
Abstracts
Sixth International Conference on the Development of Dry Lands
Desert Development: Challenges Beyond the Year 2000
Cairo, Egypt

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Challenges Beyond the Year 2000

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International Center for Agricultural Research in the Dry Areas (ICARDA)

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Topic No. 1

Application of New Technology and Technology Transfer

Session 8.b

8.b.1
Strategies for Transfer of Technology in the Drylands of India

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Agriculture, including animal husbandry, is the mainstay of economy in the Indian arid zone. Dryland agriculture is a real challenge for the farm scientists and extension workers because it is risk-prone and the farmers are mostly resource poor. Transfer of technology strategy for such farmers and farming has to be different from that for resource-rich and progressive farmers in irrigated areas. Farm scientists and extension workers, therefore, need to ponder over this and evolve appropriate transfer of technology strategy based on local needs and field experiences. This is an appropriate time to involve farmers along with researchers and extension workers in generation, assessment, refinement and transfer of technology at a faster rate.

In India, there are five transfer of technology systems in vogue. They are:

a. First-line Extension Education System being adopted by educational and research organizations,
b. National Agricultural Extension Service (NAES). Training and Visit (T&V) system,
c. Special Extension Programs on specific crops/problems,
d. Rural Development Program.
e. Extension efforts of the Non-Government Organizations (NGOs).

The concerned Central/State Government ministries have the main mandate for transfer of technology for systems ii, iii, iv out of five systems referred to above. The first-line extension education system being operated by educational and research organizations serves as their window through which the extension agencies as well as the farmers can access the latest agricultural technologies. The main objectives of the first-line extension education system are promptly demonstrating the latest agricultural technologies to farmers and extension workers with a view to reducing the time-lag between the technology generation and its adoption, testing and verifying the technologies in the socio-economic conditions of the farmers, getting the first-hand specific feedback, providing training and communication support to the concerned State Department/NGOs and develop extension models to be adopted by general extension system for large-scale multiplication. Some of the first-line extension education projects are:

- National Demonstrations Program.
- Operational Research Projects (ORPs).
- Lab-to-Land Project.
- Agricultural Science Centers (Kirishi Vigyan Kendra).
- Institute Village Linkage Program (IVLP).
- Technology Evaluation and Impact Assessment Project.

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8.b.2
Future Trends of Technology Transfer under Egyptian Agriculture

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The successful application of technology transfer in the field of agricultural engineering tools has had dramatic effects in agriculture growth and development in Egypt. These effects are being felt throughout universities, as well as government, industrial, private and public sectors. This work has been going on for more than three decades. The application of technology transfer has changed the way that scientists exchange research knowledge, techniques and ideas. In the past, public sector research in most developing countries was predominant and supported by their governments with the mandate that public sector institutions serve society on a non-profit basis. Nowadays, the Ministry of Agriculture and Land Reclamation is launching a new strategic plan to enhance research and development (R&D) through proper technology transfer techniques. The implementation cost of the plan will be shared by both government and private sector investors. This will be carried out mainly in the following major areas:

- Awareness creation
- Human resource development
- Institutional development
- Information access
- Element of technology transfer barriers
- Develop and follow private sector rules in technology transfer

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8.b.3
Strategy for *Brassica* Improvement for Moisture Stress Arid Environments

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The studies on the improvement of *Brassicas*, particularly Indian mustard *Brassica juncea* L.) for stress conditions started with the inception of this project. The early-breeding efforts consisted of acquiring maximum number of germplasm lines, testing them under stress conditions in the field, and evaluation for seed yield and its attributes. The screening of germplasm on conserved soil moisture in a highly variable climate of Hisar, India, led to the identification of some genotypes suited to these environments. Under these conditions, the stress experienced is invariably at reproductive stage. Enhancing the stress-tolerance ability of Indian mustard inter-specific crosses with *Brassica carinata*, most drought-tolerant species, was assessed. The program culminated in the release of genetic material having early maturity, more dry matter yield, high harvest index, and high yield under stress conditions.

Hybridization program for generating material for medium rainfall areas consisted of inter-specific crosses involving *B. juncea* and *B. napus*. The material generated was tall and late with high dry matter and long and more number of primary and secondary branches. The experiment aimed at breeding short duration genotypes with improvement in seed weights and all involved inter-specific crosses between *B. napus* and *B. campestris* var. Toria.

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8.b.4
Influence of Nitrogen Fertilization and Spacing on Pearl Millet Genotypes under Arid Environments

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Low and erratic rainfall coupled with poor soil fertility conditions limits crop productivity in arid and semi-arid regions. Therefore, influence of drought was studied on growth, water relations, leaf metabolism and nutrient-use efficiency (NUE) of pearl millet (*Pennisetum glaucum*) with and without nitrogen fertilization. The influence of row spacing (25, 50 and 75 cm with a fixed plant population of $2x10^5$ plants/ha) was studied for two years (1990 and 1991). The crops suffered drought at the seedling stage and again a terminal drought 45 days after sowing in both the years. Pearl millet hybrids (MH-179 and CZH-859) consistently gave higher grain yield as compared to composite (WCC-75) under varying rainfall situations (1990 and 1991). Hybrids displayed higher harvest index, N-harvest index (NHI) and N use efficiency in both good and bad rainfall years. Wider row spacing (50 and 75 cm) increased the grain yield and dry matter production but the differences were significant only in the low rainfall year. Nitrogen fertilization significantly enhanced the dry matter production and grain yields of pearl millet genotypes under all plant spacing in good as well as bad rainfall years. The beneficial effects of N fertilization were mediated through higher nutrient uptake, more efficient leaf metabolism and higher NHI and NUE besides favorable effects on root growth and leaf area development. Nitrogen application and use of hybrids coupled with wider row spacing could increase yields both under low and high moisture availability conditions.

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8.b.5
Collection of Rain Water from Plastic Houses and Utilization for Tomato Production in North Sinai

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These experiments were carried out in a private farm in North Sinai for two successive seasons during 1996 and 1997. Three water-collection methods from plastic sheets covering greenhouses were tested in order to evaluate the water collection efficiency of each system. The collected water was used for tomato production using the nutrient film technique (NFT) system in comparison with tomato production under conventional soil culture with composted or non-composted chicken manure. The results showed that the third system gave the highest rain water collection from the plastic cover over greenhouses in comparison with the other two systems.The system was also easier to install in addition to higher amount of water collected.On the other hand, tomato production using NFT system was higher with lower total amount of water consumption and higher water-use efficiency compared to production from conventional soil system. Using the composted chicken manure gave higher tomato yield than non-composted chicken manure treatment. Fruit quality was higher under NFT system than conventional soil system.

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8.b.6

The Use of Agro-meteorological Data to Calculate Irrigation Requirement

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IRRICLAC is a software developed by the Central Laboratory for Agricultural Climate (CLAC) aiming at calculating either daily irrigation requirement or irrigation scheduling for a growing season. The software is divided into three major screens. The first deals with the crop groups that include vegetables, fruits, field crops and greenhouses. By selecting a crop-group, one can select the desired crop. Almost all crops grown in Egypt are included. From the plant age, or planting date, the program selects crop coefficient (Kc) and root depth as a function of time. The program uses Penman-Montieth equation, and soon will be able to use more than ten different equations.The second screen is related to the location and includes the farm area and the nearest weather station to calculate the potential evapotranspiration (ETo) for that location. It also includes soil type which make the program select soil field capacity and permanent wilting point. The program then calculates the maximum amount of water that could be given to fill the soil down to a root depth. The program can estimate the frequency and amount of water, should be given to a certain crop at a certain location according to plant soil and crop age; i.e., how much and how often to irrigate. The last section is related to the irrigation system type, efficiency and discharge per unit length as well as distance between laterals. This section allows the program to estimate the duration of irrigation, i.e. how long to irrigate.

