OP-12 (Integrated Ecosystem Management) and OP-9 (Integrated Land and Water Management) while contributing to the protection of international waters.

A key result of CA systems is the return to more diversified and sustainable farming systems that include grass and legume cover crops, plants for deeper rooting to break compacted soils and improve uptake of moisture and nutrient management, integrated crop-livestock systems for improved organic matter management and increased biomass, and improved crop rotations for pest, weed and disease control. The result of such a shift from monocultures to diversified CA systems is the conservation and sustainable use of agricultural biodiversity on small and large farms and across farming landscapes. This includes increased crop diversity, the use of neglected and improved farmers' varieties, and restoration of the vital ecosystem functions and services provided by soil life and the biological control of pests and diseases. This is of great relevance to OP-13 (Conservation and Sustainable Use of Agricultural Biodiversity).

With the widespread adoption of CA, across farms, rural watersheds and river basins, instead of being perceived as the enemy of the environment, conservation farming will show that it can be the best partner and major contributor to the environment, by conserving the soil, improving water quality and reducing pollution. CA also illustrates the synergy between environmental management and rural development by also improving food security and livelihoods and increasing agricultural production, especially in low yielding smallholder systems, and ensuring diversified products of high quality. CA allows a better distribution of labour throughout the year, and by the second year less work, and has proven to be of great interest to farming households and communities facing labour shortage as a result of the scourge of HIV/AIDS and malaria. There are still constraints to overcome, and adapted strategies and efforts are needed for improved crop-livestock integration in CA systems, for minimizing herbicide use and for adaptation to different socio-cultural contexts.

A wealth of experiences and practices are available and continuously growing. The knowledge needs to be synthesized and validated locally - documented, monitored and evaluated. A comprehensive cost-benefit and environmental-benefit framework will help promote evidence-based adoption of CA at smallholder and wider watershed scale. Newly developed direct-seeding hand tools and animal and tractor drawn implements have enabled some farmers to change towards no-tillage practices. But such tools are not yet widely available or manufactured locally which is hindering wider uptake. Training, participatory research and farmer to farmer learning need to be accompanied

by the building of strong farmers' organizations within countries and at regional and global levels for networking and farmer empowerment.

There is still a long way to go before we can expect to see CA being widely applied as the main agricultural system and for farmers and nations to harvest their multiple benefits. Many of the experiences are from pilot projects or short duration interventions that are allowing farmers and researchers to locally test and adapt CA approaches. The Congress highlighted the fact that wider uptake by farming populations will depend on substantial support by governments, donors, technical agencies and the private sector in order to make available targeted information and knowledge, as well as appropriate CA tools, equipment and adapted inputs for the improved conservation farming systems. National strategies and investment programmes are needed for the manufacture and distribution of tools and equipment, to build capacities and awareness, and ensure continuous exchange of experiences and information for CA uptake by all types of farmers worldwide, especially by small farmers in less favourable environments, such as water-scarce savannah regions. The multiple stakeholders at the Congress, especially the 75 farmers from 10 food insecure countries, urged the global community for required support to promote and accelerate adoption of Conservation Agriculture in their farming communities.

WCCA and global interaction

During the deliberations of the Congress there were also discussions as regarding the role and function of the CA World Congresses as a regular event that becomes almost an institution for the global CA related community. Some stakeholders argued that a two year cycle is too tight as fieldwork, adaptation and adoption processes require time. The audience however endorsed that the CA World Congresses would be the accepted mechanism for global interaction and discussion with regard to CA development.

As for the IV World Congress on CA, three countries submitted their bids, namely India, Russia and Cambodia. The Congress accepted and endorsed the proposal from India to host the IV World Congress on Conservation Agriculture in New Delhi. The proposed date was verified to be February 4 to 7 February 2009. The theme of the IV CA World Congress was declared to be “Innovations for improving efficiency, equity and environment”. The official Congress website is www.wccagri.ernet.in.

Besides the Congresses it was acknowledged that the CA website of the FAO is increasingly becoming the global reference point that is available and updated for the time periods between the Congresses and with regard to information and key definitions of CA. The CA website of FAO is www.fao.org/ag/ca.

ANNEXES AND APPENDICES

Presenters, and papers

Presenters

No.	Name	Organization/ title	Country
1	Edward Chuma	ACT-COC	Zimbabwe
2	Hongwen Li	China Agricultural University	China
3	Nelson Lauxen	VENCE Tudo	Brazil
4	Forbes Walker	University of Tennessee Institute of Agriculture	USA
5	Rolf Derpsch	Consultant	Paraguay
6	Johan Rockström	Stockholm Environment Institute	Sweden
7	Martin Bwalya	African Conservation Tillage Network (ACT)	Kenya
8	Theodor Friedrich	Food and Agriculture Organization of the UN	Rome
9	Bernard Triomphe	CIRAD	France
10	Murat Karabayev	CIMMYT	Kazakhstan
11	Jim Findlay	Agricultural Resource Consultants	South Africa
12	Richard Shetto	Ministry of Agriculture and Food Security	Tanzania
13	Pedro Sanchez	The Earth Institute, Columbia University	USA
14	Gottlieb Basch	European Conservation Agriculture Federation (ECAF)	Portugal
15	Dennis Garrity	ICRAF World Agroforestry Centre	Kenya

Speeches

1. Moody Awori Vice President Kenya
2 Kipruto Arap Kirwa- Minister of Agriculture Kenya
3 Mundia Sinkatana Minister of Agriculture Zambia
4 Daniel Phororo Minister of Agriculture and Food Security Lesotho

