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Report of the Ad Hoc Expert Group Meeting on Science and Technology Issues for Sustainable Development: Principles, Methodology and Strategy for Promoting the African Green Revolution

Addis Ababa, Ethiopia
16-18 November 2004

ATTENDANCE AND ORGANIZATION

1. The Ad Hoc Expert Group meeting on Science and Technology Issues for Sustainable Development - Principles, Methodology and Strategy for Promoting the African Green Revolution - was held in the United Nations Conference Centre (UNCC), Addis Ababa, Ethiopia, from 16 to 18 November 2004. The Meeting was formally opened by Mr. Josué Dioné, Director of the Sustainable Development Division of the Economic Commission for Africa (ECA) after brief welcome remarks by Mr. Alex Tindimubona, Coordinator of the Meeting.

2. The meeting was attended by more than twenty-five Experts in science, technology and innovation policies for the promotion of the Green Revolution in Africa. Experts came from various African and non-African countries including Kenya, Uganda, Ghana, Cameroon, Egypt, Lesotho, Mali, Swaziland, Tanzania, Zambia, Ethiopia and India. The experts came from various international and regional institutions, including, Aims Agribusiness, University of Ghana, IRAD, Food Industries Technology Center, UNU-INRA, University of Nairobi, University of Lesotho, University of Swaziland, ARI-Naliendele, Kawanda Agricultural Research Institute, UNECA/SRO-SA, PATTEC and Addis Ababa University. The meeting was also attended by the staff of the Sustainable Development Division (SDD). The list of participants is provided in Annex I.

ACCOUNT OF PROCEEDINGS

A. Opening of the Meeting (Agenda Item 1)

3. On behalf of the Executive Secretary of ECA, Mr. Josué Dioné welcomed the participants and thanked them for accepting to allocate some of their precious time to come and share with ECA their expertise, experience and insights on the challenge of harnessing science and technology for sustainable development in Africa.

4. Chief among the challenges of Africa's sustainable development is the harnessing of science and technology to increase significantly the productivity and competitiveness of the food and agricultural systems in the production, processing and delivery of products to meet the demand of domestic as well as international markets. In addressing this challenge, it is increasingly admitted that Africa must design and implement its own Green Revolution. UN Secretary General Kofi Annan made repeated calls in 2003 and 2004 to African countries in this regard. In response, Mr. Dioné said, ECA has initiated a series of activities to promote an African Green Revolution Initiative.

5. The pursuit of a Green Revolution in Africa, however, can only proceed from a full recognition of the complexity arising from the diversity of agro-ecological zones, farming systems and socio-cultural contexts of the continent. It is evident, Mr. Dioné added, that different versions of Green Revolution must be designed to fit these different contexts. Yet, the design principles must be the same: to be sustainable, the African Green Revolution must be scientifically valid, economically viable, environmentally friendly and socially acceptable. Furthermore, it must be manageable by African farming communities.

6. Workable designs must build on experiences, best practices and successes in Green Revolution systems with potential for application to Africa. They must proceed from best design principles, including how to discover the potentials, entry points, driving forces and leverage factors that may be used to drive African farming communities from subsistence farming to sustainable modernization of agriculture and rural transformation (SMART), food security, broad-based economic growth, employment and poverty reduction. These designs must show how to prime and tune up communities for the adoption and implementation of Green Revolution factors – hence creating SMART systems, SMART plans and SMART communities. Finally they must link these SMART systems to other players in the investment, market, technology, infrastructure, institutional and policy (TIIP) fields to fuel and sustain the whole African Green Revolution system.

7. Mr. Dioné stated that in a recent ECA Field Project on Identification and Assessment of African Green Revolution Indicators and Design, a glimpse of the above design principles was presented at a workshop held at Kampala, Uganda, in December 2003. An outline of the principles was briefly introduced to expert participants. In light of field observations of a farming, production and delivery system designed according to the principles, these experts called for replication of the pilot system, and for a full elucidation of the principles behind its design. As part of its road map towards a Green Revolution in Africa, and in response to the increasing interest on the issue, ECA commissioned a Study on Principles, Methodology and Strategy for promoting the African Green Revolution: A Design and Training Manual." This Manual is intended to offer a useful instrument in the design effort.

8. The main objective of the meeting was to elicit advice and feedback on the principles, methodology and strategy for promoting an African Green Revolution. In this regard, Mr. Dioné specified, participants were kindly expected to:

a) Review and validate the Study on "Principles, methodology and strategy for promoting the African Green Revolution: A design and training manual;"
b) Reflect on the potential, readiness and prospects of Africa to design and implement a Green Revolution; and
c) Provide feedback, recommendations and advice on the way forward.

9. Mr. Dioné asserted that he was very pleased that the meeting gives the opportunity for an Invited Lecture sponsored by the United Nations University Institute of Natural Resources in Africa (UNU/INRA) under a long-standing partnership between the two organizations. The topic of this Lecture, "Soil Fertility in Africa" was very pertinent to the theme of the Experts Group Meeting and would be a strong source of inspiration and guidance in the deliberations.

10. In conclusion, Mr. Dioné stressed the importance that ECA attach to the inputs, feedback and advice in the peer review exercise, which aimed at validating the outcome of the Study at hand and at distilling out best practices that would allow Africa to move its Green Revolution forward. He urged participants to make feasible recommendations that ECA and its Member States could implement in policy and program development to capacitate Africa to harness advances in science and technology for sustainable agricultural transformation. He said that ECA counted on the dedication of participants to sustain the design effort and to mobilize other stakeholders for a genuine African Green Revolution.

B. Organizational Matters (Agenda Item 2)

i) Organizational matters

11. In order for the participants to know more about one another before electing their bureau, the coordinator of the meeting requested the participants to introduce themselves after which he called for nominations for the posts of Chairperson and Rapporteur. The following experts were elected unanimously for the post of Chairperson and Rapporteur:

Chairperson: Dr. Musa M. Dube

Rapporteur: Dr. Jacob M. Ngeve

ii) Adoption of the Agenda and Programme of Work

12. The meeting adopted the Agenda and Programme of Work with minor modifications. The Programme of Work is reproduced in Annex II.

Session 1: Invited Lecture by UNU/INRA

13. The lecture was presented by Prof. Seth K. A. Danso, a soil microbiologist from the University of Ghana. The title of the lecture was: *Managing lands for food security in Africa: sustainability and land quality indicators*.

14. After an introduction of the speaker by Prof Uzo Mokunye, Prof. Danso discussed the importance of soils in agricultural productivity. He said that the African Green Revolution would not be achieved unless management of land and soil were addressed and mastered. He said that agricultural land is an invaluable natural asset for the production of food, forage, fiber, etc. Land is the basis for many life-support systems and human livelihood depends on it. Intensive agricultural production normally leads to a decline in soil quality especially where artificial inputs are low. However, the economics of present-day agriculture place ever-increasing pressure on farmers to intensify land use, often exceeding the limits of what is truly sustainable. Thus, in addition to problems of malnutrition in the tropics in which 70% of the world's population is located, soil degradation is an increasingly serious problem in many tropical countries.