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Topic No. 2

Expert Systems and Modeling

Session 5.a

5.a.1
Expert System Technology Transfer to Agricultural Domain Experts

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The expert systems technology is identified as a useful tool for technology transfer. The use of expert systems technology by agricultural and veterinary domain experts has many benefits. In this paper, we present our experience in using expert system tools for the transfer of expert system technology to agricultural domain experts. Three expert systems tools are used. The first tool is based on Hierarchical Classification Generic Task and is called HGCT tool. The second tool is based on rule representation and is called MINIKROL. The third tool is based on case based reasoning and is called CBR tool. These tools are used in training courses for agriculture and veterinary domain experts. The use of these tools in training has proved to be applicable, reliable, and can be used easily by non-professional developers to develop their expert systems.

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5.a.2
Remote Sensing and Computer Supervised Digital Classification for Monitoring Desertification in Western Sudan

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The Sahel zone in El Fasher region of the Western Sudan is known as traditional home of nomadic animal husbandry system. Recently, the increase of population has led to abolition of the traditional nomadic system in favor of sedentary live. The new system practiced many activities as intensive traditional rainfed agriculture, overgrazing, felling of trees for many purposes and pressure on water resources. These activities accompanied by droughts of 1970-73 and 1983-84 have triggered desertification of El Fasher region. The major objective of this study is to demonstrate quick and efficient quantitative methodology to monitor desertification instead of the qualitative conventional method. The later method is based mainly on census, interviews and field observations. The method used for supervised digital classification of TM using computer compatible tapes (CCTs) assisted by visual interpretation of MSS and fieldwork. The outcome was a supervised digital soil classification map which monitor desertification. The results of the study showed that digital classification by computer with different bands (spectral resolution) combined together gave more information on the indicators of desertification. The higher spatial resolution of TM pixels gave a good separation of individual units of the surface objects.

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5.a.3

Utilization of Generic Agriculture Expertise Models for Technology Transfer

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Production management of agricultural products is one of the complex problems that involves many parameters and requires very complicated modeling steps. The complete set of crop management activities could be classified into evaluation, selection, diagnosis of possible plant problem, and agricultural practice activities such as irrigation, fertilization, pest control, and plant care. In this research, a topology of those agricultural activities are presented and associated with their corresponding problem solving methods. The problem-solving method for each activity is identified and described using common KADS notation. These models are utilized in developing many expert systems for different crops, such as cucumber, citrus, tomato, and lime. One of the questions that we try to answer in this paper is how to reduce time and efforts for developing similar systems for other crops. The key answer to this question is the concept of knowledge-sharing and reuse. In this paper, we stress problem-solving reuse across several tasks and crops.

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5.a.4

Growth Analysis of Cucumber Leaf and Fruit under Plastic Houses in Egypt

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The current study was carried out in order to study the leaf and fruit growth of cucumber, *Cucumis sativus* cv. Primo F1. Seedlings were transplanted into standard transplanting trays on Feb. 14, 1998 and March 1, 1999. Seedlings were transplanted into the soil on March 10, 1998 and March 19, 1999. Ten plants were randomly selected from each treatment to collect the fruit growth parameters. Fruit diameter and fruit lengths was measured as soon as they were measurable. Fruit volume is measured and calculated from fruit dimensions, and regression analysis was used to find out the best-fitted equation for predicting fruit growth rate in relation to minimum and maximum temperatures, as well as plant age and radiation. Richard's equation was compared with the best-fitted equation. The resulting equations are presented with the procedure for calculating the contained therein.

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5.a.5
The Evaluation and Impact of Expert Systems on Agriculture Sector in Egypt

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Although there are many developed expert systems in the world, little consideration has been given to the impacts resulting from their use. There is a difference between the developed expert systems (ES) in the laboratories for research and demonstration and the expert systems that can be applied in the fields. The applied expert systems must cover the end-users' requirements and meet some other evaluation criteria.In the Central Laboratory for Agricultural Expert Systems (CLAES), ESs are evaluated both in the laboratory and in the field. In the laboratory evaluation, there is an evaluation methodology to guarantee that the ES can be used in the field. The field evaluation is achieved by applying field experiments, which showed that fields managed by the ES are better than the control fields.

In this paper, the evaluation criteria that guarantee the success of ESs deployed in the fields are presented. These evaluation criteria have been applied on three ES applications, namely: CITEX for citrus cultivation, CUPTEX for cucumber cultivation under plastic tunnel, and NEPER for wheat cultivation.Expert systems potentially have several different types or categories of impact relative to the applied domain. The field experiments are used to evaluate the economical, social, and environmental impacts of the ES. The economical impact includes the cost, profit, and yield. The social impact includes the effect of the ES on improving the efficiency of the extension workers through improving their general decisions-making skills in their jobs. The environmental impact includes the effect of using the ES on water and soil conservation, and also on decreasing the amount of pesticides used in the fields.

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Topic No. 3

Soil Conservation and Degradation

Session 1.a

1.a.1
Reclamation of Sandy Soils in Arid Central China

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The arid Nigxia Plain along the Yellow River in the Ningxia Hui Autonomous Region has been irrigated for 2,200 years. Most of the soils are medium- to fine-textured, and there are large areas of sand dunes within and on the fringes of the irrigated part of the plain. Attempts to put the sandy soils into crop production using surface irrigation have failed in the past because of high soil permeability and susceptibility to wind erosion. Recently, management practices to increase water-use efficiency in the fields, reduce seepage from canals, and control wind erosion in the fields and along irrigation and drainage canals have been developed. The improved practices consist of making use of the silt in Yellow River water to reduce soil permeability, lining field laterals as well as the main canals, and adapting the highly effective checker-boarding system for stabilization of sand dunes to control wind erosion on field borders and drains. Subsoil barriers to enable rice to be grown on sands appear promising.

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1.a.2
Wind Erosion as Related to Some Soil Conservation Practices in Fuka, (Northern Coast Zone), Egypt

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The northwestern coast zone in Egypt is one of the regions subjected to wind erosion hazards in Egypt. It was selected to study the effect of soil properties, tillage system and land use on quantity and quality of soil losses by wind erosion. The wind speed and direction were recorded during the 2-year study period. The measured active speed between 5m/S to 14.3m/S represented about 28% of the time. Data showed that intensive tillage treatment (conducted by farmers with 10-year-old fig trees) produced the highest annual soil loss (10.6 t/ha/year) greater than that from under olive trees by 93%. While the parallel tillage treatment after harvest of field crops produced soil losses as low as 2.4 t/ha/year. Annual losses of organic matter, total N, P and K was higher under fig and olive trees than after harvesting field crops. This study shows the importance of the tillage system in controlling wind erosion.

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1.a.3
Irrigated Soils Degradation: Assessment and Monitoring

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The paper discusses the factors that result in soil degradation of the irrigated land in Russia, and assesses the level of degradation due to these factors. For that purpose several parameters were developed and used to monitor and estimate the ecological condition of the land in the different regions in Russia. The paper describes these parameters and the results obtained from applying them.

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1.a.4
Towards Sustainable Agriculture on Central and Marginal Slopes of Wadi El-Natrun Depression, Egypt

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The Wadi El-Natrun community is situated in a relatively fragile ecosystem, and is under environmental pressures that are already limiting or affecting its development. It is characterized by geologically complex soils formed of deposits belonging to the Quaternary and late Tertiary periods. The area is covered by Quaternary lake deposits and old alluvial deposits of sands and gravel.The total amount of precipitation in Wadi El-Natrun is very low and mostly occurs in winter. It is not sufficient for irrigating the lands. The ground water could be considered as the only possible main source of water for irrigation on its old gravelly plains and slopes. As a result of the intensive cultivation, a steady rise in the salinity of ground water has created serious problems.In central and marginal areas of Wadi El-Natrun that are not used for intensive agriculture, some farmers still use the land to grow watermelon. These areas are cultivated on a traditional basis, bringing the crop into contact with water. Such cultivation is known as non-irrigated cultivation. In order to cultivate the area, huge amounts of sand must be removed until the loamy sand to sandy loam layers wherein seeds are sown, are reached. The plant roots follow the thin fresh water layer, which rises up by capillarity. Six locations representing different geomorphological units identified by digital image processing of the Landsat of August 1997 have been studied and the mechanisms of plant's fresh water uptake have been described.