Papers presented

	Name	Title	Country
1	Richard Shetto et al	Conservation Agriculture in Tanzania: An Overview on Initiatives, Achievements, Challenges and Opportunities	Tanzania
2	Hongwen Li et al	The Current Status of Conservation Agriculture in China	China
3	Philip Boahen et al	Experiences with the Development and Diffusion of Conservation Agriculture in Ashanti and Brong Ahafo Regions of Ghana	Ghana
4	Shivaji Pandey and Theodor Friedrich,	Why Should the World be concerned about Sustainable Resource Management in Agriculture?	FAO-Rome
5	Musa J. Jambawai	The Role of Spirituality and Culture in Conservation Agriculture	
6	B. A. Adewumi	Providing Livelihood for Rural Dwellers through Efficient, Simple Technology, Low Cost Mechanical Systems	Nigeria
7	Khelifa M'Hedhbi1 and Moncef Ben-Hammouda	Direct Drilling is a Challenge for Conservation Agriculture in Tunisia	Tunisia
8	L. Seguy, Andre Chabanne	A Systemic Approach Based on Direct Sowing, Mulch-Based Cropping Systems for the Promotion of Sustainable Agriculture in Southern Countries	France
9	Moncef Ben-Hammouda et al	Auto-Toxicity of Barley Residues in Direct Sowing	Tunisia

10	Rachid Mrabet and Azeddine El Brahli	Soil and Crop Productivity under Contrasting Tillage Management Systems in Semiarid Morocco	Morocco
11	Peries R, Wightman B, Bluett C and Singh-Gill J	Conservation Tillage Contributing to Changing Soil Structure under Raised Beds in High Rainfall Southern Victoria (Australia)	Australia
12	Adrian Bolliger, Karen Damgaard Hansen and Richard Fowler	Constraints Limiting Smallholder Adoption of Conservation Agriculture: Some Observations Based on three South African Smallholder-Orientated Programmes	South Africa
13	H.Asadi	Investment Rate of Return for Irrigated Cereal Research in Iran	Iran
14	F.J. López, P.A. Casquero, J.A. Boto	Crop Residue Amount in Direct Seeding: Influence on Soil Physical Properties and Yield of Spring Barley and Maize	Spain
15	Roberto A. Peiretti	The No-Till Based Agricultural Model Proposed by CAAPAS: Its Adoption and Some of the Benefits Derived from the Process with Special Reference to the Argentinean Case	Argentina
16	Tantely M. Razafimbelo et al	Soil Carbon Storage and Physical Protection According to Tillage and Soil Cover Practices (Antsirabe, Madagascar)	Madagascar
17	Caroline Seugé et al	Natural Resources and Land-Use Management: Conditions for the Adoption of Mulch-Based Cropping System by Migrant Farmers in the Benoué River Basin (North Cameroon)	Cameroon
18	Doug McKell and Roberto A. Peiretti	Promoting Soil Conservation and Conservation Agriculture Through Farmer Associations	Canada

19	Hoà Tran Quoc et al	Example of an Iterative Approach Conducted with Smallholders in Northern Laos for the Adoption of Direct Seeding Mulch-Based Cropping Systems	Northern Laos
20	Bounthong Bouahom et al	Direct Seeding Mulch-Based Cropping Systems – A Holistic Research Approach implemented in Northern Laos	Northern Laos
21	Rachid Mrabet, Oussama El Gharass,	Performances of wheat under irrigated bed planting system in semiarid Morocco	Morocco
22	Ceris Jones and Mike Lane[2]	SOWAP (SOil and WAter Protection) – Finding and Demonstrating Ways of Better Managing the Land	United Kingdom
23	P. Lienhard et al	Impact of Urban Development and Market Access on Farming Systems Evolution in *Xieng Khouang* Province, PDR Lao.	PDR Lao
24	Michel Bertrand	Evaluation of the Agronomic, Economic and Environmental Impacts of No-Tillage Cropping Systems. Results of a Long-Term Experiment in France.	France
25	Matthieu Carof et al	Agronomic Diagnosis of No-Till Cropping Systems with Permanent Living Cover Crop in France: Effects on Winter Wheat (*Triticum aestivum* L.) Production	France
26	B. Govaerts et al	Effect of Tillage, Rotation, and Residue Management on Yield, Soil Attributes, and Soil-Borne Diseases in a Long Term Conservation Tillage Experiment	Mexico
27	A. Ratnadas et al	Impact of a Direct Seeding, Mulch-Based, Conservation Agriculture (DMC) Rainfed Rice-Based System on Soil Pest and Striga Infestation and Damage in Madagascar	Madagascar
28	M. Fuentes et al	Long-Term Effects of Tillage and Plant Residues Management on some Soil Physical Properties	Mexico

29	B. Govaerts et al	Using Optical Sensor Readings To Evaluate Crop Growth and Spatial Variability within Contrasting Tillage Systems	Mexico
30	M. Carof, S. de Tourdonnet, J. Roger-Estrade	Changes of Structural Porosity Due to Climatic and Biological Activities under No-Till Cropping Systems with Permanent Living Cover Crops: Impacts on Soil Hydrodynamics Properties	France
31	Anja Boye and Alain Albrecht	Effect of Short-Term Fallowing on Maize Productivity and Soil Properties on a Depleted Clayey Soil in Western Kenya	Kenya
32	Anja Boye and Alain Albrecht	Soil and Water Conservation by Crop Rotation with Leguminous Shrubs - A Case Study on Runoff and Soil Loss under Natural Rainfall in Western Kenya	Kenya
33	Krishna Naudin	Labour Biologique contre Labour Mécanique : Comparaison de Leurs Effets sur la Structure du Sol au Nord Cameroun	Cameroon
34	Larry Harrington	Conservation Agriculture and Resource Conserving Technologies - a global Perspective	Global perspectives
35	H.W. Mwangi et al	Development and Promotion of Cover Crops in Conservation Agriculture for Increased Maize Productivity in Kenya	Kenya
36	Hafiz Mujeeb ur Rehman	Enhancing the Rice Productivity Through Parachute Rice Transplanting Technology In Pakistan's Punjab	Pakistan
37	J. P. C. Taimo, Ademir Calegari, Manfred Schug	Conservation agriculture approach for poverty reduction and food security in Sofala Province, Mozambique	Mozambique
38	M. Mautsa	Experiences and Challenges in Private Sector Efforts in the Development and Supply of CA Equipment to Smallholder Farmers	Zimbabwe

