PART II

Sessions I - XV

SESSION I

Background to the workshop: Objectives of the workshop, process and agenda, expected outcome

I. OPENING SPEECH

by **James Butler**, Deputy Director General, FAO

The US 'Dustbowl' events in the 1930s, and comparable soil destruction across the Chernozem soils of Central Asia in subsequent decades, followed by erosion are seen as evidence of the effects of loss of adequate cover to the soil and the destruction of soil structure and thus of its porosity, resulting in disastrous decline in the productivity of those lands. As present and future demands for the products of the land increase, and food prices rise, intensification of common systems of agriculture continue to result in declines in soil's inherent productive capacities, yet remarkably little is being done as yet to promote alternative, truly sustainable systems of plant production based on improving health of soils on which their lasting success depend. Raising levels of organic matter in soils is a key both to the reversal of downward trends in productivity, to stimulating key biological processes in the soil, to enabling safe intensification of land uses, and to ensuring their sustainability into the future. The application of the principles of '*Conservation Agriculture*' – with whose development and spread FAO has already become deeply involved – indicate the way forward. He expressed optimism about the outcome of the meeting because (a) the meeting creates opportunities for addressing the issues from a multi-disciplinary perspective; (b) it aims to consolidate such partnerships by creating a 'community of practice'; and (c) it is taking place at a time when the world has been jolted out of complacency over its ability to feed itself adequately in future and many people will be interested in the findings.

II. THE CASE FOR IMPROVING SOIL HEALTH

by **Francis Shaxson** [*PPT #1 - Background*]

Soil biological processes are 'energizers' of the interactions between the four components of soil productivity – physical, chemical, biological and hydrological. This provides soils' 'self-recuperation capacity' with respect to soil porosity, of vital significance to maintaining catchments' capacities for providing both plant materials and water together. Soils' productive capacities degrade when the rate of damage exceed their inherent rates of self-recuperation. Well-managed Conservation Agriculture systems achieve this two-part reversal of trend by improving soil health through minimal/zero-tillage, thereby minimizing undesirable rates of oxidation of organic matter, and by adding organic matter faster than it is being lost, up to equilibrium state. For the undertaking of production to satisfy their needs, farmers make rational decisions within the 'envelope' that surrounds them, whose margins are determined by the interplay of potentials which the farmer can make use of and the hindrances which confront their best expression. Given the wide variety of constraints among so many different agro-ecologic and socio-economic situations across the world, the challenge is to determine, in each situation, how the needs of the land, the motivations and skills of people, and the resources available can be brought into productive balance on a sustainable basis for intensified production. The purpose of the Workshop is to provide an opportunity for different stakeholders concerned with agricultural development to examine and consider the implications of samples of evidence - from different regions - of the potential of Conservation Agriculture to improve and maintain: soil health, stable productivity, ecosystems services, and people's livelihoods. The meeting was structured to (a) provide illustrations of practices and principles of CA; (b) enable discussions, suggestions and agreements on the chief forms of interlinking decisions which can further the understanding, development and spread of CA; (c) pave the way for comparable forums to develop at continental, national and local levels.

SESSION II
Global overview on soil health and conservation agriculture – setting the scene

by Theodor Friedrich [*PPT #2 - Soil Health and CA*]

Summary of the main document: 'Underpinning conservation agriculture's benefits: The roots of soil health and function'
(by Francis Shaxson, Amir Kassam, Theodor Friedrich, Bob Boddey & Adewale Adekunle)

Introduction

- General background: increased demand for plant products, land degradation and soil erosion, increased signals for overcharge on water resources.
- Challenge: Reverse trend of non-sustainable production while increasing production.