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1.a.5
Assessment and Evaluation of Land Resources in Darb Al-Arbein, Southwestern Desert of Egypt

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The Darb Al-Arbein area in the southwestern desert of Egypt represents one of the most promising areas for agriculture development in the desert areas in Egypt. A great attention has been paid recently to establish agricultural communities along the old commercial road of Darb Al-Arbein. The extension of agricultural projects are depending basically upon factors (i.e. socio-economic, climate condition, financial support, etec.). Remote sensing data have proven to be the most suitable tools for studying the natural resources and the environment of extremely arid desert areas. Therefore, two kinds of satellite images had been used to map the land resources and desertification features, such as wind blown sands and sand dune encroachment. Interpretation of Landsat Thematic Mapper data was used for regional investigation of about 33,000 km^2. However, Panchromatic SPOT images were performed to study the wind erosion hazard on the planned agriculture development projects.

The study reveals that Landsat images are very useful for mapping land resources and selecting sites for future development along the Darb Al-Arbein road. The high resolution Panchromatic SPOT data were found to be very suitable for producing a deltoid soil map of the selected areas. The rate of movement of *barchan* sand dunes in this region has been studied using the multitemporal analysis of remote sensing data, and found to be 50 meters per year. Recommendations for further investigation of land and water resources in some selected sites using high-resolution satellite data and land information system are outlined.

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Session 2.a

2.a.1
Interaction between Climatic and Agro-ecological Conditions and their Impacts on Degradation (Desertification)

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Desertification had attracted the attention of scientists concerned about the sustainability of the resources productivity in the arid and semi-arid ecosystems. Understanding of the combined processes leading to the degradation in these ecosystems, which had been called desertification, is very crucial since the nature of suggested action to combat desertification depends on the cause. An area of disagreement among scientists is related to the role of climate, as a natural factor, inducing desertification at a specific location. Many argue that since climate had not changed during the last 5000-10000 years, then degradation in such regions should be attributed primarily to human interference.

The objective of this study was to investigate the agro-ecological changes that could occur due to climatic changes or fluctuations, in an attempt to establish the impact of climatic changes and fluctuation of a specific climate on degradation of agro-

ecological properties, thus leading to desertification. This investigation was conducted in Jordan, has different ecosystems, but dominated by an arid climate. Long and short-term climatic changes had affected, to a great extent, its land resources. Research has indicated that climate within the different eco-systems had been more humid prior to the prevailing one. Information suggested that the latest climatic changes had occurred 5000-10000 years ago. Long-term climatic changes had resulted in the formation of soils highly vulnerable to degradation processes. The prevailing climate is characterized by a high-level of annual and seasonal variability. Climatic fluctuation, as indicated by the analysis of precipitation records, indicated a substantial reduction in the annual rainfall during the last 30-40 years. The reduction in precipitation had influenced the density of plant cover, ability of various plant species to withstand arid conditions, thus accelerated erosion by wind and water.

The examination of long-term changes, as extrapolated from different types of soils occurring in different ecosystems, suggested a regional pattern of gradual changes in climate characterized by cyclic rainfall. Furthermore, the analyses indicated that aridity is gradually spreading along the southeast-northwest direction. Risk of degradation varied from one system to another. The influence of climate and climatic fluctuation were leading factors contributing to desertification. Impact of human interference varied from one ecosystem to another, but was inferior to climate. Maximum impact of human interference occurred when equilibrium between the ecosystem components was weak.

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2.a.2
Land and Water Resources Evaluation in Jordan's 100-200 mm Annual Rainfall Zone

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Planning tools were developed to assist the choice of locations for improved water harvesting interventions in Jordan's 100-200 mm annual rainfall zone. The tool used for land-resources evaluation was the FAO (1976) Framework. Land-suitability analysis was based on the existing national soil map of Jordan which comprises maps at three scales, the most detailed being 1:10,000, with about 20 soil data points per km^2. The differences in precision of the analyses at the different scales were noted. Seven possible land utilization types were considered, ranging from small-scale interventions such as water harvesting with contour furrows or small basins to larger-scale interventions involving water spreading structures or supplementary irrigation based on farm reservoirs. Economic analysis of the interventions clearly favored the larger scale interventions, involving higher investment.

A tool was also developed for estimating the availability of water for water harvesting interventions on small catchments, generally between 1 to 15 km^2 in the 100-200 m area. Available data on soil texture and existing studies of the rainfall-runoff relations of small plots and catchments were used to estimate the hydrologic properties of the soil types and associations within an individual catchment. A hydrologic modeling system was used that combined a GIS-based data entry and output interface with the wellknown HEC 1 hydrologic model system. The model enabled water balances for ungauged catchments to be calculated, and the hydrologic impact of water-

harvesting interventions to be evaluated both within and downstream of small catchments.

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2.a.3
Aeolian Sedimentation in Irrigated Lands of the Arid and Hyperarid Zones in the Sudan

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Aeolian action is a major land degradation process spreading widely in the arid and hyperarid zones of the Sudan. The irrigated land along the River Nile, White Nile Schemes and northwestern Gezira Agricultural Scheme are seriously affected by sand encroachment. This paper describes causes and impacts of sand encroachment in the irrigated agricultural land on soils and irrigation system. Aerial photographs and Landsat imagery were used to explore the spread and magnitude of sand encroachment. The major causes for aeolian erosion are the bare sandy lands (as source) and the prevailing winds from the northeast during the winter season and from the southwest during the summer season. Field data coupled with physical and chemical data were used to assess the adverse effects of wind sand deposits on the agricultural land. The data show that there are adverse changes in the morphological and physical soil properties that affected the soil internal infiltration rate, water storage capacity and soil tilth. Soil fertility decreased, especially in nitrogen, phosphorus, organic carbon and soil pH. The wind-blown sand blocked the canalization system in many irrigated schemes and made it inaccessible for farming. The adverse effects of sand encroachment on the soil physical properties coupled with the degraded fertility are threatening the sustainability of irrigated agriculture.

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2.a.4
Soil and Water Conservation and Dryland Farming for Sustainable Agricultural Production in Iran

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The Islamic Republic of Iran with an area of 1,648,000 km^2 ranks as the sixteenth largest country in the world. Iran is a high plateau (90%) mountainous country with arid to semi arid climate. Out of a total area of 160 million hectares, 20.7% is desert, 54.9% natural pasture, 7.6% forest, and only 11.6 million hectares are annually under cultivation. Due to limited water resources 2/3 of cultivated area is rainfed. The major farming system in the dryland area is cereal-pastoralism. In view of the great importance of dryland areas in the economy of Iran, the research is geared to develop improved production technology (crop varieties and package of production practices), while conserving the resource base. New crop varieties with very high yield has been developed and released to the farmers for general cultivation. With the adoption of these varieties and package of production technology, it is expected that the yield of wheat and barley will increase to 1.5 t/ha from the present very low yields of less than 0t/ha.

This increased production will not only help to overcome the food shortage at the country, but will also provide additional feed to almost 11 million sheep and goats and reduce all pressure on over-grazed pastures/rangelands. This will help in sustainable production of agriculture by conserving the environment and checking the soil degradation.

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2.a.5
Data Integration for Assessing Agricultural Soil Degradation in South-Central Iran

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In the Marvdasht plain, as in other arid and semi–arid areas, the imbalance between precipitation and evaporation requires water supply through irrigation to secure agricultural production. The sustainability of the soil resources suffers mostly from mismanagement under intensive agriculture, which directly or indirectly affects management–dependent soil properties. Soil degradation is a widespread issue in the Marvdasht plain, but geographical distribution and the total area affected are not known. Chemical deterioration includes soil nutrient loss and salinization. Soil physical deterioration mainly occurs through compaction by agricultural machinery and transportation vehicles and through sealing and crusting of the topsoil, resulting partly from mismanagement and partly from natural processes. Waterlogging is also an important soil degradation factor, which has a close relationship with potential salinity hazards that may occur under mismanagement. This research investigates the changes in soil quality under the long-term effect of irrigated winter–wheat monoculture. Soil degradation types are investigated through the application of statistical quality control (SQC) charts and geostatistics to management–dependent soil properties. The research findings are integrated through spatial analysis, using GIS facilities to map the degree and extent of soil degradation at regional level, and the causative factors of soil degradation are summarized.