39	Eric Scopel et al	Potential Role of CA in Strengthening Small-Scale Farming Systems in the Brazilian Cerrados, and How to Do it	Brazil
40	Damien Hauswirth et Michel Naitormbaide	Agriculture de Conservation et Développement en Zone Soudanienne du Tchad : Résultats Préliminaires d'un Dispositif de Recherche-Action	Chad
41	M Marake, A Basson, C Camarada, H Abdi, T Zergaber, D Phororo	Case Study – CA In Lesotho	Lesotho
42	Gottlieb Basch	Socio-Economic and Political Justification for Investing in Conservation Agriculture (Natural Resource Management): Experiences and Views of the European Conservation Agriculture Federation	European Experience
43	Calegari Ademir	The Effects of Winter Cover crops and No-Tillage on Soil Chemical Properties and Maize Yield in Brazil	Brazil
44	Samuel Agele	Efficacy of some soil management practices on soil abiotic and biotic properties and crop yields in a humid rainforest zone of Nigeria	Nigeria
45	L.A.S. Agbetoye and O.A. Babalola	Effect of Siam Weed (*Chromolaena odorata,* L.M. King & Robison) on Compaction Strength of typical Agricultural Soils of Ondo State, Nigeria.	Nigeria
46	Brian Sims and Josef Kienzle	Training in conservation agriculture equipment use: FAO's experience in sub-Saharan Africa	Sub-Saharan Africa experiences
47	Ademir Calegari, John Ashburner	Some experiences with conservation agriculture in Africa	African experiences

48	Carlos J. Pérez	Business Development Services to Enhance Linkages of Small-scale Farmers with Local and International Markets: the case of the Copan Coffee Growers Cooperative in Honduras	Honduras
49	Mbagwu, J.S.C. et al	Effect of no-tillage crop rotation systems on nutrient status of a rhodic ferralsol in Southern Brazil	Brazil
50	N.Chirinda, M. Muusha, E.Manyange, J.M. Mbetu	Introducing conservation agriculture technologies at Shashe block of farms in Masvingo District of Zimbabwe	Zimbabwe
51	Geoffrey Chomba	Factors affecting smallholder farmers' adoption of soil and water conservation practices in Zambia	Zambia
52	Rolf Derpsch	The extent of Conservation Agriculture adoption worldwide: Implications and impact	World Experience
53	Fatima Ribeiro, Bernard Triomphe, Dacio Benassi, and Bernard Hubert	Do smallholders in Southern Brazil practice Conservation Agriculture as recommended or as suits them? Preliminary evidence from Parana State	Brazil
54	Patrick Gicheru	The influence of tillage systems on surface soil water conservation and crust formation in semi arid Kenya	Kenya
55	Gitau, A.N and Gumbe, L.O	Mechanical Behaviour Of Hardsetting Soils of Semi Arid KenyaSemi-Arid Kenya	Kenya
56	Gottlieb Basch	Socio-Economic and Political Justification for Investing in Conservation Agriculture (Natural Resource Management): Experiences and Views of the European Conservation Agriculture Federation	European Experience
57	Ha Dinh Tuan et al	Conservation Agriculture by Small Scale Farmers in the Northern Mountainous Regions of Vietnam	Vietnam

58	Hoà Tran Quoc et al	Example of an Iterative Approach Conducted with Smallholders in Northern Laos for the Adoption of Direct Seeding Mulch-Based Cropping Systems	Northern Laos
59	Landers, John N, Clay, Jason, Weiss, Joseph.	Five case studies: Integrated crop/livestock ley farming with zero tillage-the win-win-win strategy for sustainable farming in the tropics	Brazil
60	C. López-Fando and M.T. Pardo	Effects of zone-tillage in rotation with no-tillage on soil properties and crop yields in a semi-arid soil.	Spain
61	Kihara J, Bationo A, Okalebo J, Waswa B, Kimetu J, Rotich E	Effects of tillage practice on cereal and legume yields in a ferralsol of western Kenya	Kenya
62	Mike Lane	SOWAP and ProTerra projects - Assessing and disseminating approaches to Conservation Agriculture in Europe	United Kingdom
63	Rachid Mrabet and Azeddine El Brahli [2]	Soil and Crop Productivity under Contrasting Tillage Management Systems in Semiarid Morocco	Morocco
64	M. Rafiq Akhtar	Impact of resource conservation technologies for sustainability of irrigated agriculture in Punjab (Pakistan)	Pakistan
65	M. A. Rahim and M. A. Haider	Multistoried cropping for sustainable land use, vertical yield enhancement, biodiversity, agricultural conservation in Agroforestry system	Bangladesh
66	Antonio Rodríguez-Lizana et al	Plant cover on olive groves: the effect on runoff and infiltration	Andalucia, Spain
67	A. Rodríguez-Lizana	A study of the influence of live plant cover in olive groves on the pollution of runoff water by nitrates	Andalucia, Spain