Components of soil productivity

- Soil productivity (vs. fertility) consists of following components: physical: architecture – pore structure; hydrological: moisture storage and infiltration; chemical: nutrients, CEC, dynamics; Biologic: soil life and non living fractions.
- Conventional agriculture is characterized by regular tillage, clean seedbed causing following effects: removal of cover, disruption of pores, destruction of structure, loss of organic matter.
- Consequences of low Soil Organic Matter are: less efficiency of mineral fertilizer - "the crops have become 'addicted' to fertilizers"; water loss as runoff; soil loss as sediment; loss of seeds, fertilizer and pesticides through erosion and leaching; less capacity to capture and slowly release water and nutrients; falling input efficiency; declining yields; reduced resilience; reduced sustainability, *degraded biotic activity, reduced soil-porosity recuperation..*
- Key features of optimum CA are the combination of continuous zero tillage, permanent soil cover and crop rotations. This combination has

become known as Conservation Agriculture, simulating forest floor conditions.

- Main feature is soil organic matter, consisting of living and non-living fractions with multiple functions, such as retaining nutrients, CEC, transforming soil components, release of organic acids, structure building, creation of macro pores.
- Advantages for the farmer through applying CA are in improved farmer's livelihood : for mechanized farmers: less machinery, 70% fuel saving; for smallholder farmers: potential advantages 50% labour saving, less drudgery, stable yields, food security; all this resulting in better livelihood/income.
- Advantages of CA for communities address public goods: less pesticide use (-20%), less pollution, lower cost for water treatment, more stable river flows, lower road/waterway maintenance.
- Global advantages are improvements of groundwater and soil resources, biodiversity and mitigation of climate change.

Hindrances to progress

- Hindrances for acceptance of CA: adaptation to agro-ecologies, nutrient depleted soils, land cultivation, tillage as base technique, challenges of tropical climate
- Intellectual barriers: erosion seen as cause of problem, fertility limited to nutrients, belief in the need for tillage, erosion taken as unavoidable, attempts to copy green revolution
- Suboptimal conditions for introduction of CA are no reason for not introducing CA; continuing with tillage would be worse; specific suboptimal conditions and their problems are: arid climates: soil cover establishment; subsistence farmers: crop rotations (maize); humid tropics: P-deficiency
- Important is to keep carbon gains and avoid tillage: one tillage operation can oxidize a year's carbon gain; avoid compaction; if necessary, break only seed lines, apply controlled traffic, in very special cases use strip tillage; other examples of new way of thinking are: "Soil erosion is not caused by deforestation, overgrazing, excessive cultivation" but by loss of SOM, porosity, plant cover; "Soil to be treated more as biological than a geological entity" leading to the concept of SOIL HEALTH; CA should not be "taught to" but developed by farmers (clubs, FFS)

Areas for further investigations

- General points for investigations: resistant reserves of SOM, effect of different OM inputs, indicators for soil health, livestock integration, mechanisms to support CA adoption, quantification of CO2 flux rates.

Site specific points for investigation: effects of crop rotations/cover crops, weed management, pest management, fertilization rates, economic values of services (water), monitoring of changes and effects

Conclusions:

- Important role of SOM for soils
- Response: CA reverses negative trend
- A new "green/blue revolution": productivity and sustainability
- Soil to be understood as living entity
- Replace the tillage presumption
- CA as example for good land husbandry: soil health, production intensification and ecosystem service
- CA is NOT a PANACEA, i.e. it is not a sufficient, but it is a NECESSARY CONDITION for sustainable land husbandry.

SESSION III

Conservation Agriculture cases from Latin America

I. BRAZIL

Conservation agriculture: No-tillage including cover crops and crop rotation in Brazil

by **Ademir Calegari** [*PPT #3 - Brazil*]