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2.a.6
The Use of GIS to Combine Analytical and Synthetic Approaches for Obtaining Efficient and Effective Soil Survey Interpretation

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In many environmental studies, Geographical Information Systems (GIS) are routinely applied. The reliability of the output of a GIS, such as maps, basically depends upon the quality of the data. In the practice of spatial sampling, the sampling scheme is a major factor influencing the efficiency and cost of the soil survey. In optimizing sampling schemes, the geostatistical theory plays an important role. The geostatistical analysis is a two-step procedure: (a) the calculation of the experimental semivariogram and fitting a model; and (b) interpolation through one of the most important geostatistical

interpolators which is the ordinary kriging algorithm by using the semivariogram parameters. Parameters of the fitted semivariogram models were calculated for the available data of effective depth of El-Hammam area to study the spatial variability of its soil properties, Variowin software and ILWIS software were used to fit the semivariograms, and the best models were selected according to the best-fit current.

The effective depths of 526 observations were interpolated by using ordinary kriging. Two types of data were used for interpolating the effective depths of the area to improve the quality of the maps. The first used the data observed from the field in grid system with spacing distance of 1000 meters and added some proposed observations at the edges of the area to reduce the error of missing information. The values of added observation were selected according to the nearest observation and in the same soil map unit. The second type used the information from the satellite image of the area to add some observations to the edges of the area. Correlation and regression analyses were performed using the "SPSS" software. Analysis of variance (ANOVA) was used as a different approach to analyze the relation between the effective depth data and the different soil map units. The result of the interpolated map was compared with the satellite image visually to see how much it is acceptable.

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2.a.7
Effect of Crop Rotation on Sustainability of Barley Production under Rainfed Conditions in the Northwest of Egypt

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Absence of a well-established crop rotation system, combined with poor soil nutrients content is one of major problems confronting barley production under rainfed conditions in the northwest coast (NWC) of Egypt. On-farm trials were conducted for four seasons (95/96, 96/97, 97/98 and 98/99) in two sites in Zone 2 of East and West Barrani, with a seasonal average rainfall slightly greater, and slightly less than 150 mm, respectively. The objective of the study was to investigate the effect of crop rotation on sustainability of barley production with keeping the natural resources and diversity of crop production throughout the optimum use of land and water resources, and determine the suitable and economical crop rotation. Rotations investigated were barley-fallow, barley-pulses, barley-wheat, barley-fertilized barley, and barley-native legume fodder compared to continuous cultivation of non-fertilized barley. The results showed that the *barley-fallow rotation* produced the highest barley grain yield and its attributes, whereas the *barley-wheat* and *barley-barley* rotations produced the lowest yield in the two sites for three years. *Barley-pulse* rotations (barley-pea and barley-lentil) performed better under the higher rainfall conditions, while *barley-vetch* showed higher performance than rotation with pulse crops under lower precipitation. The results and observations indicated that local vetch *(Vicia monantha)* is most adapted to the NWC environment, whereas other leguminous fodder (medic and Lathyrus) performed poorly and were dropped off the study in the second season. Recommendations obtained from this study were demonstrated in the last two years (97/98, 98/99) in several locations in cooperation with extension and farmers. Targeted Bedouin farmers (sheep owners) at the two sites (East and West Barrani) were particularly interested and impressed by the barley-vetch rotation, which has also indicated comparative economic advantages over other rotations.

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Session 6.a

6.a.1
The Role of the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) in Developing the Arid Areas of the Arab World

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The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) was established in 1971 as one of the specialized organizations of the League of Arab States. The decision to create ACSAD was based on the importance of the arid areas of the Arab world and the fact that the development of these areas faces similar physical, technical, economic and social constraints. ACSAD has been charged with duty related to the question of the agricultural development, i.e., the participation in finding scientific and practical solutions for the problems and difficulties which impede the development of the Arab arid areas, so as to reach to the optimum exploitation of the agricultural resources and change the arid and semi-arid areas and their economic and social frameworks from marginal areas for agricultural production and rural and nomadic life to integrated productive areas. ACSAD started, since its inception, in carrying out numerous and important activities and programs in the Arab countries and concentrated its attention on the scientific, technological and organizational aspects which contribute to the development of the Arab arid and semi-arid areas. ACSAD has played an important and vital role in solving many of problems facing these areas though research, study, application and training. It provided scientific and technical data, carried out extensive tests and disseminated the technical knowledge and expertise through the implementation of a great number of projects and programs. Being convinced of the need for formulating work strategies that take into consideration the new developments in the fields of science, technology and environment and also the economic, social and political developments, ACSAD prepared a new strategy for the period 1998-2008 which gives more attention to some important agricultural issues such as the conservation of the environment and biodiversity, desertification control, the integrated management of the water resources and the information systems. This work strategy aims to make ACSAD's activities and programs more dynamic and flexible vis-à-vis the new developments in the fields of technology and the agricultural policies, and it also aims to give ACSAD distinctive characteristics in certain fields, especially the Arab water security, provision of the reliable genetic resources, the conservation of the environment and the biodiversity of the exploitation of the non-traditional agricultural resources in addition to its other duties in the fields of the survey, evaluation and development of the agricultural natural resources in the Arab arid and semi-arid areas.

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6.a.2
AOAD Approach for Sustainable Dry Land Development in the Arab Region

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6.a.3
Proposed Strategy for the Development of Remote Desert Areas in Egypt

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The present and future development plans of Egypt call for the integrated development of vast desert regions, mostly in remote areas, to meet the increasing food demands and promote the migration of population to the newly developed areas. Through the last few decades, Egypt gained considerable experiences in the various fields of desert development. However, the greater majority of the newly developed desert areas were adjacent or connected to the old Nile Valley systems. The large areas earmarked for the present and future developments are remote desert areas, which require the adoption of a strategy that varies considerably from that of the development of areas adjacent to the Nile Valley.

The proposed strategy addresses, in an integrated way, the rationale of use of limited and mostly non-sustainable water resources, use of land resources of varied limitations, appropriate cropping patterns, use of inputs and processing of products, energy requirements and socio-economic and manpower developments. The strategy takes into consideration; (i) relevance of development patterns to the potentials and constraints of the available natural resources, (ii) main controlling factors relevant to technical, economic and social aspects, (iii) integration with possible non-agricultural activities and, (iv) flexibility to meet the ever-changing variables of world trade and economic conditions. It is of paramount significance for the planning and execution of these developmental activities to adhere and adopt the integrated measures to minimize the environmental impacts of factors of degradation, processing and recycling of wastes, and combating pollution of the available resources to achieve sustainable development and sound environmental conditions.

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6.a.4
Impact of Desert Fringes Reclamation of the Nile Valley on the Water and Soil Quality

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The interaction between human activities with water and soil quality has recently been studied in the sandy desert areas adjacent to the Nile floodplain. The area located west of Tahta, Upper Egypt, is subjected to intensive reclamation processes. The use of traditional irrigation techniques in the area affects the adjacent low cultivated land in the Nile Valley. In this work, water regime and the geochemistry of water and soil in the area have been investigated. Results revealed that land reclamation activity in the desert fringes lead to changes in the groundwater regime and some water and soil chemical properties. Water losses from the irrigation system are mainly due to the non-suitable irrigation methods and subsoil types. Also, high flow of groundwater as seepage toward the adjacent traditionally cultivated land is inevitable. Such waterlogging problems lead to soil salinization (with a dominance of chloride and sulfate salts) and have consequently degraded more than 1000 acres. The study strongly recommended future plans to avoid the waterlogging problems in the traditionally cultivated land. This could

be essentially by installation of an effective drainage system in the reclaimed area and traditional lands as well.