15. Prof. Danso emphasized that the decline in traditional soil management practices has often speeded up the reduction in soil fertility on intensively cropped lands. Inability to replace nutrients removed by crops would usually result in reduced yields of subsequent crops and in reduced cover. Exposure of the soil to the direct effects of the weather leads to accelerated erosion and leaching of nutrients. Consequently, deterioration in the physical, chemical and biological properties ensue, culminating in a degraded soil with reduced capacity to support crop growth.

16. Prof. Danso said that fertile soils would normally have adequate levels of soil organic matter (SOM), not only because of its vital role in the provision of plant nutrients but also by maintaining soil quality through its effects on soil structure, water-holding capacity and in providing food for the numerous soil organisms that carry out vital functions in the soil. Soil

fertility is dynamic because the intrinsic properties of many soils are being changed by climate and anthropogenic factors, and the question of soil fertility sustenance assumes greatest importance on the African continent. For example, agriculture in much of Sub-Saharan Africa is still dominated by small-scale resource-poor farmers who have limited capability to purchase fertilizers and other inputs to increase agricultural production and reverse declines in soil fertility. For the resource-poor farmer in Africa therefore, land degradation stands out as one of the most serious threats to food security. Although the multiple roles of SOM have been acknowledged, from a practical agricultural standpoint, it is important for two main reasons. First as a "revolving nutrient bank" account and second, as an agent to improve soil structure, maintain tilt and minimize erosion. These days, emphasis has been put on characterizing the various fractions of SOM, as they affect differently the quality and functional roles of soils. The resistant or stable fraction of soil organic matter contributes mainly to nutrient holding capacity and soil colour. This fraction of organic matter decomposes very slowly and, therefore, has less influence on soil fertility than the "active" organic fraction. Decline in SOM would usually have adverse effects on soil fertility, including: i. reduced activity of soil organisms such as bacteria relevant in nutrient supply and general soil health; ii. rapid deterioration in soil structure; iii. crusting and surface compaction due to reduced resistance to rain-drop energy; iv. reduced water infiltration and increased runoff, causing further erosion; v. drought and desertification because of reduced detention of surface runoff; vi. lower availability of essential plant nutrients, both directly in respect of nutrients held by the organic matter, and directly in the soil microenvironment which renders nutrients available and in a lowered exchange capacity; and vii. an accelerated decay curve of organic carbon under high temperature tropical conditions, resulting in acute problems in these environments. There exist inter-relationships between soil productivity, crop management and socio-economic constraints. It is therefore essential to consider all these in any attempts to improve soil fertility in Africa in particular, rather than any attempts to treat soils in isolation.

17. Prof. Danso pointed out that while degradation of soil quality can take place rapidly, restoration of degraded soil tends to be a slow and costly process. Three major processes account for soil quality degradation. These are: physical, chemical and biological. Physical degradation covers the processes of wind, water and tillage erosion, soil compaction and water-logging. Chemical degradation consists of the loss of soil nutrients and organic matter and accumulation of heavy metals and other toxic compounds, soil acidification, salinity and contamination with toxic substances. The soil's chemical and soil physical properties that affect infiltration and storage of water in soil would also contribute to its fertility status. Biological degradation includes reduced activity and diversity of the soil biota that are responsible for many of the key processes and functions of soil. Of the three major processes affecting soil degradation, biological degradation, which is considered by some to be the most serious form of soil degradation, is the least studied and also most difficult to quantity.

18. Prof. Danso underscored the fact that soil nutrient balances measured for many cropping systems in several African countries have been negative, indicating that farmers are mining the soil. It is, therefore, essential for farmers and other stakeholders keen to promote sustainable agricultural production to monitor soil quality and take measures to avoid or minimize soil degradation to preserve the production capabilities of the land and protect the wider environment.

19. Prof. Danso underlined that although soil quality is linked to sustainability, soil quality cannot be measured directly. Therefore, measurable properties of soil or plants that

provide clues or indicators about how well the soil can function are used. Understanding factors that affect soil quality provides the tools for assessing and managing soil so that it functions optimally and is not degraded for future use. By monitoring changes in soil quality, it can be determined if a set of practices are sustainable. Indicators are therefore a means to an end. They are pointers that can guide planners in making decisions about using their nation's resources sustainably.

20. Prof. Danso mentioned that the search for sustainability indicators for renewable natural resource management, and in agriculture and rural development in particular, has its origins in the sustainable development paradigm. There is much concern that land quality is changing, Prof. Danso added, but there is not much formal monitoring of what is changing, in what direction or at what rate. In this respect, the availability of land quality information (LQI) is important for sustainable agriculture. On-farm indicators must be: 1. easy and practical to use by farmers, farm consultants, and scientists alike; 2. relatively cost-effective to measure; 3. subject to straightforward interpretation; and 4. should be acceptable to the target user groups, although these differences have not detracted their use, nor have there been doubts about the importance of indicators in soil quality assessments.

21. Another major issue to be considered when choosing and measuring sustainability indicators, Prof. Danso said, is whether indicators are to be constructed and monitored between sites at a single point in time, monitored over time, or both. Ideally indicators of both types should be measured. A fundamental issue is time. There is the need to know what has changed, and what is changing. With a focus on farming systems this requires an understanding of what has happened to the biophysical environment, how people's perceptions and management and livelihood strategies have changed, how policies and institutions have changed, and how these have affected each other. However, monitoring over time is more problematic, as information from external sources is generally required.

22. Prof. Danso added that thresholds are particularly important in an agri-environmental context given the propensity of ecological systems to change from one state to another. Target indicators are like critical loads and levels. When an indicator passes this level then the system is considered to be unsustainable or on the road to unsustainability. Issues arise as to the identification of a threshold level (be it qualitative or quantitative) and who should identify this level: an expert view; a consensus of experts; or, views of local stakeholders and communities. The increasing attention paid to local soil knowledge in recent years is the result of a greater recognition that the knowledge of people who have been interacting with their soils for long can offer many insights about the sustainable management of tropical soils. Local knowledge related to agriculture can be defined as indigenous skills, knowledge and technology accumulated by local people derived from their direct interaction with the environment. The use of local indicators of land quality as a compliment to scientific knowledge has the advantage that it is easier for farmers to adopt any resultant improvements in technologies developed through such participatory approaches. A further issue is whether passing a threshold level for one indicator is sufficient to signify unsustainability, or whether several indicators need to have passed their threshold levels before the system is unsustainable. Agreement on the identification of thresholds is not, however, universal. Instead of definitions, which are numerous, it is perhaps more useful to identify the uses and desirable properties of indicators: i. assess conditions and changes; ii. compare across place and situations; iii. assess conditions and trends in relation to goals and targets; iv. provide early warning information; and, v. anticipate future conditions and trends.

23. The UN Convention to Combat Desertification, for which most countries are party, places an obligation on countries to prepare national action programmes, including aspects related to soil quality. A more recent international development, of relevance to soil quality indicators, is the on-going examination of the soil organic carbon issue within the context of the UN Framework Convention on Climate Change.