68	Soutou G., Naudin K., Scopel E.	Crop water balance in conventional and direct seeding mulch-based cotton cropping systems in North Cameroon	Cameroon
69	M.Temesgen W.Hoogmoed, J. Rockstrom. H, Savenije HG	Conservation Agriculture Implements for Smallholder Farmers in Semi-Arid Ethiopia	Ethiopia
70	Thierry Brévault and Krishna Naudin	Factors affecting cotton seedling in mulch-based cropping systems in North Cameroon	Cameroon
71	G. van Lynden, Ceris Jones, Katleen Gillijn	Documentation and evaluation of case studies of soil and water protection using conservation tillage in North and Central Europe	North and Central Europe
72	Vincent Boubie Bado et al	Long-term effects of fertilizers and cropping system managements on soil and crop yields in the Guinean savannah zone of Burkina Faso (West Africa)	Burkina Faso
73	Forbes Walker et al	Development and Implementation of No-Till Systems in Tennessee in the Southeastern United States: 1960s to present	USA

The papers presented above are available in the CD - ROM accompanying this publication and also in the ACT Website (www.act-africa.org).

Programme

Sunday, October 2, 2005

09:00 am 06:30 pm: Registration (Registration will take place at SAFARI PARK HOTEL)

Registration

Monday, October 3, 2005

Venue: Jambo Conference Hall: 08.30 10.30 am:
Session Convenor: Shilibwa Mwamzali
Session Chairperson: James Ongwae, PS, Ministry of Agriculture,

08:00 08:30 am: Entertainments and Initial Opening Session
Introductions/Announcements

08:30 10:00 am: Official Opening Session

1. Statement by COC Chair:
Edward Chuma Welcome statement; Congress background
Brief Welcome Statements by Ministers/Dignitaries present

2. Statement by Host Country/Minister:
Mr. Kipruto Arap Kirwa, Minister of Agriculture, Kenya

3. Official Opening Statement: Guest of Honor:
His Excellency the Vice President of the Republic of Kenya and Minister for Home Affairs, Hon. Dr. A. A. Moody Awori

(1)Role Play: Kenya CA-FFS Group CA SARD Project

10:00 11.00 am: Opening Plenary Session Keynote presentations

Introductory Presentation: Congress Purpose and framework the IIIWCCA Foot print,
Martin Bwalya ACT Coordinator

Keynote Presentation: 1. Conservation Agriculture Building the foundation for Africa's thrust on food security, poverty alleviation/worth creation and overall development. *Richard Mkandawire, NEPAD Agricultural Advisor; NEPAD Secretariat*
2. Conservation Agriculture and the Millennium Development Goals. Petro Sancherz, UN Millennium Project Hunger Task Force

Sunday, October 2, 2005

11:00 - 11:30 am: Break

Opening Plenary Session Keynote presentations: **Facilitator Bady Cury**

11:30 12:00 noon: Paper 1.1: Why should the world be concerned about natural resource management in Agriculture, (Should we be concerned about Agriculture in natural resource degradation and biodiversity loss: Global Evidence): Shavaji Pandey Director, Agricultural Support Systems Division, FAO, Rome

12:00 12:30 noon: Paper 1.2: Socio-economic and political justification for investing in conservation agriculture (natural resource management): ECAF experiences in developed countries and largescale farming enterprises. *Gottlieb Basch, European Conservation Agriculture Federation (ECAF)*

12:30 01:00 pm: Paper 1.3: The extent of Conservation Agriculture adoption worldwide: Implications and impact. *Rolf Derpsch, International CA Consultant* 01:00 01:15 pm: Plenary Discussions

01:00 02:30 pm LUNCH

02.30 pm 05.30 pm; Parallel Sessions

Theme Facilitator: Gabriel Rugalema and Paola Termine	Theme Facilitator: Moncef Ben-Hammouda and Kurt Steiner	Theme Facilitator: Alain Albrecht and Jama Bashir
Session 1: Socio-economic and cultural dimensions in CA adoption and Impacts	Session 2: Conservation Agriculture and integrated Rainwater management enhancing rain water harvesting, in-situ retention and use productivity	Session 3: CA in Agroforestry: Options and Impacts