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6.a.5
Dry Atmospheric Fall-out as a Factor of Secondary Irrigated Lands Salinization

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Irrational human economic activity has resulted in increases of chemical pollutant emissions into the atmosphere. On the other hand, solid suspended practices of different chemical composition come into the atmosphere from natural sources: seas, oceans, lakes, deserts, and irrigated territories. Intensity of the process depends on many reasons: temperature, humidity, wind velocity and direction, and others. In the main, suspended particles are being removed out of the atmosphere with wet (precipitation) and dry fall out eolian transfer. Long-term research conducted in SANIGMI in the field of dry atmospheric fall out monitoring have revealed the definite role of dry atmospheric fallout in the processes of secondary salinization of arid and irrigated lands.

Taking the Pre-Aral region and the Bukhara province as an example emissions of dust-salt and sand-salt aerosol sources were defined, as well as gradation of relative salt content in aerosol and the change dynamic of the upper soil horizon. The impact of dry atmospheric fall-out on the processes of salinization of arid and irrigated lands was shown.

The role of upper deflation soil layer of the arid zone was a source of water soluble salts emission: it was also a natural salt-receiver due to dry deposition of aerosol out of the atmosphere. Analogous research conducted in the zone of intensive irrigation and anthropogenic impact of industrial discharges revealed the role of atmospheric fall-out as a factor of secondary salinization of the irrigated lands.

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6.a.6
Possibilities of Exploiting the Olive Waste Water "Margin" for the Stabilization of Earthen Dikes in the Arid Zones of Tunisia

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The dry farming activities in the arid regions of Tunisia are mainly supported by the various water-harvesting techniques (jessour, tabia,). However, the rainfall regime, which is characterized by its torrentially, frequently causes major damage to the earthen dikes. The olive represents the main cultivated tree. Thus, the 'margin", which is liquid by-product resulting from the olive oil extraction operations, is produced in huge quantities and therefore, represents a serious environmental problem. We have tried in this laboratory investigation to study the possibilities of recycling the "margin" to improve earthen dike stabilization. Obtained results showed that the "margin" allows to reach more quickly the optimum proctor with a better dry density. The improvement of the dry density depends on the initial water content of the soil. The permeability of the soil compacted with "margin" has significantly decreased (9 to 13 times). The internal friction angle remained unchanged, whereas the cohesion decreased.

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Topic No. 4

Water Management and Conservation

Session 7.a

7.a.1
Agricultural Development of Mega-Projects in Egypt

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Modern Agricultural development in Egypt started in as early as the first years of the 19th century. The cultivated area in the country at that time was about 2.5 million feddans (1 feddan=0.42 hectares) and the population was about 2.5 million i.e., the per capita share of agricultural land was about one feddan. Since then, population in Egypt has doubled every 50 years. Around 1850, the number of Egyptians became 5 m; in 1900 this number was 10 m.; in 1950 it doubled to 20 m; from 1950 to 2000 population tripled to a high figure of more than 60 m. This increase in population was not followed by a similar increase in cultivated land. The major event of constructing the High Aswan Dam in the 1960's enabled Egypt to reclaim an area of about 2.0 m. feddans, mainly in the northern belt of the Nile Delta and the eastern and western fringes of the Nile Valley and Delta. Inspite of this, the per capita share of agricultural land in Egypt has fallen sharply to one–eight of a feddan (or approximately 500 m^2/person). With this state of affairs Egypt has to continue with large size agricultural development projects in order to cope with the fast-growing population and the pressing need to produce their food and natural fiber. However, the major constraint for agricultural development in Egypt is not food, it is water. Egypt's share of the Nile water, which forms more than 95% of the country's budget is fixed according to international agreements at 55.5×10^9 m^3/year, and therefore, the country has to comprehensively apply the principle of "crop per drop" in order to be able to produce the maximum of agricultural commodities for the same amount of water. The purpose of this paper is to show the Egyptian philosophy of mega-projects for agricultural development taking the Toshka Project as a case study.

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7.a.2
Increasing Water Productivity to Cope with Water Scarcity in the Dry Areas

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Water scarcity, is a well-recognized problem in the dry areas, particularly in West Asia and North Africa (WANA). High rate of population growth and improved economies result in continuous diversion of agricultural water to higher priority sectors. If agricultural production and livelihoods are to be sustained in these areas, greater priority must be given to enhancing the efficiency of water procurement and utilization.Water-efficient techniques, such as supplemental irrigation in rainfed areas and water harvesting in the drier environments, demonstrated substantial increases in irrigation water and rainwater productivity. Revised irrigation scheduling to apply less water than full crop water requirements at the proper time has shown great improvement in water productivity. Farmer-managed demonstration plots in Syria have shown that applying 50% of full supplemental irrigation water reduced yield by only 10-15%. When the saved water is applied to new land, much higher farm production can be achieved.

Combining a water-efficient technique with improved water management options and appropriate inputs, varieties and cultural practices can substantially increase water productivity.

Producing more food with less water is attainable, but poses enormous challenges to transfer existing supplies, encourages more efficient use, and promotes natural resources conservation. On-farm water-use efficient techniques, if coupled with improved management options, cultural practices, genetic make-up, and proper socio-economic interventions would help in achieving this objective. Conventional approach to maximize yields, although appropriate in water-ample areas, may not be optimal when water, not land, is most limiting to production. Maximizing water-use efficiency, not yield, should be the objective of sound water management or improved farm production and sustainable development. Current guidelines on crop water requirements for maximizing yields need to be revised if water productivity is to be maximized instead.As water is more limiting than land in the water-scarce areas, maximizing water use efficiency, not yield, may be a more appropriate.

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7.a.3
The Groundwater and its Role in the Fragile Ecology in the South of Tarim Basin

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To meet the demand for water resources in pace with expansion of the oil exploitation in Tarim Basin, it is becoming increasingly important to study the characteristics of groundwater and its role in the fragile eco-environment in the south of Tarim Basin. The Quaternary aquifers with the Tertiary impermeable beds, both confined and unconfined, formed by loose diluvial and alluvial cobble gravel, gravel, sand gravel, fine sand and clay, are the main aquifers. The thickness of the aquifers is about 200-900 m, the depth of groundwater table varies from 50-100 m in piedmont slope plain to 1-3m in the fine soil plain, and the water salinity is 1-3g/L in the former, and 3-5g/L in the later.

The water quality in the ancient channels is better than that in other region. The majority of groundwater resources is seepage transformation of surface water, including runoff and irrigation water, which accounts for more than 95% of total groundwater recharge. Ground-water has been changing extensively as affected by climate change and human activity.

In the period of human history, climate still played a leading role in the evolution of groundwater. Sustained arid climate resulted in reduced runoff and change of river courses, which influenced recharge and distribution of ground-water. With the development of civilization of human society, the impacts of human activity to water system played a more and more significant role environmentally. Resulting from that, the ground-water reduced 26.2% in 46 years from 1950 to 1995 in the south of Tarim Basin. At the same time, ground-water table dropped 3-5 m widespread and spring water also was reduced to about 28.7%, although exploitation and utilization of groundwater is very limited, which is about 2.3% of groundwater resources. The regulating and controlling role of groundwater in an ecosystem is very outstanding, especially eco-environment in the south of Tarim Basin. The groundwater table suitable for desert plant growth is 3-4 m from surface, otherwise, if higher than that the salinization will rise, and lower than that plant degeneration and land desertification would be caused. From now on, the development and utilization of water based on their

potential and water-saving techniques not only promote the regional economy, but also protect groundwater and improve the environment.

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7.a.4
Managing the North African Aquifer System as a Shared Resource for Desert Development

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The North African countries are experiencing severe water shortages that increase with time. Surface water supplies are insufficient to meet the escalating water demands. Non-conventional water resources, such as seawater desalination, are technically difficult and economically expensive to develop. The need to provide for the exploding population in the region and their socioeconomic development has led to increasing dependence on groundwater resources of limited recharge. The huge and extensive North African aquifer system offers alternative water resources to alleviate present shortage in the foreseeable future. Large parts of this system, however, are shared by more than two countries. The sustainability of this precious resource depends on the peaceful cooperation among the countries involved. Several issues related to exploiting shared groundwater resources must be tackled in a mutual cooperative spirit. They include problems of common pool resources, hydrogeological uncertainties and a paradigm shift from the fragmentary conception of separately isolated aquifer subsystems to a holistic "mega watershed" approach covering the whole region. Certain strategic and managerial guidelines must be formulated. Alternative water-saving development models may be considered. Regional socioeconomic integration should be encouraged. Failure to achieve these objectives enhances completion and speeds up the exhaustion and deterioration of this vital resource. The ensuing economic problems can lead to socio-political strife and trigger conflicts that would potentially endanger the peace and stability in the whole region.