After dramatic effects of soil erosion following un-planned expansion of agriculture across the country, it was found hat mechanical soil conservation practices were insufficient to control the problem. From a few hectares under no-till in the early 1970s, the spread of fully-developed CA has now spread to some 26 million ha, with 5.7 million ha in Paraná State alone. Adequate systems comprise minimal/no-tillage plus cover crops and rotations. In a non-conventional paradigm, these orderly systems have resulted in higher storage of water in the soil profile, reduced surface evaporation of water, and related hydrologic benefits, raised yields per ha of many crops, improved weed control, better efficiency of use of inputs and energy inputs, and showing themselves to be both economically feasible and ecologically sustainable. A range of cover-crops in the rotations are used to maintain soil cover, provide additional fodder, and augment organic matter, at the same time as fulfilling multiple agronomic, ecological or economic functions simultaneously. Soil organic matter levels are consistently found to be a keystone soil quality indicator, inextricably linked to other physical, chemical and biological soil quality indicators, and an indicator of sustainability. More than fifty percent of total cropped land in Brazil is now estimated to be managed under appropriate CA systems, on the lands of both large-scale and small-scale farmers. Reasons for the latter to favour CA systems include savings in time and labour, control of erosion, higher yields and greater income. The development of associations of farmers interested in CA systems has been crucial in the increase and spread of CA systems in Brazil.

II. PARAGUAY

Experiences with conservation agriculture/No-till in Paraguay

by **Rolf Derpsch** [*PPT #4 - Paraguay*]

CA methods for a wide range of crops have spread from about 20,000 ha in 1992 to 2.2 million ha in 2008 (65% of all agricultural land in Paraguay), among both mechanized medium and large farmers using tractor equipment, and among small-scale farmers with farms of less than 20 ha using hand labour or animal traction. CA has hade significant positive effects on soil conditions, its physical, chemical and biological conditions, resulting in increasing productivity over time; average yields have increased between 1 % and 30%. There have been beneficial effects on soil moisture through continual cover lessening evaporation from the soil surface. Small farmers have commented that they would never go back to the old system, because the reduced work-load and other benefits have improved their livelihoods. Farming sustainability has been improved through these effects and that of minimizing soil erosion. Adaptation, adopting and spread of CA methods has been significantly favoured by many joint activities between the public sector, international aid agencies and the private sector. The nature and se verity of imitations which still limit he extent and rate of spread of CA in Paraguay include: limited relevant research n CA; high cost of advisory coverage of 300,000 small farmers; limited financial and personal capabilities of the Extension (advisory) service; limited support for the spread of CA among small farmers by international aid agencies in some departments. Knowledge is still the most important limiting factor in the spread of CA methods. Needed improvements include more alliances between stakeholders and donors; more research on green manure/cover crops for efficient and cost-effective weed control, N-fixation, soil loosening etc.

III. ARGENTINA

Environmental and productive quality management in conservation agriculture

by **Santiago Lorenzatti** [*PPT #5 - Argentina*]

There are currently an estimated 15-16 million ha of CA in Argentina. It has been found that it presents a real and concrete alternative to tillage agriculture that has proved to be more ecologically benign, maintaining yields and reducing costs without impacting adversely on the environment. Its optimum expression is seen when it includes not only no-till, rotations and cover crops but also integrated insect pest and disease management, nutrients restoration and rational and professional use of external supplies. It has been shown that the agronomic ecosystems are no longer vulnerable and productive areas have been extended without experiencing some common risks. Soil productivity has increased due to better chemical and physical aspects of fertility and more efficient water economy. It had reduced fossil fuel consumption, lessened carbon dioxide emissions due to the absence of tillage, and increased soil organic matter, favouring carbon sequestration. In this context, the farmers' organization AAPRESID is developing an initiative to develop an Environmental and Productive Quality Management System which can offer certification. This involves the development of a Good Management Practices Protocol and the use and recoding of scientifically-based indicators that enable measuring the impact of the agriculture on the environment. The certification will be of the process, not the product. Among other aspects, it is anticipated that this will bring producers and consumers closer together, and generate new leverage for the creation and growth of new service companies.