Mini Workshop 1	Mini Workshop 2	Mini Workshop 3	Mini Workshop 4	Mini Workshop 5	Mini Workshop 6	Mini Workshop 7
CA in enhancing labour productivity issues, challenges and impact Facilitator: Josef Kienzle	Risks and investment concerns in CA adoption Facilitator: Allan Norton	Cultural and traditional factors in CA adoption Facilitator: Reynolds Shula	Socio-economic impacts of CA in farming communities Facilitator: Paola Termine	Impacts of CA on water use, soil quality and production Facilitator: Paul Nyende	Rainwater Productivity in dryland farming Facilitator: Nuhu Hatibu	Conservation Agriculture in Agroforestry Facilitator: Alain Albrecht
02:30 - 02:50 pm Presentation 1.1 CA and Food Security in the context of HIV/ AIDS crisis: breaking the vicious circle. Pier Giorgio Menchini, Swaziland	02:30 - 02:50 pm Presentation 2.1 CA in supporting vulnerable households to deal with food insecurity and income generation: Experiences from River of Life. Brian Oldrieve, Zimbabwe	02:30 - 02:50 pm Presentation 3.1 "Driving forces" in the shift to CA: Experiences in smallholder farming systems in Brazil. Lutécia Canalli Brazil	02:30 - 02:50 pm -Presentation 4.1 Restoration of rural livelihoods through conservation agriculture: Case study of land rehabilitation measures of the Tiriki, Edward Mulaama, Kenya	02:30 - 02:50 pm Presentation 5.1 Impact of Resource Conservation Technologies for sustainability of Irrigated Agriculture in Punjab, Pakistan. M. Rafiq Akhtar, Pakistan	02:30 - 02:50 pm Presentation 6.1 Water management: Feasible and viable options for in-field rainwater harvesting and enhancing rainwater productivity (more crop per drop): Maimbo Malesu Searnet	02:30 - 02:50 pm Presentation 7.1 Short-term tree fallows and no tillage: an opportunity to improve yields and ecosystem services in the tropics the IMPALA Project synthesis. Anja Boye, Kenya
02:50 - 03:10 pm Presentation 1.2 Labour productivity a determining element in the evolution of dry season sorghum cropping systems in N/Cameroon Bertrand Mathieu, Cameroon	02:50 - 03:10 pm Presentation 2.2 CA in enhancing food security and stability in income for vulnerable households: Experiences from Lesotho August Basson, Lesotho	02:50 - 03:10 pm Presentation 3.2 Factors Influencing Smallholder Farmers' adoption of soil conservation practices In Zambia. Geoffrey CHOMBA, Zambia	02:50 - 03:10 pm Presentation 4.2 CA in deployment of development resources to relief support. Case of DFID - Zimbabwe. Joanne Manda & Tom Barrett, DFID-Zimbabwe	02:50 - 03:10 pm Presentation 5.2 The influence of tillage systems on surface soil water conservation and crust formation in semi arid. Patrick Gicheru, Kenya	02:50 - 03:10 pm Presentation 6.2 Factors responsible for sustainable agriculture in Indo-Gangetic basin; S.K. Sharma; India	02:50 - 03:10 pm Presentation 7.2 Coppicing fallow and CA benefits in Unimodal rainfall conditions. Paramu Mafongoya, Zambia

Mini Workshop 1	Mini Workshop 2	Mini Workshop 3	Mini Workshop 4	Mini Workshop 5	Mini Workshop 6	Mini Workshop 7
03:10 - 05:30 pm Discussions	03:10 - 03:30 pm Presentation 2.3 Challenges for the adoption of CA by smallholders in semi-arid Southern Zambia Frédéric Baudron, Mwanza HM, Bwalya M,	03:30 - 05:30 pm Presentation 3.3 Conservation agriculture approach for poverty reduction and food security in Sofala Province, Mozambique. J.P.C. Taimo, Mozambique	03:30 - 05:30 pm Discussions	03:30 - 05:30 pm Discussions	03:30 - 05:30 pm Presentation 6.3 Impact of CA on crop water use and production: Case the dry food slopes of North- West Mount Kenya. L. Njeru, Kenya	03:30 - 05:30 pm Presentation

End of Formal Programming

Evening Events:

Monday evening:	
•Event:	Entertainments
•Time:	07.00 to 09.00 pm
•Venue:	Pool side
•Participation:	Open
Note: Cash bar	

Tuesday, October 4, 2005

Application/adoption of Conservation Agriculture: Challenges and Issues

Plenary Session 2: Keynote Presentations:
Facilitator - Timothy Simalenga

Feedback reports 08.00 08.30 am

08:30 09:00 am: Paper 2.1: Evolving of government policy on CA in Zambia and its role in enhancing CA adoption: Mr. Mundia Sinkatana, Minister of Agriculture, Zambia

09:00 09:30 am: Paper 2.2: CA in theory vs. in practice, as a set of technologies vs. as an innovation process: Lessons, gaps and challenges from selected experiences around the world. Bernard Triomphe, CIRAD

09:30 10:00 am: Paper 2.3: Three decades of NRM research in the CGIAR centers: Lessons and challenges. *CGIAR* (It is the CGIAR Mission to promote sustainable agriculture for food security and viable farming in developing countries How has/is research in the CGIAR centers adjusted/adjusting to the challenges); Dennis Garrity ICRAF; Steve Towmlow ICRISAT; Pat Wall CIMMYT; Frank Place ICRAF and Richard Thomas - ICARDA

Role Play Presentation (15 minutes) Tanzania Farmer group

10:15 10:35 am: Short case presentation: Development, diffusion and evaluation of productive cropping systems to implement Conservation Agriculture. Approaches & experiences of CIRAD and its partners. Marco Wopereis, CIRAD

10:35 10:55 am: - Short case presentation: Making a difference in the lives of the poor and vulnerable communities Experiences from promotion of conservation Agriculture in Lesotho. Mr. Daniel Phororo, Minister of Agriculture and Food Security, Lesotho

10:55 11:10 am: Discussions

11:10 am - 11:30 am **Break**

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10:55 11:10 am: Discussions

11:10 am - 11:30 am **Break**

11.30 am -01.00 pm **Open Session**

Posters Session 11:45 am: Video Show 1: Video from Uganda Paul

Information Kiosks and exhibitions 12:15 noon: Video show 2: Experiences with CA in Mozambique 01:00 am

02:30 pm LUNCH

01:00 am 02:30 pm **LUNCH**

02.30 to 05.30 pm Afternoon Sessions

Theme Facilitator: Victor Chude	Theme Facilitator: Olivier Husson	Theme Facilitator: KPC Rao & Nuhu Hatibu
Session 4: Strategies and approaches in CA Extension-dissemination and Training	Session 5: Technical Challenges and issues in CA adoption:	Session 6: Integrated Management of Watersheds: A Powerful Strategy for Conservation Agriculture and Conservation Agriculture Sustainable Livelihood Security