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7.a.5
Decline of Groundwater Quality in the Khanasser Valley (Syria) Due to Salt-Water Intrusion

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The Khanasser Valley in northern Syria is located at approximately 70 km southeast of the city of Aleppo and adjacent to the Jabul salt lake. The rapid development of tube-well irrigation in the area over the past 10 years has led to a substantial increase in groundwater withdrawal from the upper, unconfined aquifer. Recent observations indicate an increase in water salinity, which may lead to soil salinization and possible land degradation. A systematic survey of groundwater levels, water quality and water use was carried out to assess impact of increased water use on the quality of the groundwater. In total, 165 wells were surveyed and detailed water quality analyses were carried out for 37 wells. The study shows that the recent increase in irrigation activities over the past 10 years in the Valley has had a negative effect on the groundwater

quality. The gradient of electro-conductivity values of the groundwater in the Valley indicates that a large part of the aquifer has been affected by salt-water intrusion from the salt lake, due to intensive groundwater use for irrigation in spring and summer. The EC values ranged between 5 and 24 mS/cm and sodium absorption ratio values between 6.6 and 20 in almost half of the valley. According to internationally accepted standards, this indicates high to very high sodium and salinity hazard. Alternative options for groundwater management will have to be developed, which ensure more careful water use and which protect the soils in the Valley from salinization.

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Session 8.a

8.a.1
Wadi Hydrology Towards Sustainable Development of Dry Lands

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With increasing population and limited water resources in the Arab region, the water issue is gaining increasing importance every day. This paper addresses wadi hydrology, as an important, though often neglected, component of the water budget of the region. First, basic characteristics of arid and semi-arid zones are presented. Then, the water scarcity problem in the Arab region is addressed. Wadi water flows, though intermittent and rare, are introduced as a viable source of high quality fresh water. The major scientific, technological, and managerial constraints and deficiencies in the region, which handicap the full utilization of this resource, are addressed. UNESCO's IHP Program has been overviewed, and the most recent activities in the field of Wadi hydrology and plans of action to overcome these deficiencies are presented.

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8.a.2
Agricultural Water Management in the Arabian Peninsula

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Most of the Arabian Peninsula (AP) is characterized by high potential crop water use and low precipitation. Agriculture accounts for by far the largest share of water use in the AP, and in many places water is being used faster than it is being renewed. Much of the AP is rangeland, which has been degraded to various degrees by overgrazing. The large animal population is supported by irrigated or imported fodder, resulting in a large part of the water consumed by agriculture supporting irrigated forages, commonly alfalfa and Rhodes grass. The water use efficiencies of these irrigated forages may be lower than those of indigenous species. The ICARDA Arabian Peninsula Regional Program is coordinating studies conducted by the countries of the AP to determine the water use efficiencies of commonly grown forages and mixtures of these forages. These data will be compared to equivalent data from indigenous species whose seeds have been harvested on collection missions in the region. *In-situ* studies are also underway to determine water use of naturally occurring indigenous species. If the water use efficiency of indigenous forages is sufficiently high, particularly under low water conditions, it may be possible to begin substituting them for Rhodes grass and alfalfa.

There is also considerable scope for improving on-farm water management through training programs and the application of available technologies, such as irrigation scheduling and water measurement. Work is also being conducted on developing protected agriculture within the region to maximize water use efficiency and minimize potential contamination of soil and water by agricultural chemicals.

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8.a.3
Comprehensive Techniques of Developing Water-Saving and High Efficient Agriculture under Rainfall Harvesting in China

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Rainwater is a major water resource of agriculture production in the Loess Plateau. The erratic rainfall often causes frequent crop failures. However, the favorable conditions provide the probability in time and space to collect excess monsoon rainfall into soil or cistern for limited supplementary irrigation during dry spells. Therefore, many ways to concentrate runoff into soil have been found and used since ancient times, including (1) transforming topography for cutting runoff; (2) ploughing and raking soil to keep water; (3) increasing cover to reduce the loss of soil moisture and improve water use efficiency; (4) reasonable forming crop pattern and increasing input of fertilizer to improve water use efficiency; (5) internal seeding and rotation of crops to reduce runoff. In recent years, the newly developing rainfall harvesting system in China takes a new look for agriculture production in dry land. It uses rooftops, asphalt pavement, earthen road, natural soil surface and artificial catchment to harvest rainfall, and store it in the cellar for supplementary irrigation in the field or developing small-scale · ard economy. Moreover, combined with drip irrigation, harvested rainwater can be used in greenhouses to grow rare flowers or other cash crops. Small-scale (family unit) rainwater harvesting project has been spread in Loess Plateau. Limited by fragile eco-environment, properly designed rainwater harvesting system that is suitable to use in large scale has been in the experimental stage. Some key technical problems (such as catchment materials, water quality protection and high efficiency of water use) need to be solved.

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8.a.4
Ensuring Sustainable Development of Irrigated Agriculture in Uzbekistan Part of Golodnoya Steppe

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The old irrigated zone of the Golodnoya Steppe was subjected to leaching during the period from 1969 to 1988 which resulted in decreasing salt content in the soil from 6.7 gm/L to 2.8 gm/L. Cotton yield was increased during this period by about 14 C/ha. Due to aggravation of the drainage network lately, fertility of the soil decreas· J and its productivity declined sharply. Salinity of irrigation water increased from 0.75 gm/L to 1.7 gm/L. Shortage of water supply for irrigation, in addition to poor drainage system,

increased the problem of salinization. This article analyses the constraints facing the sustainable development of irrigated land in the Golodnoya Steppe area.

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8.a.5
Inter-temporal Wastewater Reuse in Irrigation and Revenue Maximization: The Case of Tyre Region, South Lebanon

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Land application, or the reuse of secondary treated wastewater in irrigation, is a potential cost-effective and environmentally sound solution for the wastewater disposal problems. It is a well established practice in many arid and semi-arid regions in the world. Several studies have addressed the direct and immediate use of the secondary treated effluent, while fewer have tackled the impact of the storage of excess unused effluent for later use. The focus of this paper is to investigate the economic feasibility of land application in presence of a storage facility with several capacities. To fulfill the above objective, a dynamic linear programming model was developed to determine the optimal cropping pattern that will consume all or most of the effluent throughout the optimization horizon, utilize all the effluent's nitrogen and brings in the highest revenues. A case study in the Tyre region, South Lebanon, was used for model application. Different reservoir capacity scenarios were developed and then compared to a no-storage scenario. The results indicate that the presence of a reservoir will enhance the efficiency of the wastewater usage and the flexibility of the associated cropping pattern. Furthermore, it will reduce the need for supplementary irrigation with fresh water and increase the revenues obtained.

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8.a.6
Runoff Modeling of Micro-Catchment Water Harvesting

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Water harvesting, the collection and storage of surface runoff from catchment areas, can greatly increase the water availability for agricultural production in the dry areas. The amount of runoff water that can be collected depends on the precipitation characteristics and the physical properties of the catchment area. To properly design water-harvesting systems, it is essential to estimate runoff. Therefore, mathematical models that are capable of predicting surface runoff from different catchments areas are extremely valuable tools for the efficient design of water-harvesting systems.To assess the effect of various treatments for improving runoff generation and to evaluate the use of different runoff estimation models, a total of 36 micro-catchments were installed at Tel Hadya in northwest Syria. The plots were laid out on a montmorrillonitic clay soil (Calcixerollic Xerochrept). The average rainfall is 350 mm. The plots vary in the following features: (i) soil profile, i.e., deep and shallow; (ii) slope, i.e., 5% and 10%, (iii) length, i.e., 4, 8, 12 m; (iv) surface treatment, i.e., natural, compacted (5 kg/cm^2), and dispersed by sodium chloride (1.25 kg NaCl/m^2). Rainfall and runoff data have been collected since the fall of 1994. As expected, runoff rates were higher at the shallow soil

than at the deep soil. Runoff efficiencies decreased with catchment length. The surface treatments, especially dispersion, increased runoff. However, the effect of treatment was more pronounced on the shallow soils than at the deep soils. The performance of the surface treatment over time is presented. The data from the micro-catchments were used to test a number of different rainfall-runoff models, i.e., a linear model, the curve-number method, and a physically-based infiltration model. The model parameter estimation techniques are described and the advantages and disadvantages of the different models for the design of water-harvesting systems are discussed.