SESSION IV
Conservation Agriculture cases from Asia

I. CHINA

Conservation Agriculture Development in China

by **Gao Huanwen** [*PPT #6 - China*]

China is characterized by a large land area, high population, and mostly small family farms. Single crops per year are found in areas of <500 mm rainfall in the north, through double cropping on irrigated land in the central areas with rainfall 600-800 mm, and in the south, paddy fields with multiple cropping under rainfall of > 1000 mm. Studies of Conservation Tillage (sic) began in the 1970s, with human or animal power; investigations with powered equipment began in 1991. There are currently about 3.3 million ha of CT in China: 1.4 million ha in the north, using light tractors and passive seeders; 0.6 million ha in the centre, using mid-sized tractors and power-driven no-till seeders; in the south there is rice direct-seeding, no-till transplanting mainly using hand tools or animal power. It is recognized that it would be desirable to minimize soil disturbance, have cover crops, and follow rotations in all situations. However, the small size of farms, lack of sufficient appropriate equipment and, as yet, limited research and experience of managing combinations of seeds, fertilizers, water, cover crops etc. for true CA in the varied ecozones of the country, plus an extension system not yet oriented to such systems, are factors hindering CA's wider spread. It would be desirable to have an 'ecology subsidy mechanism' which encouraged farmers to make the transformation, making use of CA-dedicated research and effective oriented extension, and also offering the possibility for farmers to acquire suitable equipment initially at reduced cost. In the meantime, progress is being made in learning how, first, to reduce tillage, then to develop rotations and further increase soil cover, and move towards ideal situations step by step as different agro-ecologic and socio-economic conditions permit.

II. KAZAKHSTAN

Improvement of soil and water management in Kazakhstan: Conservation agriculture for wheat production and crop diversification

by **Murat Karabayev** [*PPT #7 - Kazakhstan*]

Kazakhstan has a continental climate, with hot summers and sub-zero winters, and mean annual rainfall (varying from north o south, between 400-250mm. A major crop is wheat, whose yields have generally ranged between 0.9-1.1 t/ha. Soil moisture inadequacy is a significant factor limiting yields. In addition, water and wind erosion is widespread. Concerns about drought, soil salinity and weed infestation are increasing, while decreasing soil fertility is evidenced by loss of topsoil organic matter. After initial work in 2000, the area under zero/minimal tillage and direct sowing has been rising rapidly from zero to around 600,000 ha in 2008, in both irrigated and no-irrigated conditions. Yield benefits in rainfed areas derive much from improved soil moisture conditions, related to better infiltration of water derived from both rainfall and winter snowfall. An attraction to farmers is also the reduction in costs, and the better timeliness of sowing due to reduced energy-use. In irrigated conditions, CA methodology applied on permanent raised beds has proved very efficient. Experience to date shows beneficial changes in both the physiological characteristics of individual plants and in overall yields. Good information has been amassed on the comparative economics of wheat-growing under tillage and CA systems of production. Key aspect still requiring attention include: weed control; economically viable crop rotations and diversification of production; plant nutrition under CA conditions with respect not only to grain yields alone but also generation of plant biomass usable to raise organic-matter levels in the soil; processing and marketing of newly-introduced crops; building scientific and technical capacity, teaching new technologies and agricultural methodologies, providing appropriate training courses at all levels, providing suitable consulting services, and building public awareness of these up-to-date farming systems.

III. DPR KOREA

Introduction of conservation agriculture techniques in DPR Korea

by **Kim Kyong Il and Kim Chol Hun** [*PPT #8 - DPR Korea*]

In DPR Korea, approximately half the arable land is under paddy rice, and half under upland crops. Mean rainfall is 1000-1200 mm annually, of which some

60% falls in July and August. Winter temperatures fall below freezing, while summer temperatures average 24 degrees. The government's fundamental agricultural policy is to provoke a revolution in seeds, crop intensification, and diversification. Since the initial convincing work on CA in 2003 on three cooperative farms, the methods have spread to another 22 farms, and thousands of hectares are at the stage of introductory CA work. The growing awareness and benefits of CA are seen as closely aligning strongly with the government's aims to intensify cropping and make continuous improvements in soil fertility. CA techniques are being applied as: no-till paddy transplanting or no-till direct seeding with mulching; no-till upland crops with direct seeding and mulching; CA potato production (coverage with straw, not soil); maize or paddy direct seeded after green manure crops. Crop residues are retained to provide dense complete soil cover, whether planting is by hand or machine. Progressive annual increases in soil organic matter, in soil inhabiting organisms, and in available N, P and K have been recorded. Yields of main crops have increased by 10% or more, while labour, fuel and time have been saved in the process of production. Now that results and advantages of CA's introduction are clear, it is important to raise interest among policy-makers so that they can formulate appropriate strategies for its further encouragement. Non-farm agricultural staff also should be informed of its advantages and methods, and also traditional farm machinery needs to be replaced by equipment most appropriate to the effective further spread of CA.