24. Prof Danso stated that it is important to make best use of existing methods and sources of data. FAO is the principal source of many kinds of natural resource data related to developing countries, and must therefore take advantage of this position to develop useful indicators. Statistics on changes in area harvested of annual crops could be calculated by summing the areas of the individual crops, already reported by FAO. It may reflect or be an indicator of the expansion of agriculture onto more environmentally sensitive lands, or into forested areas. Some of the existing data bases besides those at the FAO include the World Bank Economic and Social Database (BESD), The World Resources Institute Database, and the UNEP/GEMS/GRID Database.

25. Prof. Danso discussed additional sources of information that can be used. The first is the possibility of using secondary historical sources (public records, resource surveys, aerial photographs and satellite images, farmers' and extension agents own knowledge, past academic studies etc.) as a point of comparison and possible trending. If these secondary sources consist of only a one-off observation then any trends inferred can only be linear and used with some caution. A second source is the use of biophysical information from sites, which were previously of a similar type to other study sites, but have been cultivated or otherwise used in a different manner over a recent known time-period. In this way measurements taken at the same moment in time can be treated as observations at differing time points and a *baseline* site can be paired with other sites. A third set of observations is possible if projections, model simulations or something similar are used to try to identify future values of relevant variables. These can range from the use of extremely complex agri-environmental models such as the Erosion Productivity Impact Calculator (EPIC) and the CENTURY Model to very crude 'guesstimates' of future states.

26. Prof. Danso asserted that an important emerging challenge is to improve the quality of existing data, identify what additional data are needed, to develop linkages among the natural resources, social and economic dimensions and especially to make it more easily accessible among the developing countries. At the joint initiative of FAO, UNDP, UNEP and the World Bank, the Land Quality Information (LQI) programme was started. It aimed at assisting planners and policy-makers in countries to make better use of their existing information on land quality and to promote more systematic data and information collection.

27. An important question is: how can indicators be best structured and classified? The indicators obtained are often organized in the form of frameworks. Indicator frameworks are therefore used for the logical grouping of individual indicators or indicator sets. The most widely adopted framework is the pressure-state-response (PSR) framework, which is being used by a number of countries and organizations in their indicator work. The PSR is issue-oriented. The P of the framework stands for the pressure put on land by human activities or interventions. An example is the effect or pressure that forest clearing and short fallow periods have or exert on land. These pressures will alter the state (S) of the land, through nutrient mining and resulting in poor crop yields. The mitigation action or response (R) could be, a policy response to curtail fallow cropping.

28. Prof. Danso concluded by talking about the Framework for the Evaluation of Sustainable Land Management (FESLM), used in the LQI programme of the World Bank. The FESLM framework identifies the 5 pillars of sustainable land management as: i. productivity - maintain or enhance production services; ii. security - reduce the level of production risk; iii. protection - protect the potential of natural resources and prevent degradation of soil and water quality; iv. viability - be economically viable; and v. acceptability - be socially acceptable. It can be seen that some of these pillars are related to economic, social or biophysical issues.

Discussions

29. The following points, issues and observations were also highlighted in the discussions:

- What are the elements of a revolution? Who are the revolutionaries? Who are those who oppose the Revolution - the counter-revolutionaries? Who are the reactionaries? A revolution is not a rebellion. It is a holistic movement. What is the end goal of a Green Revolution in Africa? How can we have a cohesive approach to this Green Revolution? Experts can be the cause of the problem.
- There is no Green Revolution without soil and soil scientists. High yielding varieties need better soils. The Green Revolution failed in Africa because improved varieties were adapted to rich soils; local varieties were neglected even though they were the ones adapted to poor soils.
- Land degradation is a major problem to agricultural productivity in Africa. A big proportion (one billion ha) of the 3.2 billion ha of potentially arable land is affected by physical degradation (erosion), chemical degradation (nutrient depletion) and biological degradation (organic matter decline).
- Some 230 million ha of land are chemically degraded, making it the most serious form of degradation in Africa. Reasons for this are: the conversion of perennial vegetation to annual cropping, causing depletion of various mineral nutrients, rapid decomposition of soil organic matter resulting in the release of carbon to the atmosphere, and reduction of ecosystem carbon storage.
- Faced with the problem of degradation and infertility, farmers have two choices: (a) abandon land in fallow to regenerate natural fertility, or (b) use fertilizers that they can hardly afford. There is also the risk of pollution by these chemicals.
- Shifting cultivation cannot be encouraged in these days of rapid population growth. The result appears to be intensified agriculture, where one piece of land is used continuously over a long time.
- In Africa, loss of soil fertility is caused by low CEC, low organic matter, low water holding capacity, unfavourable pH, nutrient toxicities, leaching, nutrient mining and interference with nutrient fixation.
- For a Green Revolution to be realized in Africa, the soil fertility package should include provision of improved germplasm, appropriate cropping design and the control of pests and diseases. Also, national policies with regard to farmer incentives should not be perverse.
- Sustainable agriculture is linked to soil quality, and this means assessing and managing the soil so that it functions optimally now and is not degraded for future use; and must be associated with monitoring changes in soil quality.

- Sustainability indicators should involve changes in the condition of land resources, rates of adoption of recommended farming practices, changes in management practices, changes in yields and other outputs, and rural development issues (tenure, population densities, etc).
- Modifiable soil constraints include those that can be overcome through management; examples are low nutrient and water availability, low and high pH, soil compaction and low soil organic matter content.
- Farmers' knowledge needs to be incorporated in soil management because it is the result of hundreds of years of trial and error and accumulated experiences, it is valuable knowledge that tends to fade away with time, it facilitates both actors (farmer and technician) to have a shared understanding of soils, and it is the farmer who knows and experiments with soils.
- Local soil quality indicators are traditional soil characteristics, usually in the farmer's language, such as water-retaining soil, black soil and deep soil.
- Soil biota play an important role in soil fertility maintenance. They promote nutrient acquisition, storage and cycling, biological control of soil-borne pests and diseases, synthesis and decomposition of soil organic matter, regulate carbon sequestration and Greenhouse gas emissions, modify soil physical structure and water regimes, and assist in detoxification. Examples of such soil biota are microflora (e.g. bacteria and fungi), microfauna (e.g. protozoa and nematodes), mesofauna (e.g. mites), and macrofauna (e.g. earthworms and centipedes).
- Peasant agriculture suffers from burning of agricultural lands. Fire is more frequent in the savannas. Fires result in death of beneficial microorganisms, depletion and alteration of soil organic matter, disruption of chemical composition, volatilization and potential loss of N, and non-availability of mineral N, K, Mg and Ca.
- The African Green Revolution has to be different from the Asian Green Revolution in that it must use less fertilizer.
- With good soils, and good genotypes the AGRI cannot fail; genotypes best suited to African environments (those that take up less P from soil and still produce high yields) are the types we need to enhance our Green Revolution.
- If shifting cultivation goes on, we shall have no land left in the next few years. We have enough land, let us manage those soils properly.
- Africa must continue to adopt the necessary changes to ensure a Green Revolution. With dedication we should be able to do it within 10 years. The Asian Green Revolution adopted an expensive input approach and they succeeded; we do not have to go that way. We need some clarification and insight on using genetic manipulation to improve the soil itself.
- Genotypes should be applied directly to soil. Attempts have been made to incorporate rhizobium gene or N-fixing gene, but they have not been successful. E.g. the Bt gene has been shown to have insecticide efficiency (and can reduce the use of chemical insecticides). It is a question of farmers being allowed to use these transgenics. Work is going on in genetically manipulated microorganisms, but there is difficulty in having them used in agriculture by farmers.
- Subsidies are needed to encourage fertilizer use. Who should be blamed for lack of subsidies? Africans do not encourage subsidies as it is done in America and elsewhere. We need to help the farmers. Fertilizer use keeps going down.
- The main ingredients of Asian Green Revolution were: (a) adoption of varieties (through breeding) followed by (b) good natural resource management (soil, water), (c) fertilizer

use, and (d) farm inputs, which were made available to farmers by government. This should be the pattern Africa should follow to effect its own Green Revolution.