Mini Workshop 8	Mini Workshop 9	Mini Workshop 10	Mini Workshop 11	Mini Workshop 12
Extension-Training and dissemination tools and approaches Facilitator: Herbert Mwanza	Empowering farmers and farmer organizations Facilitator: August Basson	02:50 - 03:10 pm Presentation 3.2 Factors Influencing Smallholder Farmers' adoption of soil conservation practices In Zambia. Geoffrey CHOMBA, Zambia	02:50 - 03:10 pm Presentation 4.2 CA in deployment of development resources to relief support. Case of DFID - Zimbabwe. Joanne Manda & Tom Barrett, DFID-Zimbabwe	02:50 - 03:10 pm Presentation 5.2 The influence of tillage systems on surface soil water conservation and crust formation in semi arid. Patrick Gicheru, Kenya

02:30 02:50 pm Presentation 8.1 Setting up of natural resource management activities: From a mass extension method towards a decision-tool approach. Krishna Naudin, Cameroon	02:30 - 02:50 pm Presentation 9.1 Case Study: Experiences of an NGO in tropical Brazil, Promoting Zero Tillage through Clubes. John N. Landers, Brazil	02:30 - 02:50 pm Presentation 10.1 Direct sowing under cover crop and traditional farm ing system comparison effect on weed control and soil productivity in northern Cameroon. Jean-Paul Olina, el at. Cameroon	02:30 - 02:50 pm Presentation 11.1 Agronomic diagnosis of no-till cropping systems with permanent living cover crop in France: effects on soil properties and wheat production Carof M., et al. France	02:30 - 02:50 pm Presentation 12.1 Enhancing livelihoods and conserving natural resources through integrated watershed management -The case of watershed development in India or Lessons from long-term experiences in India S.P. Wani, India
03:10 - 03:30 pm Presentation 8.2 Diffusion of conservation agriculture techniques and socio-territorial approach in the Lake Alaotra area, Madagascar Stéphane Chabierski, Madagascar	02:50 - 03:10 pm Presentation 9.2 Improving land management and livelihoods of small-scale farmers through Conservation Agriculture: The Uganda Experience. Drake Mubiru, Uganda	02:50 - 03:10 pm Presentation 10.2 Conservation tillage reduces weed pressure and labour demands in maize-based systems in the derived savanna of Nigeria. Linus Franke, et al. Nigeria	02:50 - 03:10 pm Presentation 11.2 Crop residue amount in direct seeding: influence on soil physical properties and yield of spring barley and maize. Javier F. López, Spain	02:50 - 03:10 pm Presentation 12.2 Integrated technological innovations for livelihood security and environmental rehabilitation through integrated watershed management Bharat R. Sharma, India
03:10 - 03:30 pm Presentation 8.2 Diffusion of conservation agriculture techniques and socio-territorial approach in the Lake Alaotra area, Madagascar Stéphane Chabierski, Madagascar	03:10 - 03:30 pm Presentation 9.3 Multi-Sectorial Participation and Educational Approaches: A Categorical Imperative in the Promotion of Innovative Technologies like CA. Benjamin Serkfem, Cameroon	03:10 - 03:30 pm Presentation 10.3 Herbicides as a weed management option in CA: Feasibility and marginal benefits/ costs for smallholder farmers. Jim Findlay, South Africa	03:30 - 05:30 pm Discussions	03:30 - 05:30 pm Small group discussions **Group 1:** Technical requirements for high performance in IMW **Group 2:** The social factors necessary for success in IMW **Group 3:** Policy and institutional requirements for scaling up IMW**:**

Evening Events:

Tuesday evening:

- Event: CGIAR Centres Reception (Responsible; Dr. Bakaar Mohamed, ICRAF)
- Time: Starting at 07.00 pm
- Venue: To be advised

Participation: By invitation

Tuesday, October 4, 2005

Day Field Visits

Destinations

Other Participants (Maximum spaces of 40 participants on each trip)

Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
KARI-KABETE	Laikipia	Machakos 1 Yatta/Mwla/ Katangi	Machakos 2 Iiyuni/Kola areas	Nakuru 1	Nakuru 2
Visit to the Kenya Agriculture Research Institute (KARI) within Nairobi. Morning Programme Only	Largescale commercial farming with wheat and maize. Dairy farming in smallholder systems. 200kms from Nairobi in the rift valley	About 50 kms from Nairobi. Dryland farming and horticulture production in both hilly and flat plain topography.	About 50 kms from Nairobi. Dryland farming and horticulture production in both hilly and flat plain topography.	160 kms from Nairobi on the floor of the Rift Valley. Extensive maize and wheat farming.	160 kms from Nairobi on the floor of the Rift Valley. Extensive maize and wheat farming.
NARL-Kabete: CA equipment demonstrations Legume Research Network bulking/demo plots Long term Soil fertility programme	Will see Conservation Agriculture efforts in both large scale and smallscale farms and how these two groups of farmers are helping each other to scale up Conservation agriculture	Water harvesting by individual group members. Water harvesting and horticulture, fruit trees. Soil conservation structures.	Water harvesting by individual group members. Water harvesting and horticulture, fruit trees. Soil conservation structures.	Smallscale farmers promoting CA in dry areas working with cover crops and how to control weeds. Seed production systems for sustainability. Visit farmers practicing soil and water conservation	Integration of organic and inorganic fertilizers including cover crop and composting among smallscale CA farmers. Local tools manufacturing and use in Gilgil.