SESSION V
Conservation Agriculture cases from Africa

I. AFRICA

Assessing and accompanying CA development in Africa: Emerging lessons

by **Bernard Triomphe, Saidi Mkomwa and Josef Kienzle** [*PPT #9 - Africa*]

Due to the intrinsic complexity of CA as a technical system, and to the many aspects involved in is promotion, understanding and accompanying CA development requires making due use of appropriate conceptual considerations. Firstly, it involves innovation in the farming system, to provide local adaptation, with reference to interlinked biophysical, agronomic, socio-economic and social aspects. Linked to farmers are non-farm agriculturists involved in developing and disseminating knowledge, advising farmers, providing relevant services or shaping local or national policies. Secondly, it involves consideration of innovation pathways – the routes and time as farmers shift from current practices to CA practices. This is a better way of looking at CA than just referring to 'adoption'. Thirdly, it needs to characterize CA as farmers actually adapt, integrate and implement it, and their actual access to knowledge, advice and resources. A final consideration is how to measure CA performance and impact. A series of case-studies were undertaken across Africa in 2005-2006 having regard to these considerations. The first lesson to emerge is that the farmers do not tend to go for permanent no-tillage, but rather go for disturbing the soil periodically. This is clearly better than continuous tillage, and corresponds better with a number of farmers' objectives with regard to management under their local conditions. A second outcome is that many if not most farmers struggle to maintain adequate soil cover. Thirdly, there are good reasons on the one hand for using herbicides under certain conditions, but also other reasons for not using them. A fourth lesson is that the prevalence of a 'project' approach to piloting CA seems to be a major problem, on account of unrealistically short time-frames, discontinuities in strategies and availability of support, and limited lead-time for institutionalizing a proper CA agenda into existing institutions and policies. Pre-eminence is often given to 'demonstrating' CA rather than adapting it in a participatory manner to the local context. In particular, farmers and their associations appear to play a secondary role compared with those of outsiders. Even the principles of Farmer Field Schools are seldom wholly adequate, if only because of its costs and its sensitivity to the qualities and skills of the facilitators. Rather than asking about "How to change farmers' mindset and convince them of the beauty of CA and what wonders it can do for their soils?" we should be asking "What type of CA should be developed, for and with what types of farmers and conditions, with what approach, at what cost with what benefits to farmers and society?". One should accept that eventual success, wherever achievable, will depend on a complex, and relatively slow process which needs to be re-invented and nurtured locally, 'on-the-go', given existing conditions, constraints and opportunities.

II. AFRICA

Enhancing access to CA knowledge and information and partnerships: Experiences of the African Conservation Tillage Network (ACT)

by **Saidi Mkomwa and Josef Kienzle** [*PPT #9 - Africa*]