- There are two schools of thought regarding the use of new varieties to effect a Green Revolution. (a) develop the genotypes and then look for inputs that go with them. (b) breed for varieties which use less fertilizer.
- Many countries in Africa have rock phosphate deposits. Is availability the problem? Assess their availability and if they are water-soluble, use them directly. If not water soluble, process them before use.
- Some degraded soils cannot be repaired. Some 60-70% of the soils are threatened by iron pans. With erosion damage, we cannot repair the soil.
- Recommendations should be the last thing to make to the AU; AU has seen too many recommendations that have just been shelved.

Session 2: Principles, methodology and strategy for promoting the African Green Revolution: A Design and Training Manual

This presentation was made in three parts by Prof. Dezi Ngambeki.

PART 1 – Diagnosis - problem identification

30. After independence, African countries were faced with a multi-facetted problem: how to feed their populations, attain food self-sufficiency and food security, achieve economic development and secure reliable sources of income for their rural populations. They started wondering how countries outside Africa had handled the problem. The challenge was how African countries could modernize their agriculture so as to transform their rural populations. They were faced with a problem of priority setting, especially for the internal factors of their farming systems involving crops and livestock, land resources and existing technologies. There were interactions of new technologies, policies, institutions, infrastructure, market influences and natural environmental factors (climate).

31. It is important to have an understanding of the African farmer – the community entry process - to achieve community consensus on priority constraints and analyze community characteristics such as their composition, social elements (psychological, economic, political) and community segments (marginalized and grassroots, middle and upper classes).

32. There is need to mobilize and sensitize communities so as to identify common themes of interest, channels of communication, their strengths and weaknesses, and make an assessment of their needs, through convening community meetings. These will be enhanced by data gathering tools (maps, transect maps and other resources), and identification of participatory data types (agro-ecological, topographical).

33. Participatory data gathering methods include direct observation, village/parish sketch maps, transect walks, holding of community village meetings, use of maps to show resources, mobility and social and economic facilities. Participatory problem analysis involves ranking methods such as preferences ranking in order of importance of a problem by set criteria, pair-wise ranking matrices which identify main problems and compare priorities of focus groups and criteria used by individual members from each focus group, and direct matrix problem ranking (which gives information on worst problems and criteria or reasons why they are being ranked so). Time diagrams involve a daily activity diagram (how activities are

allocated to individuals by education, age, sex/gender), a seasonal calendar (how resources are allocated to the various activities), the areas where there are problems, bottlenecks and opportunities, and the historical profile.

34. Relationships and decision diagrams are flow diagrams, Venn diagrams (which show how key problems are interlinked), key individuals in community, institutions and their relationship or their importance for decision-making, and problem tree analysis (which shows main problems and their causes).

35. Community visioning must consider the resource map of communities, the products and opportunities in the communities, how communities can be organized to work together so as to rationally use their land, water, swamps, and forests for mutual social, cultural and economic benefits; how to use available technologies and resources for their own present needs and needs of future generations; to have a community vision or image of what they want to be and what they want to have as a future organized community living together; the shared values of working together, their relationship as users and stakeholders; and organizing principles.

36. African farming systems must be redesigned so as to cater for a fast growing African population (2-3.8%), slow growing agricultural production growth (1 to 2.8%/year); small arable land area/person (0.1 - 1.44 ha). In the continent there are also complex farming systems; there are some 16-30 agro-ecological zones, about 20 crop, livestock and socio-economic systems and an array of farming constraints.

37. Green Revolution design principles must take into consideration the geo-politico-economic environment, the critical mass of science and technology and national capacity for research and development, a long term vision or strategic master plan, planning for a sustainable use of natural resources, long term national investment plans, use of appropriate methods and procedures, tuning and priming rural communities, and designing of on-farm testing of Green Revolution core components.

Highlight of discussions following the presentation

- These methods have been used for many years. We need to organize ourselves and to look at what we have done taking the shortest time possible. Since we are not at the same pace of development, we need to do all we can in our respective countries so as to effect a Green Revolution.
- Farming Systems Research has been with us for a long time. The challenge of international centres (such as IITA) is to make African farming systems sustainable.
- To whom is the manual written? How will it be utilized? The target of the document is the trainer of trainers.
- We are presupposing that the barriers to a Green Revolution are different between Asia and Africa. The soils are different, crops are not responding the same way, resources are not the same.
- It will be important for a design team to be a mix of diverse disciplines; there is also a missing link – that is the farmer himself.
- Participation in design teams takes lot of time and experience. Farming systems have evolved with time and we must adapt our strategies to the changing systems.
- The document should be made simple to be useful to all.

- External inputs - agro-chemicals, mechanization, irrigation, provision of credit – all require money. The African Green Revolution must minimize some of the costs.
- We must also take into account the fact we are in a new situation – trade liberalization.
- Local knowledge and modern knowledge should be combined and used.
- For Asia, there was willingness and support of Government.
- The Asian Green Revolution targeted one or two crops. The African Green Revolution targets many crops.
- Water was a major component of the GR in Asia; it was more a question of managing soil to control the water.
- Production systems in India are as diverse as in Africa.
- Green Revolution technologies are not missing in Africa.
- Government policies to support farmers is what is necessary.
- The manual should expose the reader or user to the process of participatory enquiry.
- Let's make sure that local knowledge and scientific knowledge are combined as a principle of the African Green Revolution.
- Priority setting of farming constraints is lacking.
- There is need to mobilize and sensitize communities so as to identify common themes of interest, channels of communications, strengths and weaknesses.
- Participatory data gathering and problem analysis clarify the identification of field constraints.
- There is need to re-design Africa's farming systems so as to cater for the fast growing population, slow agricultural growth, and small arable land area/person.
- Green Revolution design principles must consider geo-political environment, critical mass of S&T, long term master plan, sustainable use of natural resources, national investment plans and use of appropriate methods and procedures.
- The manual should simplified.

PART 2 Design – Modeling

38. Farmers' goals include providing food, catering for basic social needs, generating decent income and managing risks.

39. To model farming systems analysts have to know the production systems (crop, livestock, land resources, technologies, institutions, infrastructure and the natural environment), and collect an array of technical field data on them. Once these data have been collected, they have to be analyzed technically with production functions (for crop, livestock), supply and demand functions (leading commodities), taking into consideration environmental or natural factors, seasonal calendar analysis, and socio-institutional factors of influence.