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8.a.7
Sea Water Agriculture the Ultimate Conservation of Freshwater

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Just sixteen percent of the world's farmland is irrigated, yet it produces thirty six percent of the world's food. Since 1978, the amount of irrigated land per person has decreased by nearly ten percent. Planetary Design Corporation has spent nearly two decades developing sea water based agriculture, products and technologies that promote economic growth and significant environmental benefits from previously unusable land and untreated sea water. Hundreds of wild halophytes (salt tolerant plants) have been surveyed for economic potential and their ability to be grown commercially. Several have been selected for production. This paper will report the results from experimental farms located at a dozen sites in nine countries.

Proven products from halophyte farming include poly un-saturated vegetable oil, gluten-free flour, fresh vegetables, high protein animal feed and fiber board. Potential products are pharmaceutical and cosmetic compounds, a saponin source, and others. Sea water irrigation has potential ecological consequences. More than a decade of farming experience has shown that management techniques can prevent salt build up or waterlogging of the soil. The atmospheric carbon balance benefits when biomass is produced on desert sea coast soils where little had existed previously. Biodiversity is also increased on the site by wetlands created with halophytic species. The amount of fresh water saved by growing food, animal feed, and commercial commodities with sea water will be discussed. The science of seawater agriculture can help re-green and feed the world.

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Session 11.a

11.a.1
Agroforestry Systems: A Sequential Drainwater Reuse Strategy for Sustainable Irrigated Agriculture

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Continued agricultural production on 930,000 ha.of irrigated farmland on the west side of California's San Joaquin Valley is at risk from shallow, saline ground-water tables, the lack of a region-wide out-of-valley drainage system, and the potential concentrated

toxic impacts of trace elements in the drainage. Reuse of saline drainage and subsequent reduction of drainage volume in an agroforestry system is being investigated as a drainage management option. Subsurface drainage from croplands having an average concentration of 8,000 mg/l TDS, 10 mg/l B and 350 mg/l Se is reused to irrigate a eucalyptus plantation. Evapo-concentrated subsurface drainage from the eucalyptus plantation is reused again to irrigate euhalophytic herbaceous species, such as *Salicornia*. The resultant progressively concentrated unusable drainage, 15 to 20 percent of the original drainage volume, is disposed in a regulated solar evaporator where solid salts are harvested and stored. Although in the west side of California's San Joaquin Valley this approach is showing short-term promise, the long-term technical, environmental, and economic feasibility is still being addressed.

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11.a.2
Crop Response to Irrigation with Low Quality Water in Arid and Semi-Arid Zones and their Management Practices

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This paper presents crops response and yield to different salinity levels of irrigation water (low quality water) obtained through blending of irrigation water with drainage water and through use of saline ground-water at field conditions. Crop yields at ACSAD experimental farm located in Deir Ezor in northeast of Syria in agricultural experimental farms in Tunisia and Libya are presented. Yields functions and related to salinity of irrigation water (EC_{iw}) were obtained using non-linear programming. Threshold data obtained were comparable to EC values tabulated by FAO, but not comparable to EC_{iw}) also tabulated by FAO. Data of soil moisture extraction obtained by gravimetric soil moisture measurements versus soil depth and time throughout growth period, and using tensiometers at three depths 25-50-75m to schedule irrigation time with different quality of irrigation water, were used in order to develop soil moisture extraction patterns in the form: wx=wi (time)w2 (root zone depth)w3 (EC of irrigation water) <g1> where wx unit is mm/day/cm, while w1,w2, and w3 are statistical experimental functions obtained by non-linear programming software.

Validity of the model obtained was assessed by repeated integral of wx function over depth and time to give the water consumption throughout the irrigation period (Et) in mm in the form: Et={{wx*dz*dt for each salinity level and compared to actual water consumption data. Excellent matching was obtained.{g2}. Soil solution obtained by vacuum lysimeters inserted at different soil depths in the root zone was obtained at field capacity and analyzed for cations and anions. Data obtained were correlated to salinity of irrigation water at three levels of leaching fractions, i.e., 0, 15 and 30 % for cotton. Salt balance practices within the soil profile have been pinpointed to prevent soil degradation by salinity in order to have sustainable use of soils and the low quality water.

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11.a.3
Yearly Monitoring of Salinity and Some Related Parameters in Irrigation Canals and Drains of the Delta region, Egypt

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Samples were collected monthly from irrigation canals of Ismailia, Bahr Moeice, and the drains of Edko, Mohsama, and Hanout, beside samples from the Damietta and Rossetta branches of River Nile. Locations of water sampling were (a) at start of canal and (b) a point midway before the mixing site of drainwater with Nile water as well as (c) a point after the mixing site. Mixing of drain water with irrigation canal waters is practiced in many places of Egypt in order to utilize much of the water resources.

Ranges of EC of water were 0.35 to 0.40 dS/m increased by mixing to between 0.50 to 0.70 dS/m. For drainwater ranges were between 1.0 and 3.0 dS/m in most cases.

The Ca:Mg ratio of water in the two Nile branches ranged from 16 to 40. It increased to between 50 and 65 in irrigation canals; and from 60 to 70 in waters of drains. Determinations of SAR and Adj SAR, as well as SSP, were also performed. Sodium adsorption ratio (SAR) was very low and ranged between less than one to 3 in the fresh waters of the River Nile, whereas it ranged between 4 to 7 in the waters of the drains. Soluble sodium percent (SSP) in the two Nile branches ranged between 24 to 40, increasing further in the drainwaters from 50 to 60. Water of the drains may be used for irrigating crops with little risk of adverse effects from the salinity and sodicity viewpoints, provided that some precautions are taken.

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11.a.4
Small Water-Harvesting Reservoirs: Issues of Planning and Management in the Dry Areas

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Rainfall in the steppe (badia) areas of West Asia and North Africa (WANA) is low in amount, uneven in distribution and often falls with high intensity, causing substantial runoff. Most of this scarce resource is usually lost with little benefit. Implementing appropriate water-harvesting techniques improves rain-use efficiency and can reverse the process of desertification in this region. Small water harvesting reservoirs are indigenous systems, widely used in these drier environments for domestic, livestock and agricultural purposes. They can be more, economically, socially and environmentally effective than large reservoirs in the remote dry areas. It was found, however, that the planning and management of these reservoirs is generally poor, resulting in low efficiency of water collection and use.

Planning small but large number of reservoirs distributed over the catchment area as an alternative to the current practice of building large reservoirs has real advantages in water-saving, social equity and environmental impact. The common practice of keeping stored water in the reservoir during the winter season for agricultural use in the dry summer may not be the best strategy. To maximize the benefits, it is generally recommended that water be transferred from the reservoir and

stored in the soil as soon as possible after collection. Storing reservoir water in the soil profile for direct use by crops in the winter saves substantial evaporation losses that normally occur during the high evaporative demand period of the summer. In addition, emptying the reservoir early in the winter provides more capacity to store potential runoff events over the season. Higher reservoir water-use efficiency can be achieved by supplemental irrigation of winter crops over full irrigation of summer crops.