The ACT is a not-for-profit voluntary membership NGO with offices in Nairobi. It receives funds from many international organizations. The current membership stands at 1200 individuals and institutions from 33 countries. As the earlier 'Green Revolution' model appears to be less than satisfactory for African situations, and food prices and costs of transport rise, a new paradigm "Producing locally for local consumption' seems to be emerging. In this context, CA has the potential to enhance food security through increased and stabilized productivity of soils and crops. Building on indigenous and scientific knowledge, and using innovative equipment designs from fore-runner Brazil, CA is beginning to spread in Africa. But its more rapid spread requires better understanding of: why many farmers 'backed away' from the Green Revolution and reverted to worse conditions than before; the identification and removal of current hindrances to farmers accessing and perfecting available improved practices. ACT aims to facilitate the shift from the common 'input-based approaches' to those better informed by sharing up-to-date knowledge and adaptations. What is lacking is not knowledge but the will to make best use of it. ACT provides web-based support to its members by providing a wide range of information relevant to the use, development and spread of appropriate CA methodology. A reference book on CA for farmers and advisory staff, and case studies, brochures and informative leaflets are produced and distributed. ACT is involved with the World Congresses on Conservation Agriculture, and provides learning-education and training support to Farmer Field Schools curriculum development and adaptation. International tailor-made workshops and training courses have provided many CA graduates scattered throughout Africa who provide a good nucleus for CA expansion. A major challenge is to accelerate and address the issue of curriculum reform at higher education levels so that agricultural colleges preferentially teach CA principles and practices vs. tillage methods. In recognizing farming communities and farmers no only as producers but also as stewards/managers of broader ecosystems, emphasis is now being laced on developing human capital and potentials at the farm level. Networking farming communities can help utilize their strength of togetherness to lobby for and tap into existing resources for micro-credit, insurances and environmental services.iii. Kenya and Tanzania

III. KENYA AND TANZANIA

Conservation Agriculture adoption experiences in East Africa: The case of Kenya and Tanzania

by **Barrack Okoba and Wilfred Mariki** [*PPT #10 - Kenya and Tanzania*]

From 2004, the CA-SARD Project ('Conservation Agriculture for Sustained Rural Development') introduced the concept of CA in rural areas of northern Tanzania and in western and central regions of Kenya, where there was evidence of widespread land degradation, low soil fertility and high soil loss due to poor cover and low organic matter levels. It has the developmental objectives of improving food security and rural livelihoods of small and medium farmers, to be approached through Farmer Field Schools, in which all production constraints are identified and farmers and community leaders are involved in learning about CA. The area covers approximately four agro-ecological zones, from the Upper Highlands to the Lower Midlands across which the climatic conditions correspond with altitudinal gradient in terms of rainfall (400-2200mm/yr.), temperature and soil fertility. The higher is the altitude, the higher the rainfall and the lesser the soil degradation. Through participatory assessments by practising farmers, it is found that the net financial benefits can be higher under CA than under conventional tillage agriculture, particularly because of savings in labour/time, lesser amount and cost of fertilizer required to maintain yields, and reduced energy/fuel costs for tillage and spraying operations. 20 large-scale farmers (>100 ha) operate some aspects of CA on a total 10,000 ha of land, using not-till plus permanent soil cover, but not using crop rotations. 500 medium-scale farmers (10-50 ha) covering approx. 3,000 ha combine no-tillage and crop associations and make efforts to achieve permanent soil cover, despite competition from livestock for fodder. Smallholders (2.5-10 ha) cover about 20,000 ha of land parcels, under mixed cropping systems. They are using a combination of no-till and permanent soil cover using legume cover crops. Though crop rotations are hardly practised, they have been using crop associations. Positive improvements due to the practices used have been quantified for earthworm populations, biomass and grain yields. Feedback from Farmer Field Schools have shown up the following challenges to the adoption of CA: (a) how to integrate livestock and mixed cropping on smallholdings; (b) unavailability or inaccessibility of CA inputs and equipment in local markets; (c) low capacity of local manufacturers of hand/animal-driven CA equipment; (d) how to develop effective CA in semi-arid to arid zones in view of their characteristic environmental limiting factors; (e) lack of supporting policies and implementing institutions.