Drip Irrigation for vegetables and bananas Biotechnology Programme. Herbicides application/sprayers	Use of machinery. Land rehabilitation/soil conservation projects in Laikipia oriented towards Arid and Semi arid	CA at Katangi, basket weaving (south yatta women group) Kari-katumani		FFS: Kikapu and Kerima. Direct planting using fitarreli Fruit and vegetable processing Njoro canning factory.	FFS: Ngesha. Direct planting using Fitarreli KARI-Njoro wheat and oil-crops, water harvesting. Visit one large scale farmer.

Evening Events:

Wednesday evening:

- Event: Traditional African Dinner (Responsible - COC)
- Time: Starting at 07.00 pm
- Venue: Nyama choma Restaurant

Participation: All participants are invited

Thursday, October 6, 2005

Plenary Session 4: Advances and Initiatives in CA Promotion

Venue: Main Theater I
08.00 - 08.30 am: Reporting back from Field Visits: 08.00 08.30 am:
Facilitator Raj K. Gupta

Plenary Session 4: Keynote Presentations
08:30 - 08:50 am: - Paper 4.1: Recent developments and Experiences with CA promotion and adoption in China lessons. Prof. Li Hongwen, China
08.50 - 09.10 am: - Paper 4.2: CA in Tanzania: Status and Trends. Richard Shetto, Tanzania
09:10 - 09:30 am: - Paper 4.3: Development and Implementation of No-Till Systems in Tennessee in the Southeastern United States: 1960s to present. Forbes Walker

Role Play Presentation (15 minutes) Kenya Farmer Group

09:30 - 10:00 am: - Paper 4.4: Experiences promoting CA in northern Kazakhastan, Murat Karabayev, Kazakhastan
10:00 - 10:30 am: - Paper 4.5: Experiences promoting CA in West Africa Synthesis from the West African Process. Patrice Djamen

Farmer Experiences (10 minutes): Tanzania Farmer

10:40 11:00 am: - Discussions

11:00 11:30 am: Break

11:30 01:00 pm Open Session

Posters Session / Information Kiosks and Exhibitions	11:30 am: Zero Tillage in Pakistan R. Akhtar 12:00 noon: Video Show 2	**Posters Session / Information Kiosks and Exhibitions**

01:00 am 02:30 pm LUNCH

02:30 05.00 pm Special Meetings Session

Special Interest group meetings (formal/informal) (Own organized or organized by/through the Congress Organizing Committee); Each meeting will be free to prepare and submit to the Congress Committee a brief (2 pages at most) on petinent issues in their subject matter which their would wish to bring to the attention of the Congress

Meeting 2: Facilitators: Sally Bunning and Marietha Owenya Time: 02:30 05:00 pm: Venue: Tent 1 Special farmers' session: Farmers' forum: Purpose Allow farmer to farmer interaction at cross continental level (smallholder farmers) Bring out focused farmers' perspectives on CA issues to the rest of the congress Participants Farmers from all continents Farmer organizations Smallholder, commercial and emerging commercial farmers Programme Half day discussion session Outputs of Farmer forum Farmer-to-farmer links for possible future interaction Farmers' statement outlining key priority issues/concerns on CA development, adoption/ promotion	Meeting 4: Edward Chuma and Martin Bwalya Time: 02:30 04:00 pm: Venue: Pan-African CA unit (ACT) Purpose Review operation of ACT with the view to ensure the Network's focus on value adding activities Participants ACT steering committee and other invited persons Programme ACT Expected Outputs Practical plan in the focus and operations of the Network including structural set-up	Other Meetings - …: See Congress Secretariat to organize an interest group meeting you may wish to hold

Meeting 3: Facilitator: Bernard Triomphe and Martin Bwalya Time: **04:00 05:30 pm**: Venue: **Global CA Unit (Mechanism)** Past efforts in regional / continental collaboration and networking (CAAPAS in Latin America, or ACT in Africa, etc…) have underlined some key role such efforts would play in enhancing widespread adoption of CA. A special session is being organized at the IIIWCCA to explore on **the need and opportunity for establishing a global platform / networking mechanism on CA**. Among other issues,	**Meeting 1:** Josef Kienzle and Walter Chigwada Time: 02:30 04:00 pm: Venue: **Tent 2** **Private Sector meeting** Key areas: - inputs supply - product marketing - financing - service providers Incentives for private sector interest and participation Experiences and lessons from private sector collaborations and involvement Entry points for private sector collaboration	

Evening Events:

Thursday Evening:

Event: Launch of the CA Manual (Responsible; ACT and IIRR)
Time: Starting at 06.00 pm
Venue: Mamta Poolside
Participation: By invitation

Friday, October 7, 2005

Enhancing widespread adoption of Conservation Agriculture: Incentives, Policies and Political Will

08.30 10.30 am

Theme Facilitator: Pat Wall and Forbes Walker	**Theme Facilitator:** Torsten Andersson	**Theme Facilitator:** Steve Twomlow & Marco Wopereis
Session 7: Enhancing environmental quality and resilience	Session 8: Policies, infrastructure support and private sector involvement in enhancing CA adoption	Session 9: Science and supportive Research