40. Leverage factors include farmer priorities (food and income), technology generation (biological, chemical and physical), institutions (research and development, and markets), and infrastructure (roads and transport). Other leverage factors to be analyzed are crops (land, labour, capital, technology), livestock (animals, pastures, feed, technology), and risks (natural rains, drought, soils, pests, diseases and weeds.

41. The Indian Green Revolution involved multiplication and wide adoption of improved rice and wheat varieties, biological and technological improvements, complementary crop production technologies, improved farmer accessibility to necessary inputs, provision of infrastructure (irrigation networks, input supply), provision of institutional support in research and development, extension, good policy and price stabilization.

42. The following components of the African Green Revolution are among the most important ones:

- Biological crop-livestock technologies
- Chemical and crop management
- Bio-physical and complementary technologies
- Post harvest handling and marketing technologies
- Socio political institutions
- On-farm testing and widespread adoption
- Yield increases of 40% and above
- Sustainable development

Discussions

43. Some of the points highlighted in the discussions are as follows:

- In order to improve the document, give examples from the four corners of the continent and examples from a range of stakeholders.
- There is a need to isolate in what respect the African Green Revolution Initiative (AGRI) is different from other initiatives.
- Much money is being spent on food imports, yet Africa is said to have no money. How can this be reconciled given that 24 billion dollars are spent by Africa for food imports? Money is there but it is not properly channeled for efficient use. Even banking loans can be obtained if the loan project is properly designed.
- There is a need to mobilize Africa's own financial resources instead of believing that it has no funds for the African Green Revolution Initiative.
- Soils are mentioned in the document under management of natural resources.
- There is need to identify various farming systems, available technologies, and ensure large-scale demonstrations of these technologies.
- Good communication skills for technology transfer are needed.
- It appears difficult to envisage the full attainment of geographical coverage for the AGRI.
- Farmers are the active players and reaching them and mobilizing them are the main challenge.
- The integration of Africa into the global economy is also a vital challenge for our development.
- Mistakes have been made long time ago that are being made again today. One breeder and too many agricultural economists cannot redesign African Farming Systems. Some 250 million dollars are being spent by CGIAR each year to do research related to the Green Revolution in Africa. How can this expert group do this with no money at all?

- The InterAcademy Panel was commissioned by Kofi Annan to conduct a study on the Green Revolution in Africa. The report of that study has not been used.
- We cannot succeed without linking our initiative with the NEPAD initiatives.
- Do we really need a manual for a Green Revolution? Let us task ECA to bring our Ministers of agriculture to be inspired on the need to change their minds and put their heads together for a Green Revolution in Africa.
- ECA should find a way of coordinating the initiatives of FARA and NARS so that they can come together and effect the development of agriculture.
- Let's not go back to reinvent the wheel. Much has been done, let us use this information to effect change in agriculture.
- A manual has just been developed by the Dutch for Africa to be sold to Africans. Perhaps Africa should also develop its own manual for its own Green Revolution.

PART 3 - Development

44. The highlights of the presentation can be summarized as follow:

Piloting and on-farm testing of piloted designs
- Generation, validation, demonstration
- Farmer type – small, medium, large
- Systems – crop, livestock
- Resources, input supply

Scaling up national successes
- Formation and coordination of African Green Revolution teams
- Public and private sector partnership
- Selection and networking on demonstration and promotion sites
- Coordination of expert teams in research, extension and development
- Systems support for policies, institutions, infrastructure and markets
- Provision of critical mass of human, material and financial resources

Scaling up neighbouring countries
- Formation of regional partnerships
- Selection and networking on-farm testing/promotion centres
- Harmonization of regional priorities
- Selection of technology generation centres
- Sharing/exchange of critical/facilities' germplasm, biotech
- Provision of adequate support systems
- Mobilization of adequate human, financial, material resources

Methods applied
- Participatory methods
- Participatory development communication
- Survey methods
- Field technical assessment
- Multiple regression
- Linear programming
- Shear / transformation matrices
- On-farm trials and breeding

- Extension models

The way forward

- Identify interest and political will of African countries
- Initiate consultative African Green Revolution high level meetings
- Agree on an agenda/involve lead national institutions
- Formation of African Green Revolution design, technology generation and logistical support teams
- Training sessions with field practices
- Mobilization of human, financial and material resources.
- Redesign of farming systems
- Piloting of African Green Revolution designs in two African countries
- Launch of Green Revolution for Africa.

Discussions

45. The highlights of the discussions are the following:

- Are politicians appearing in the design teams? What is the process in calling people to form a team? The process involves many participants, who fit into different stages of the process. The formation of the design team proposed in the document is the minimum. Formation of the design team will also be determined by the needs.
- What outputs will be derived from the integration model? What if the farmers say they will not adopt the proposed model?
- Good sensitization of farmers and stakeholders is a precondition to success.
- Since they are the decision makers, is it possible to ask the Ministers of agriculture in our respective countries to meet so as to have a clear idea on how to start the process.
- We need to involve the politicians. We need political support especially at the beginning of the process. This means we have to do some good lobbying. We start with Ministers of agriculture and progress to the Prime Minister.
- Concern about the composition and profile of the design team is that it is going to be top-down approach.
- We start with a small team of facilitators; then once we reach the implementation stage, we will select the scientific design team.
- The design and training manual and its contents should be put across to other stakeholders (CGIAR centers, NEPAD secretariat, FARA) in order to get feedback from them about its content.
- ECA is clear on what it is proposing, especially to ensure that it is not doing what has already been done.
- The manual is addressing issues such as policy and marketing. Manual should address all other issues of importance to Africa's agriculture.
- Climate and environment have significant implications since climate changes very rapidly.
- The interactions between crop-livestock have to be analyzed thoroughly. What is livestock giving to crops and what are the crops giving to livestock?
- ECA is a facilitator. It decided to answer the call from Kofi Annan to initiate a Green Revolution in Africa. The process will continue with several more stakeholders and different teams and disciplines coming aboard.

- This meeting is attended by people with a lot of power who can move the ideas forward.
- To be more practical, let us divide Africa into regions or climatic regions with similar problems.
- Start making models with feasibility studies. Investors will invest only if there is profit; hence feasibilities studies in each areas.
- A consultant was given an assignment and he has done it well. Let us base our thinking on where we are going from here.
- African governments have their own agendas on the Green Revolution, so their input is missing in the manual. It appears theoretical. It should be based on practical issues on the ground.
- The manual has probed into our thinking about where we are going. We are not designing anything from afresh. The challenge is ours. Where do we have to go with this idea of African Green Revolution?
- Piloting and on-farm testing of designs should involve knowledge generation, farmer type, systems and resources available.
- There is a need to develop public and private sector partnership.
- The methods to be applied are participatory techniques, communication development, field assessment, multiple and linear programming and various extension models.
- The way forward is considered to be the identification of interest and political will of African countries, initiation of consultative Green Revolution high level meetings, getting agreement on the agenda, making training sessions, mobilization of resources, redesigning of Green Revolution teams in pilot African countries and the launching of the Green Revolution in Africa.
- Ministers of agriculture in African countries should be encouraged to meet and decide on the steps to be taken to launch the African Green Revolution.
- Other issues include those of integration, types of tools to use, the role of ECA as facilitator.
- Political will worked in Asia but may not work in all African countries.
- Subsidies worked in India but have not worked in Africa, despite huge efforts in this direction.

