

Session 4: Sustainable Land Use and Agriculture

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Synthesis of presentations

A. Dr. Ronald Bellefontaine, CIRAD-Foret, France, reported on a very low cost method of tree propagation by the process of "root suckering and ground layering". It is technically and rapidly practicable by poor populations and may be very beneficial to increase their standards of life and to combat desertification. These vegetative propagation techniques have important advantages including low cost, reduced hole-digging and subsequent erosion, as well as the reproduction of trees with farmer-preferred physical characteristics. Before the total disappearance of the remaining vegetation, the induction of suckering (ground layering) by slightly wounding the roots (branches) at the right time is less expensive than re-planting. These forms of asexual regeneration have not been sufficiently considered up to now. He displayed vivid photos of his trials in different countries from Mediterranean Region and Tropical Africa. Usually suckers develop roots down to 5 or 10 cm but there are two exceptions at 80 cm. For two other species, amazingly 81 m suckers were also reported. More than 875 species have been identified and published.

Research priorities

- to find the best time(s) of the year in each country when the success of this technique is more assured and to document the conditions under which suckers and layers can later become independent of the mother tree;
- to experiment the root cuttings method, especially the respect of plant polarity;
- to record the traditional knowledge and to start local case studies on key indigenous species which show this ability.

B. Dr. Asamoah Larbi, ICARDA, Syria, discussed the critical situation of insufficient forage for a growing population of livestock in Central and West Asia and North Africa. Overgrazing has caused land degradation and loss of biodiversity in these regions. Development of improved indigenous forage legumes with high protein content and yield, and the potential to enhance soil fertility are the objectives of this research project. Cooperation of the ICARDA scientists and national partners has resulted in the identification and release of high-yielding, nutritious legumes, particularly vetches (*Vicia spp*) and *Lathyrus spp* suitable for grazing, hay making, and harvesting at maturity

for seed and straw. Forage legumes germplasm improvement for increased production and productivity was emphasized.

C. Mr Humberto Alves Barbosa, FUNCEME- Fundação Cearense de Meteorologia e Recursos Hídricos, Brazil, linked sustainable indices and climate variability in the state of Ceará, Northeast Brazil. Fluctuations of sea-surface temperature in the tropical Pacific (Ni2o 3.4 index) and Atlantic (Dipole index) were linked to drought and high rainfall occurrences. He found that total seasonal maize and bean production is inversely correlated with Ni2o 3.4 and Atlantic Dipole indices. Year-to-year averaged February-April sea-surface temperature fluctuations explain about 50% of the inter annual variability in maize and bean production over the rainy season. Variation of +0.5°C from a 30-year mean indicates drought, while -0.5°C indicates a rainy season.

D. Dr. Abule Ebro, Adami Tulu Agricultural Research Center, Ethiopia, discussed the conflicts in the Awash Valley of Ethiopia since 1960 between the pastoralists who want to graze their herds on the one hand, and the conservationists who prefer protection of the wildlife habitat on the other. The conflict, aggravated by drought, has threatened the co-existent of Afar and Kereyu graziers, park and plantations, and resulted in the rangeland deterioration. This degradation has caused bush encroachment on grasslands. Improvement in livestock marketing and animal fattening is a direct approach for increasing the income of the graziers. As diversification is thought to improve the well-being of the affected pastoralists, the following activities have been foreseen for their benefits: apiculture, palm leaves processing, fish farming, ecotourism, and handicraft, establishment of saving and credit groups, and increasing social services.

E. Dr. Mohammed Karrou, INRA, Morocco, was concerned that some of the very precious rainfall in the drylands of Morocco is wasted through evaporation and runoff. Insufficient and unreliable rainfall, drought and low diversification of crops have resulted in natural resources degradation, low production, and low water-use efficiency. Improving water-use efficiency through the implementation of appropriate technologies may lead to poverty mitigation. Soil and water conservation (straw management), and soil fertility improvement (including legumes in rotation) are recommended. Timely cropping is a strategy for having a weed free stand, and maturing earlier than the warm spring weather impedes growth of small-grained cereals. Planting of improved adapted trees, shrubs and aromatic and medicinal crops, along with water harvesting is advised. Commitment and willingness of farmers, extension agents and government is essential for the success of such undertakings.

F. Ms. Zhang Qian, Peking University, China, made policy analysis in grassland management of Xilingol Prefecture, Inner Mongolia. The Livestock and Grassland Double-Contract Responsibility System (LGDCRS) implemented since 1984, which was constituted based on the Clementsian Succession Theory and property right theory, has the expectation that the herders will control their livestock population below the carrying capacity of their pasture to maintain a sustainable livestock breeding when they have long-term usufruct of rangeland. However, over 20 years' practice of LGDCRS has fallen short of its goals. Moreover, six years of implementing Fencing Grassland and Moving Users policy (FGMU) has also failed to restore the degraded rangelands. According to the field work study, there are three problems encountered in the implementation of LGDCRS and FGMU in Xilingol Prefecture causing the failure of these policies.

1. Neglect of character of the grassland ecosystem;

2. Three defects in implementation, non-operational standard of carrying capacity, lack of the expected external preconditions, and the expanding gap between the rich and the poor, changed the livestock breeding depending on natural rangeland into high-invested production;
3. The very high cost of FG MU.