Mini Workshop 13 CA in mitigating adverse environmental impacts caused by agricultural activities Facilitator: Pat Wall and Forbes Walker	Mini Workshop 14 Policy and Advocacy in enhancing support to CA adoption Facilitator: Joanna Manda	Mini Workshop 15 Lessons on marketing and involvement of private sector and NGOs in CA promotion Facilitator: Susan Wren	Mini Workshop 16 Enhancing impact: Research approaches and methodologies Facilitator: Steve Twomlow & Marco Wopereis
Venue:	Venue:	Venue:	Venue:
08:30 - 08:50 am Presentation 13.1 Recognizing and strengthening synergies between CA and the global environmental agendas. Mohamed Sessay & Anna Tengberg, Kenya	08:30 - 08:50 am Presentation 14.1 Impact modeling (ICRAF/sida) Joseph Sang, Kenya	08:30 08:50 am Presentation 15.1 Experiences and challenges in realizing the commitment to CA promotion in the Municipality - case of Santa Catarina Municipality Leandro Wilder, Brazil	08:30 08:50 pm Presentation 16.1 Effect of tillage, rotation, and residue management on yield, soil attributes, and soil-borne diseases in a long term conservation tillage experiment. B. Govaerts, et al. Mexico
08:50 - 09:10 am Presentation 13.2 Soil carbon storage and protection according to tillage and soil cover practices (Antsirabe-Madagascar) Alain Albrecht, et al.	08:50 - 09:10 am Presentation 14.2 Policy development and implementation within NRM. Anna Tengberg & Mohamed Sessay, Kenya	08:50 - 09:10 am Presentation 15.2 Facilitating Markets and market incentives in CA promotion among smallholder farmers: Case from ASP Zambia. Reynolds Shula, Zambia	08:50 - 09:10 am Presentation 16.3 Associating Cassava with Brachiaria sp. on degraded hillsides in Madagascar. Lesson and Issue on the reaserch approach. Oliver Husson, Madagascar

09:10 - 09:30 am Presentation 14.3 Evaluation of the agronomic, economic and environmental impacts of no-till cropping system. Results of a long-term experiment in France. Michel Bertrand, et al. France 09:30 10:30 am Discussions	09:10 - 09:30 am Presentation 15.3 Godfrey Bahiigwa the Coordinator for SAKSS (Strategic Analysis and Knowledge Support Systems) will be presenting the paper. Godfrey Bahiigwa 09:30 10:30 am Discussions	09:10 - 09:30 am Presentation 14.3 Impact of Technologies and Market Access on Natural Resources and Farming Systems Evolution in Southern Xayaburi Province. Hoà Tran Quoc, Chanthasone Khamxaykhay, Florent Tivet, Loas 09:30 10:30 am Discussions	09:10 - 09:30 am Presentation 16.2 Enhancing applicability and impact of research on natural resource management. Lessons from KARI. 09:30 10:30 am Discussions

10:30 11:00 am: Break

11:00 am 01:00 pm: Plenary Session 5: Facilitator Mohamed Bakarr

11:00 11:30 am: Keynote Presentation: Producing more with less Water: Finding synergies when faced with trade-offs. Johan Rockstrom (Sweden)

Farmer Experiences (10 minutes): Lesotho Farmer

Farmer Experiences (10 minutes): Botswana Farmer (Mr. Gus Nilson)

Panel Discussion: Issues on enhancing CA adoption different perspectives

i. Hon. Mundia Sikantana - Zambia Minister of Agriculture
ii. Hon. Daniel Phororo - Lesotho Minister of Agriculture
iii. Mr. Achyut Das India (Agragamee Orissa/Sustainet)
iv. Larry Harrington
v. Farmer

01:00 02:00 pm LUNCH

Concluding Plenary Session: 02:00 pm 04:30 pm

02:00 02:45 pm Synthesis of Congress Outputs - Core Facilitators

02:45 03:00 pm Farmers' statement "Our view"

02:45 03:00 pm Private Sector statement "Our view"

03.00 - 3.45 pm: Future initiatives:

i. CA Knowledge Management - Tonie Putter
ii. Pan African CA platform (ACT) - Martin Bwalya
iii. Global CA entity - Bernard Triomphe
iv. Next congress - Edward Chuma

Congress evaluation: Reynolds Shula and Brian Sims

Presentation of Award for the winning Kiosk

Closing ceremony: Official Address: Guest of Honour: Minister of Agriculture Kenya

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fertilizer with front wheel for equine traction

Two-row planter for animal traction

One-row planter for micro-tractor

Micro-tractor mounted two-row ridger
for onions and other vegetables

Tractor 3-point hitch mounted planter
(3-row soya or 2-row maize)

Planter – 3-row (soya) or 2-row (maize) –
for small tractors

Tractor-mounted three-row ridger
and fertilizer for no-till tomato, tobacco, etc

Tractor 3-point hitch mounted planter
(3-row soya or 2-row maize)

1.Trailed no-till planter
(5 rows soya, 3 rows maize)

Tractor 3-point hitch mounted planter
(5-row soya or 3-row maize)

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Conservation Agriculture practices make agriculture more productive and at the same time conserve the environment and result in sustainable production intensification. The focus of CA is on the people involved in agriculture including the related support services and the end result is better livelihoods security and sustained income.

These Proceedings synthesise the deliberations of the III World Congress on Conservation Agriculture held in Nairobi from 3 to 7 October 2005.

The Proceedings are published at a time when soaring food and energy prices have severely impacted on the livelihoods of millions of smallholder farmers and many more consumers. The newly evolving world focus on agricultural production and increased productivity strikes a balance between enhanced access to agricultural inputs and equipment; and the vital knowledge related to sustainable profitable agricultural practices.

Conservation Agriculture stakeholders around the globe have participated in the sequence of World Congress events (Madrid, 2001; Foz do Iguaçu, 2003; Nairobi, 2005; New Delhi, 2009) to share their experiences of and commitment to CA. Communities of Practice are learning from successes and confronting challenges from local to global level, from smallholders to commercial farmers to extension and policy advisers. The aim of this collaborative effort is to link production, livelihoods and conservation.

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