Comments on the draft Design and Training Manual

46. Detailed comments were made on the draft Design and Training Manual. In addition to those already mentioned above they included:

- The document is not a training manual
- There is a need for a preface and/or an executive summary
- Some titles of sections are too clumsy and need to be rephrased
- The document needs to be thoroughly edited to remove obvious typing and formatting and other errors
- The document could be shortened and be more focused on essential points
- The manual should be sent to other stakeholders to get their feedback
- The diagram on page 14 and 15 is more confusing than elucidating
- There is a need for a re-organization of the sections to allow smooth flow of concepts. It is suggested to box some items that are more definitional but need to remain in the main body of text and to annex those that need not remain in the main body of text.

- Sections 4 and 5 have some repetitions in data collection. There is need to rework them or may be merge them.
- Participation of farmers, which is central to the AGR, is not shown as very central in the draft document – especially in section 2 which is biased more towards explaining the roles of researchers and design team. E.g. section 2.3 on strategy for implementing AGR, there is a need to include the farmers as 5th key actor.
- Other issues which are not related to technology but are key requirements for an AGR are not included in the draft document or are not discussed at length, e.g. marketing, irrigation, transport infrastructure, institutions, policies.
- HIV/AIDS is now a new challenge which can actually hinder the progress of the AGR through: a) loss of the skilled officials responsible for promoting the AGR, e.g. extension and research staff, and b) diminution of labour available for agricultural production. Therefore, there is need to explicitly include this major constraint and how it can be addressed.
- On page 30 there is a list of characterization of farmers into middle, high and low classes. In participatory methodology is this necessary?
- We still need to be very clear to whom this manual is being addressed.
- Title should read: "Promoting the African Green Revolution" or "A proposed model for Designing and Promoting the African Green Revolution".
- There is a need to expand more on the Asian Green Revolution: What was the situation before? How was the seed industry set-up? How the new seed was multiplied and distributed, i.e. the new set-up of the seed industry?
- There is no need to give a typology of participation but to emphasize in the text the need to use interactive participation and self-mobilization in promoting the AGR.
- The linear programming concepts of the AGR model should be reviewed to be easily understandable by practitioners who are non-technical.
- Existing initiatives in agricultural transformation need to be taken into account.
- ECA can facilitate the dissemination of the draft manual once it is finalized.
- More examples of success stories should be taken from a wider geographical coverage of Africa and included in the AGR manual to illustrate how the AGR components are working and to make the manual richer.
- Enrich the section on the Review of the Asian/Indian Green Revolution experiences
- Elaborate on the present status in Africa with respect to AGR
- Include the level of preparedness of African countries for the AGR (summarize Kampala Report on Indicators of a country's preparedness for AGR)
- Include recommendations of Expert Group Meetings on AGR: June 2003, December 2003, November 2004
- Make references to: Biotechnology, African Water Vision 2025, Declaration of African Heads of States on Integrated Sustainable Development
- Since there is no other similar manual, it is necessary to target multiple audiences at different levels of decision-making and implementing AGR
- There is a need to liaise at high national policy level to be in line with geo-political environment and long-term master plans.
- Re-organize the Structure of AGR Manual
    - Add Preamble and/or Executive Summary
    - Part I Conceptual Framework of African Green Revolution
    - Review of Status of AGR in Africa
    - Review of the Asian Green Revolution
    - The Concept of African Green Revolution

- Part II Diagnosis of the African Farming Systems
- Part III Design of African Green Revolution
- Part IV Development of African Green Revolution
- Appendix I Analytical tools of AGR
  - I Multiple Regression Analyses
  - II Linear Programming
  - III Transformation matrices
- Appendix II
  - Case Studies
- Appendix III
  - List of Participants of Expert Group Meeting, November 2004
  - List of Participants of Expert Group Meeting, December 2003
  - List of Participants of Expert Group Meeting, June 2004

- Participants are invited to send further comments on the draft manual to the secretariat.

Session 3 - Experiences from the field

a) *Experience from India*

47. The Indian experience with its Green Revolution was presented by Dr. Aldas Janaiah.

1 *What was the scenario*? Heavy dependence on corn and wheat from the USA. 60% of the population was suffering from hunger.

2 *What was the goal*: Strategy was to attain food self sufficiency.
3 *What was the approach*: Targeted favourable environments first without much input; irrigated areas. Then moved towards unfavorable areas through diversification. Producing more food in favourable areas and distributing it to the less favourable areas to meet food requirements.

4 *Key elements of the success*:

a. Availability of technologies and irrigation infrastructure. Technologies were rudimentary.
b. Political will to make a change. First, imported high yielding rice and wheat varieties and multiplied and distributed them. Doubled food grain production. Green Revolution took place within two years, hence the name.
c. Government bought all surpluses from farmers and kept them for the future. Hence farmers were encouraged to keep producing.
d. Credit: Government nationalized banks and 43% total lending had to go to farmers. This created a significant means for farmers to purchase inputs.
e. Price support to farmers for key commodities.
f. Strong research system.
g. Farming training centres for new technologies.
h. Strong technology transfer system.

48. The highlights of the discussions can be summarized as follows:

- Bring African Ministers of Agriculture to interact with Asian Ministers of Agriculture to exchange their conception about productivity. May add value to your ECA efforts.
- Why ECA instead of FAO in sending African agriculture Ministers to Asia?
- Political will may not work in all places. In Nigeria there was no follow-up of loans despite availability of credit facilities for farmers.
- In India, they worked with international centres in genotypes and these facilities are still in operation.
- How did Indian farmers manage Indian subsidies? Subsidies are given depending on country: USA 800/ha; Europe 300/ha, India 250/ha
- How did India manage the environmental problems in their Green Revolution?
- Markets were developed due to political will.
- Minimum support price were extended to different crops.
- Surplus production: government regulated market and public distribution system were set up.
- Chances of misusing agricultural subsidies in Nigeria were high because they were given in kind (fertilizer supplied to farmers – unique fertilizer prices all over the country).
- India took risks with effects of fertilizer on the environment because the priority was given to food security.

b) *Experience from Egypt*

49. The experience from Egypt was presented by Dr. Ahmed Khorshid.

- The experience relates to the success of the government in promoting affordable wheat (bread) through a mix of policies, including price support for the farmers.
- The government and the private sector played an important role in the success.
- Farmers are well organized.

c) *Experience from Tanzania*

50. The highlights and lessons of the presentation are the following:

- Establish on-farm trials/participatory variety selection
- Introduce rural trade fairs
- Mobilize people to have the message of Green Revolution in motion
- Encourage farmers to be seed producers

d) Experience from Uganda

The highlights of the presentation include:

- Banana is the most important crop in the country.
- Uganda is the second world producer of the commodity.