G. Ms Nagwa Hassan Elnwshy, Suez Canal University, Egypt, advocated fish farming for combating desertification in the Sinaitic Peninsula. In a laboratory experiment she showed that raising fish and using the fish pond water for irrigation is a viable alternative to traditional farming as usual in deserts. The fish pond water had higher nitrogen and organic matter content than the well water used for irrigation. Her study proved that tilapia fish (*Oreochromis niloticus*) performs equally well in groundwater and natural open waters. Soil quality is improved by irrigating with fish pond water. The added income from such enterprises decreases over-exploitation of natural resources thus reduces land degradation.

Species and variety trials with other fish species with waters of different salinity levels, and Salt tolerant plants, such as date palm, are recommended to be planted and irrigated with the fish pond water.

H. Mr Lugman Mohamedein Mohamed, Forest National Corporation, the Sudan, discussed assessment of *Acacia seyal* management as a means of degraded dryland rehabilitation in the Sudan. Large scale mechanized farms are expanding at the expense of *Acacia seyal* forests. Overpopulation, poverty, war, overgrazing and migration have lead to deforestation, deterioration of forest cover, and environmental degradation that is the manifestation of desertification. In harmony with the government efforts in implementing the National Action Programme to Combat Desertification, cooperation of the local communities was requested. Particular attention in this on going study is paid to identification of different varieties of this valuable tree. Forest inventory is made by measuring breast height diameter and height of trees, the parameters used in estimating the volume of each trunk. The socio-economic survey examines the local participation in managing and rehabilitating the vegetative cover, and their willingness in forest management for their own well-being. This study is going to identify which of the following 4 methods delivers the best results:

1. Forest protection with the very strict government control;
2. Government and people participation in forest management;
3. Contract agreement between the government and the people;
4. Collaborative forest management through partnership between the government and local community.

I. Mr Raddaoui Boubaker, Office de l'Elevage et des Paturages (OEP), Tunisia, believed that organizational culture of learning transparency and accountability is essential in monitoring the success or failure of a project. Recovery of a degraded rangeland through fodder shrub planting and complementary activities of public awareness and training addressed to the local agro-pastoral communities in the Kasserine, Tunisia. Participatory monitoring tools, integrated with remote sensing data and GIS were used at specific sites in the framework of Tunisian National Action Plan to Combat Desertification to evaluate the impact on the environment and the local community's life. Biophysical outcomes and social impacts are going to be measured by certain indices. Preliminary

results show that plantation of fodder shrubs have a positive impact on the degraded rangeland reclamation. However, the overall success of the project is entirely dependent on the proper involvement of the local farmers and breeders.

Research Priorities

Note: Each small letter corresponds to the research priorities of the presentation preceded by its capital equivalent.

a. Identification of other plants, which may be propagated using the same method; finding the best time(s) of the year when the success of the treatment is more assured;

application of growth hormones for initiation of root growth in difficult cases.

b. As some of the C4 grasses such as *Panicum antidotale* Retz. are potential N-fixers, and they tolerate heat and drought, their identification and improvement is suggested;

alfalfa with its very long roots (10 meters) is a valuable fodder that maybe planted with spate irrigation in very deep soils; fodder trees, such as *Acacia salicina* Lindl., offer a potential stock for drylands facing recurrent droughts. This tree provides pollen and nectar for honeybees in fall and winter, too.

c. Introducing soil and plant parameters in the model is necessary to predict the yield more accurately. As most of the soils in Northeastern Brazil are underlain with rock, thus water remains in the rooting zone, the improved model may be used to estimate the area of spate-irrigated farm fields based on the amount of flood-producing rainfalls, thus 'riding the variability curve'.

d. Participation of the locals in genetic resource conservation and biodiversity protection; rangeland productivity determination, and effect of management in yield enhancement; domestic and export marketing information; collection of traditional knowledge in weed control, rangeland yield assessment, and range plant evaluation; finding the not-so-obvious causes of land degradation and possible ways for their prevention and remediation; water harvesting for spate irrigation and the artificial recharge of groundwater.

e. Identification and/or breeding of drought and salt resistant small-grained cereals; developing wheat and barley with exceptionally long roots; spate irrigation of cereals in rotation with annual and perennial fodder legumes; soil building through spate irrigation along with the artificial recharge of groundwater.

f. Reinstitution of nomadism for the herders, along with the provision of water and fuelwood on their treks through water conservation methods, particularly spate irrigation and the artificial recharge of groundwater.

g. Species and variety trials with fish and shrimp, with waters of different salinity levels, are recommended. Salt tolerant plants, such as date palm, maybe irrigated with the fish pond water.

h. Variety and provenance trials, pruning and thinning studies, fertility experiments, and advanced forest management research project may contribute to an increase in yield and enhancement of gum arabic.

i. Spate irrigation of fodder shrubs, along with the species trial of fodder trees in the water spreaders will bring more forage and better protection of the fragile soil.

Human Development Index, a Practical Tool for Well-Being Assessment

Assessment of the Human Development Index (HDI) at certain intervals (e.g., 5 years) is a more accurate method of measuring the impact of reclamation activities.

As the main aim of all of the desertification control activities is provision of a better living condition for the desert-dwellers, even for the entire human population, inclusion of HDI assessment in the entire reported project is strongly recommended.