IV. TUNISIA

Direct drilling in Tunisia is a case of technology transfer

by **Moncef Ben-Hammouda, Khelifa M'hedhbi and Hatem Cheikh M'hamed**
[*PPT #11 - Tunisia*]

In contrast with the conventional mode of diffusion - from small research plots on state research stations, through state development agencies, to farmers ('vertical' transfer) - a 'horizontal' approach to diffusion for spreading CA based on Direct Drilling (CA/DD) is being used in Tunisia). With assistance from CIRAD-France and FFEM/AFD, research is conducted at farm level with farmers using field layouts that can provide statistically-valid data for experiments undertaken at multiple sites and over several years, to compare CA/DD with Conventional Drilling (after tillage). First step extension of the successful research results is done by the farmer on his farm, while strongly assisted by a coordinated multi-disciplinary research team from six technical institutes. Other farmers then willing to undertake their own tests of CA/DD on a small scale are assisted by a specialized crop-production extension team from the public sector. It has been found that other, but sceptical, farmers did not wait long to test for themselves, and some farmers are now recognized by their peers as CA/DD farmer-experts, who can command a fee for their services. As elsewhere, decompaction of soil is a key first step when beginning the process. The Tunisian climate is Mediterranean, characterized by intense, sudden, irregular rainfalls, with large inter-year variability, necessitating different agronomic sequences from one year to another. CA/DD requires a permanent mulching as dry residues of a prior crop or a cover crop, and adapted agronomic sequences, different from static rotations. 'Biological tillage' by soil organisms and by deep-rooted crops becomes the means of maintaining soil porosity, contributing to the overall cost-savings provided by CA/DD. Because of the variable nature of the climate, cropping is opportunistic, using short-season varieties to take advantage of short and irregular periods of adequate soil moisture. Where CA/DD is practised, adequate soil cover has greatly reduced erosion by wind and water, maximizes water-use efficiency and protects soil organisms from direct solar radiation. As noted above, farmer-to-farmer spread of successful CA/DD techniques appears to be occurring, and once they spread more widely, it is anticipated that a state programme could be set up to diffuse the systems among small farmers also.

V. SWAZILAND

Conservation Agriculture in Swaziland

by **James Breen** [*PPT #12 - Swaziland*]

The objective of the project is to provide encouragement of community based natural resource management as a basis for long-term food security amongst resource-poor farmers in Swaziland. Over the last six years, FAO's Emergency Programme in Swaziland has trained a total of around 800 farmers, plus advisory and other staff, and provided limited number of examples of CA equipment suitable for small farmers to use. This process has included a Study Tour to the Potshini Community [CA] Project in South Africa by 17 farmers and two Extension Service staff in 2005, and the selection in 2007 of 85 'Lead Farmers' to facilitate farmer-to-farmer spread There is now a demand from farmers in Shewala for expansion of CA as they recognize it as 'the most sustainable way to produce food'. Jab planters and ox-drawn direct seeders are favoured here. A Field Day was held on June 20th, 2008, attended by 90 farmers and others. Farmers are now requesting more support from NGOs and Extension to implement CA in the areas where it has been in use for some years. It is fervently hoped that this work to expand the spread of CA will be given continuity by a seamless transition of funding for its extension and expansion from its FAO/EP source – which ended in July 2008 - to new sources in the EU and Norway. The most important requirements for the successful implementation of CA in Swaziland *[and, comparably, elsewhere]* include:

(a) An agreed plan to implement CA over the next five years to be drawn up with the cooperation of all stakeholders in Swaziland, including farmers and farmer groups, Extension and Research staff, Government Mechanization Unit staff, related Government Ministries and all relevant private sector firms. This plan should build on experience gained so far in the implementation of CA and should include achievable targets and a good monitoring and evaluation system to identify and deal with field problems as they arise. (b) Active and sustained field research on CA by the Research Department comparing it with conventional agriculture. (c) Policy support to CA and active participation by all members of the National CA Task Force in the sustained promotion of CA. (d) Sustained and practical training for extension and research staff and for farmers, with constant back-up field visits. (e) Adequate supplies of quality seed of maize, sorghum, various legumes and cover crops to ensure maximum biomass yields. (f) Sufficient and affordable supplies of jab planters, ox-drawn planters (possibly on a contractor basis) and tractor-drawn planters. (g) Credit for sustainable procurement of quality, locally adapted seed and other farm inputs thus ensuring good yields. (h) An understanding with livestock owners that crop residues on CA farms will no longer be available free to their stock and that they must make alternative arrangements in this regard. (i) Large scale, sustained, practical training programme for farmers and extension workers. (j) CA to be fully integrated into curriculum at University of Swaziland. (k) Sufficient extension staff (ratio of 1:60 farmers is recommended in Zimbabwe; the ratio in Swaziland is well over 1:1000). (l) Development of well managed side-by-side demonstrations comparing CA with conventional tillage over several years. (m) Need for good farm management and timely planting, weeding and pest/disease control.