- Exotic varieties are more tolerant to many biotic and abiotic stresses.
- The problem of soil fertility is serious.
- The problem of pest is severe.
- Farmers suspect that scientists are introducing problems.

Session 4 –Group Work

Concerns were raised that the expert group meeting did not have the mandate to validate the Manual and that the experts could best add value by helping ECA to chart its role and the way forward in the AGR process.

Terms of Reference for the three Working Groups: To provide guidance on the way forward for a successful African Green Revolution by answering the following five questions.

1. Where are we?
2. Where do we want to go?
3. How will we get there?
4. How shall we know we are on track?
5. How shall we know we have arrived?

A- GROUP I

Where are we?

- ECA developed indicators of assessment for the African Green Revolution
- ECA already has major programs that address elements of AGR, e.g. chair and secretariat of UN Water Africa; also likely to be chair of UN Energy Africa
- ECA also promotes good initiatives such as trade and market access, transport and governance.
- Half of African countries are food insecure and are relying on food imports for many reasons, some of which include infrastructure, climate, government's lack of support to farmers, lack of market access, dumping, and lack of supportive policies for the African Green Revolution.
- Weak on partnership and coordination with major players, e.g. FAO, AU, ILRI.
- There is no well integrated use of existing services such as universities and research.
- Africa has abundant policies at sub-regional and regional levels with little integration.

Where do we want to go?

- Integrate what has already been done. ECA should do an integrative/planning analysis of the role of specialized agencies.
- Identification and dissemination of good practices of AGR to facilitate replication/scaling up.
- Countries should be food self-sufficient.
- Countries should be able to openly support farmers with subsidies.
- Agriculture should be recognized as an engine of growth.
- There should be more even distribution of the successes of Green Revolution.

- Success stories to be generalized.
- ECA should capitalize on what has been done already.

How do we want to get there?

- Use the manual for advocacy for the African Green Revolution.
- Provide a platform where specialized agencies can meet to create synergy, identify their comparative advantages, and be able to catalyze the Green Revolution process.
- Pilot test the indicators of assessment and apply them to countries and sub-regions, and synthesize the regional/Africa wide document.
- ECA has similar initiatives that have used this approach, e.g. governance, Africa Gender Development Index, assessing regional integration in Africa (ARIA).
- Create platforms on which several organizations and countries can meet.

How will we know we are on track?

- Peer review by different stakeholders which include major groups (research organizations, governments, RECS, private sector, donors).
- Self assessment (achievement of the set indicators and achievements).
- External evaluation.

How will we know we have arrived?

- Feed back from clients (governments, RECs and partners)
- Food self-sufficiency in Africa

The way forward

- Indicators should be pilot tested and their application promoted.
- Extensive profiling of countries should be done.
- ECA should take stock of work being done in-house that is relevant to the African Green Revolution initiative and coordinate activities.
- ECA should take into account the priorities of African Governments in driving the Green Revolution agenda forward.
- Partnerships should be promoted and an appropriate coordinating mechanism put in place to ensure effectiveness.
- A coordinated and integrated use of existing resources including academia and research institutions should be ensured.
- Collaborative and coordinated activities to ensure that food is available and accessible in an optimal and efficient manner.

GROUP II

(a) Where are we?

- ECA has identified some countries based on measurable indicators for the preparedness of countries to take up Green Revolution initiatives.

- ECA has also tested and validated indicators that were discussed during the Kampala meeting.
- ECA also identified 14 countries in West, East and Southern Africa that were evaluated for preparedness for uptake of Green Revolution.
- There is a report available from the Kampala meeting on these issues.

(b) Where do we want to go?

- ECA should play a facilitator role to convince African governments and stakeholders of the need for a Green Revolution and the role that governments and stakeholders should play to achieve it;
- ECA should convey the message to decision makers to make sure that the Green Revolution will be achieved;
- ECA should also study, summarize and point out the success stories that exist in many countries and disseminate them to other countries;
- ECA should promote networking at the grassroots level;
- ECA should show the potential of available technologies through advocacy and sensitization.

(c) How do we want to get there?

ECA will know that we are getting there by:

- networking of the national and regional systems particularly national and agricultural research systems;
- collecting success stories and evaluating and studying them with the objective of showing that the Green Revolution Initiative is good for all stakeholders (farmers, governments and investors);
- making all existing technologies available;
- capitalizing on the uniqueness of the African Green Revolution;
- reaching donors and connecting them with investors and farmers;
- building capacity through workshops, short-term training and exchange visits.

(d) How will we know we are on track?

- Monitoring mechanisms to know vertical and horizontal progress across regions using indicators. For instance, we can monitor the number of governments adopting Green Revolution Initiatives;
- Monitor the area under cultivation and examine whether governments are addressing TIIP (technology, infrastructure, institutions and policies).
- In addition, ECA can evaluate how integrated the sub-regional networks are.

How will we know we have arrived?

ECA can do the following:

- Monitor farm-level indicators like increase in farm income;

- Monitor national level indicators discussed in the Kampala meeting such as increases in literacy levels, import of food, per capita food production, level of agricultural investments;
- Monitoring rate of uptake of ongoing activities and level of participation of the private sector.

GROUP III

Where are we?

- Existence of parallel initiatives/processes from international, continental, regional, national institutions, e.g. NEPAD, CGIAR, NARS;
- UNECA: indicators developed; draft design of training manual;
- Technology available;
- Missing link between technology generation and uptake;
- Inadequate political will;
- Inadequate allocation of resources for agriculture in national budgets;
- Inadequate/lack of conducive policy framework for agricultural production.

Where do we want to go?

- Ensure food security at household level;
- Poverty alleviation;
- Surplus production;
- Sustainable agricultural production and marketing systems.

How do we want to get there?

- Identify players;
- Identify gaps (institutional frameworks; policy frameworks);
- National assessment (situation analysis);
- With AU and other players, invite policy makers to raise awareness on AGR.

How will we know we are on track?

- Supportive and conducive policy in place
- Use of Kampala indicators

How will we know we have arrived?

- Field production achievements;
- Food security for the African rural populations;
- Poverty alleviation for African rural populations.

Plenary Discussions

51. Delegates discussed the need for critically examining at what level ECA should measure the impact of its work. The overriding concern was whether ECA measures impacts at the farm level. Delegates also pointed out that governments were not coherent when using nationally produced resources. Therefore there was a need to look at government policies that promote agriculture and sustainable development.

52. African governments have abundant policies at the regional level and continental levels. We should therefore make concerted efforts to know where our governments are, for example, by closely examining the Sirte Declaration. This will allow us to integrate our prescriptions with those already adopted by Heads of governments.

53. In the future ECA should ensure that there is professional balance of experts at meetings with crosscutting themes.

54. There is a unifying factor missing. NARS met, identified their priorities and formed sub-regional organizations (e.g. ASARECA). At Africa-wide level, there is FARA. ECA should be party or a player to the regional initiative. It can send this manual to different regional bodies for review and validation.

55. There is a need to liaise with regional bodies to continue the brainstorming of strategies for the African Green Revolution.

56. ECA commissioned a study on how Africa can achieve its own Green Revolution. Let us learn how to design it for easy implementation.

57. Demolish the ivory tower syndrome of academic research and go practical.

58. All participants should endeavor to mobilize political support for the African Green Revolution Initiative.

Session 5: Adoption of conclusions, recommendations and the way forward

After three days of deliberations, the following conclusions and recommendations were adopted:

1. The manual needs to be cleaned up, simplified, restructured and edited. The geographical coverage should be widened and should include all stakeholders; it should take into consideration of all existing farming systems issues and the work done by other organizations in this area.
2. There is a need to better define 1- who is target audience of the manual? 2- what competences are we trying to capitalize on? 3- what is the meaning of validation? 4- who are the revolutionaries? 5- to what extent is the manual going to help us achieve Green Revolution? 6-who are the actors (governments, Ministers)? and 7-how are the various efforts in Africa (FAO, NEPAD etc) going to integrate into this?
3. The soil is one of the most important resources for the African Green Revolution.

4. In using land for agricultural production, irreversible degradation should be avoided through the use of integrated soil fertility and land quality management. This may require lower levels on reliance on inorganic fertilizers.
5. Involve farmers in all the endeavors of work related to the soil because the indigenous knowledge of farmers is important.
6. With good soils, and good genotypes we cannot fail; genotypes best suited to our environments (those that take up less P from soil and still produce high yields) are the types we need for the enhancement of our Green Revolution.
7. Africa should modernize its agriculture and transform its rural populations if the Green Revolution is to succeed.
8. Priority setting of farming constraints should be fostered for the Green Revolution to move forward.
9. There is need to mobilize and sensitize communities so as to identify common themes of interest, channels of communications, strengths and weaknesses.
10. There is need to re-design Africa's farming systems, so as to cater for the fast growing population, slow agricultural growth, and small arable land area/person.
11. GR design principles must consider the geo-political environment, the critical mass of S&T experts, have a long term master plan for sustainable use of natural resources, and make national investment plans for agriculture.
12. Africa has funds to finance a Green Revolution; policy makers should be sensitized to make these funds available.
13. No need to reinvent the wheel; so much information is already available. It just needs to be properly harnessed for the benefit of a Green Revolution in Africa.
14. The way forward should be identifying interest and obtaining political will of African countries, initiating consultative Green Revolution high level meetings, getting agreement on the Green Revolution agenda, making training sessions, mobilizing resources, re-designing Green Revolution teams in pilot African countries and officially launching of the Green Revolution.
15. Intra-African trade should be promoted actively.
16. African governments should mobilize and put more financial resources in agricultural research.
17. ECA should revisit the recommendations of the Sirte meeting of February 2004, and clarify the target audience of the manual.
18. The African Ministers of Agriculture should interact with Asian Ministers of Agriculture so as to emulate what led to the success of the Green Revolution in Asia.
19. ECA should facilitate national assessments in order to capture gaps.
20. What can we do? The missing link is ownership. Not technology, not finance. The strategy should be that the national governments that will be using the process be given ownership.
21. Let us be the ambassadors of the African Green Revolution.

Closing of the meeting

Closing Remarks

59. The remarks were made by chairman, Dr. Musa Dube, and by Mr. Josué Dioné, Director, Sustainable Development Division, ECA.

60. Dr. Dube thanked all participants for nominating him as chairman and for a job well done. He said that it had been a very trying and fulfilling experience. Dr. Dube was warmly commended for his excellent work and leadership.

61. In his closing remarks, delivered on his behalf by Mr. Alex Tindimubona, Mr. Dioné first said that participants had accomplished their mission. They had reviewed the African Green Revolution Design Manual and had found it relevant for several target audiences involved in the promotion of the African Green Revolution. He stated that he appreciated that the manual was the output of the African brain, professional experience and perspective. Developed by Africans for Africans, and reflecting a deep grassroots understanding of the African context, the Manual stands a good chance of being effective in launching a sustainable modernization of agriculture and rural transformation (SMART), he added. Furthermore, he said that the experts had shown that the Manual was a living document, which was already being used even as ECA continues to clean it up, process it and disseminate it for further validation. He congratulated all participants for their contribution.

62. Mr. Dioné added that participants had dwelt at length on advising the ECA and Africa in general on where Africa is with respect to the African Green Revolution, where it wants to go, and how to get there. He acknowledged the contribution participants made on how to improve the Manual, on follow up actions for the design effort, and on future work of ECA on the African Green Revolution.

63. Mr. Dioné said that participants had exchanged their own field experiences, best practices, best designs and models, and best plans for promoting the African Green Revolution and that it had been an enriching experience for all. ECA appreciated all the effort and work participants had put into this exercise, and the contributions they had made over the last three days.

64. Mr. Dioné stated that ECA will take all the recommendations very seriously, and will try to implement them to the extent possible within ECA's mandate and capacity. He said that ECA remains committed to the promotion of the African Green Revolution, in conformity with its strategic plan and road map, which entails extensive mobilization and coordination with multiple stakeholders.

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Annex II
Program of Work

Tuesday, 16 November 2004

9:00 a.m. – 9:3 0 Registration of Participants
9:30 a.m. – 10 :15 a.m.

- Opening the meeting (Agenda Item 1)
- Organizational matters (Agenda Item 2)

10:15 a.m – 10:30 a.m. Tea Break

10:30 a.m. – 1:00 p.m. Session 1 Invited Lecture by UNU/INRA

10:30 a.m. – 11:00 am. Lecture Part 1
11:20 a.m. – 11:50 a.m. Lecture Part 2
12:10 p.m. – 12:40 p.m. Lecture Part 3
12:40 p.m. – 1:00 p.m. Discussion

1:00 p.m.- 2:30 p.m. Lunch Break

2:30 p.m. – 4:00 p.m. Session 2

- Principles, methodology and strategy of promoting the African Green Revolution - Part 1
- Discussion

4:00 p.m. – 4:1 5 p.m. Tea Break

4:15 p.m. – 5:3 0 p.m. Session 2 (contd)

- Principles, methodology and strategy of promoting the African Green Revolution - Part 2
- Discussion

Wednesday, 17 November 2004

9:00 a.m. – 10 :15 a.m. Session 2 (contd)

- Principles, methodology and strategy of promoting the African Green Revolution - Part 3 (contd)
- Discussion

10:15 a.m. – 10:30 a.m. Tea Break

10:30 a.m. – 12:3 0 p.m. Session 3

- Experiences from the Field
- Discussion

12:30 p.m. – 2:3 0 p.m. - Lunch break

2:30 p.m. – 4:00 p.m. Session 4 Validation Group Work

4:00 p.m. – 4:1 5 p.m. Tea Break

4:15 p.m. – 5:3 0 p.m. Session 4 (contd)

- Validation Group Work: Conclusions and Recommendations (contd)

Thursday, 18 November 2004

9:00 a.m. – 10 :15 a.m. Session 4 (contd)

- Validation Group Work: Conclusions and Recommendations (contd)

10:15 a.m. - 10:30 a.m. Tea Break

Session 5: Adoption of Conclusions, Recommendations and Way Forward

10:30 a.m. – 12:30 p.m

Adoption of conclusions and recommendations
Closing of the Meeting