VI. MADAGASCAR

Sustainable crop intensification in Madagascar through promoting cropping systems on plant cover

by **Jean-Louis Reboul** [*PPT #13 - Madagascar*]

Since 1990 an NGO ('TAFA') has been in collaboration with IRAD and with CIRAD/Brasil in adapting direct-seeding cropping systems to the diverse agro-climatic and agro-ecologic situations in Madagascar. This has included work on farmers' fields among a wide range of cropping systems and degrees of farming sophistication. Effects have been observed and measured over 15 year, and have shown potentials for improving soil health and function, and people's health. The promotion of these varied systems as a national priority was decided by the Government. The technical successes have provided a basis for AFD and CIRAD to develop an international programme in the 'direct seeding' cropping programmes and some countries in both Africa and

Asia. All the appropriate policies and arrangements to promote adaptation, adoption and spread seem to be have been organized by the Government together with TAFA, built around an original institutional organization – 'The Madagascar Direct Seeding Group' -- a National Diffusion Strategy, much training, and the recent implication of the research community. However, in spite of significant investments, the spread of these technically-validated technologies has amounted to only about 2,500 ha, on which only simple systems seem to be appropriated by the Malagasy farmers. Some hindrances have been identified: (a) insistence by donors on focussing on small farmers alone - among whom change is always slow - exacerbated by the fact of exposure of the technical advisory staff (who have little technical background in the concepts and methods and too little training) to many challenging problems they don't know how to address; (b) complexity of the 'perfect' systems proposed by the scientific community; (c) little or no attention to larger commercially-oriented farmers who could show evidence of the potential benefits, nor involvement of the private sector etc. The type and extent of necessary improvements for wider and more rapid spread include: (i) Strengthening the national operational capacity through experimentation and exposure to field practice, (ii) simplification of the technology for easier understanding by the intended users, (iii) amplification and diversification of training and education activities, and specific training of a large number of Extension staff; (iv) further elaboration f the |national Diffusion Strategy to cover a wide range of users and support agencies, (v) specific assistance to individuals, (vi) support to small farmers by providing appropriate inputs and equipment; (vii) specific support to private sector operators to provide services by large mechanized units; (viii) funding of group activities to improve sustainable land management on communal lands.

SESSIONS VI – XV

Working Groups and Action Plan

Sessions VI-XV were dedicated to discussions in three parallel Working Groups: (1) Science and Technology; (2) Field practice and Development; (3) Policy and Financing. The purpose was to discuss and marshal the information which had been presented, and to provide - to the plenary group and to the team drafting the report on the outcome of the Workshop - an input from each of the special-topic groups under the sub-headings: Principles and Issues; Investors and Opportunities for Investment; Cross-sector Knowledge-brokering; Contributions to an Action Plan.

The results of their discussions and recommendations were presented to, and discussed in plenary sessions, and the agreed compilations transmitted to the Drafting Team. A draft Action Plan was prepared and presented, again in plenary session, for comments by the three subject-matter Working Groups. The draft plan was amended accordingly, and the final draft version was then adopted by the participants.

The finalized Action Plan, entitled 'A Framework for Action', provides a concise summary of the presentations and discussions, and the recommendations that arose from them, moulded into statements of the central concerns and the characteristics of CA which can effectively address them.

The summary of Sessions VI-XV is provided by the "Framework for Action" document adopted by the Workshop, and is reproduced as Part III of this report.