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11.a.5
Cropping-Pattern Options in the Newly Reclaimed Desert Land In Egypt: Impact on Water and Fertilizer Use

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Extending agriculture to desert lands is one of the major goals of the national agricultural strategy to increase agricultural production in Egypt. The newly reclaimed desert lands are characterized by a fragile ecosystem, scarcity of water supply, and low soil fertility. In addition, unstable cropping system practiced by the new settlers is another threat to sustainability. Therefore, proper management of these resources is crucial. As the cropping pattern is evolving, continuous changes in water and fertilizer use have occurred. Economic factors, water availability, and the experience of the settlers affect the choice of crops to be grown and their sequences. To address these problems a Resource Management Program was established as part of the NVRSRP/ICARDA. The program consist of 1) monitoring farmers' practices to understand how farmers activities affect the natural resource base, and 2) evaluate a new cropping pattern options. Results from four villages in El- Bustan showed that cultivated crops by farmers was increased from five crops in 1995/96 season to 14 crops in 1997/98 season. Moreover, about 60% of the farmers replaced wheat and berseem with vegetables, which resulted in using more water. As a result of this change, rate of application of N fertilizers increased by 65% compared to the rate used in the initial cropping season. Long-term trials were established where prevailing rotations used by farmers in the area are compared with proposed crop rotations that could offer a better and sustainable cropping pattern options for farmers in the New Land.

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11.a.6
Row Spacing and Partitioning of Evapotranspiration into Components under Winter Grown Wheat in Northern Syria

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A study was conducted on the long-term two course, wheat-lentil rotation trial established at ICARDA in northern Syria, on a swelling clay soil (Calcixerollic Xerochrept) during the crop growth season of 1996-97. At this site, an allied study

showed that saturated (+5mm tension) and unsaturated (-40mm tension) hydraulic conductivity were inordinately high (typically between 300-500mm and 30-60 mm hr^{-1}, respectively) relative to conductivity reported in the literature for similar type soils elsewhere. The purpose of the present study was to investigate for winter wheat sown with different row spacing how evapotranspiration partitions into evaporation and transpiration on highly conductive soils. The wheat crop was sown at 17 and 30 cm row spacing at a sowing rate of 120 kg ha^{-1}.

In this study, evapotranspiration from the crop was inferred from changes in soil moisture content over time, while evaporation and rainfall interception were measured daily using microlysimetry. Between sowing and Day 80 (tillering stage), evapotranspiration was mainly soil evaporation. However, after Day 80, transpiration became progressively more important. For both row spacing, cumulative evapotranspiration over the season was approximately 390 mm of soil water. In the narrow row spaced crop, transpiration and soil evaporation were approximately 200 mm and 190 mm of water respectively. Conversely, for the wide row spaced crop, 170 mm of water was transpired while 220 mm of water evaporated from the soil surface. As the amount of the incident radiation intercepted at the soil surface did not differ significantly between the two crops over the growing season, it seems likely then that the increase in evaporation was due to increased convection of water vapor to the atmosphere due to the enhanced movement of air between the rows in the wide spaced crop.

In addition, other studies conducted on a similar type of soil have measured loss of water vapor via soil evaporation and interception in similar seasons to be approximately 150 mm, with transpiration being approximately 250 mm, commonly achieving grain yields in excess of 5 t ha^{-1}compared with 1.5 t ha^{-1} (ranging from 0.5 to 2.6 t ha^{-1} in the last 10 years) in the study zone. This suggests that soils with high hydraulic conductivity may have heightened levels of soil evaporation and concomitantly lower levels of transpiration when compared with soils of low hydraulic conductivity. Hence, in order to improve transpiration efficiency in these soils, physical methods to impede soil evaporation such as reducing row spacing, or direct sowing into stubble may be necessary for yields on these soils to be increased.

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11.a.7
Sustaining Productivity of Mustard under Rainfed Conditions with Brackish Water in Rajasthan, India

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India is major rapeseed-mustard growing country in the world, contributing 31.2% area (6.6 mha) and 22.8% production (6.94 mt). Of four major rapeseed-mustard growing countries, viz., China, India, USA and Canada, India is the second to China in its area and third in production. In India, rapeseed-mustard is mostly grown in marginal soils where either irrigation facilities are not available or poor quality of irrigation water is poor. In most of the areas where mustard is grown, land is fallow in the Kharif season, thus production per unit areas is low as compared to China, Canada and USA. Therefore, study was undertaken during 1996-97 and 1997-98 to maximize the production per unit area under rainfed conditions of semi-arid tract of Rajasthan at Bharatpur, where irrigation with brackish water occurs.

Maximum production of 14 Q/ha mustard equivalent yield (1 quintal = 100 kg) was obtained from Bajra + Guar (fodder) mustard cropping system followed by guar (fodder) – mustard cropping system (11.73 Q/ha mustard equivalent yield). The lowest yield was recorded in the fallow--mustard cropping system (7.10 Q/ha) being commonly followed by farmers. Thus, keeping land fallow in the Kharif season is not economic and by taking legume mixed fodder, farmers may get nutritious fodder up to 500 Q/ha. This saves ploughing in the Kharif season for controlling weeds and, after harvesting of fodder crops (45 days after sowing), sufficient time is available to conserve the rainwater for mustard as a rainfed crop.

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Topic No. 5

Range Management, Forage and Livestock

Session 9.a

9.a.1
Can Cactus Help to Prevent and to Combat Desertification?

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The species of the *Opuntia spp.* subgenus have developed phenological, physiological and structural adaptations favorable to their development in arid environments, in which water is the main factor limiting the development of most plant species. Among these adaptations stand out its asynchronous reproduction, and its CAM metabolism, which combined with structural adaptations, such as succulence, allow this plant to continue the assimilation of carbon dioxide during long periods of drought and in this way reach acceptable productivity levels even in years of severe drought. Besides:

(i) Biomass generation per unit of water is on average about three times higher than for C4 plants and five times higher than for C3 plants.
(ii) Under optimal conditions the various types of plants can produce similar amounts of dry matter per surface area, but under arid and semi-arid conditions, CAM plants are superior to C3 and C4 plants.
(iii) *Opuntia spp.* can develop in severely degraded soils, which are inadequate for other crops. *Opuntia spp.* have a great capacity for adaptation and are ideal for responding to global environmental changes. Their root characteristics avoid wind and rain erosion, encouraging their growth in degraded areas.
(iv) *Opuntia spp.* have an asynchronous development of various plant organs, so that even under worst conditions some part of the plant is not affected.
(v) The establishment of sustainable systems of production based on *Opuntia spp.* may contribute to the food security of populations in agriculturally marginalized areas and to the improvement of the soil.
(vi) *Opuntia spp.* are some of the best plants for the reforestation of arid and semi-arid areas because can resist scarce and erratic rainfall and high temperatures.

Opuntia spp. present various alternatives to its exploitation:

(i) **Forage:** Since they grow in severely degraded land, their use is important because of their abundance (900,000 ha) in areas where few crops can grow. Also present high palatability and digestibility, and reduce the need for supplying water to animals; however, they must be combined with other foods to complete the daily diet, because they are poor in proteins, although rich in carbohydrates and calcium.
(ii) **Vegetable:** They are consumed fresh mainly in Mexico and by Mexicans living in the United States of America; however, Mexican exports to Europe and Asia are increasing, which shows an expanded demand in non-traditional markets, which should be adequately examined.
(iii) **Fruit:** A cultivation policy must be defined aiming at achieving high yields and high quality; to achieve both objectives a sustainable horticultural system is required. The potential market for this product is extensive but little exploited, so better marketing strategies and post-harvest technology are required. Due to their management requirements, Opuntia spp. require extensive labor, which is an important variable in developing countries.

(iv) **Cochineal:** Carminic acid is obtained, which is a natural red dye accepted by health authorities worldwide, with variable yields according to the production system used, i.e.plant density, irrigation, and fertilization systems. Cochineal constitutes a significant alternative because of its profitability and intensive use of labor, but the market for this product has big price fluctuations, which makes investment decisions difficult.

(v) **Industrialization:** It is feasible to industrialize cladodes, fruit, and nopalitos. This potential market deals mainly with concentrated foods, juices, liquors, semi-processed and processed vegetables, food supplements and the cosmetic industry; it is feasible, but it requires work and investment to develop the market.

(vi) **Medicinal Applications:** There is some experimental research with promising results on the use of nopalito for *gastritis*; for *diabetes* due to the reduction of glucose in blood and insulin; for *hypercholesterolemia* by reducing total cholesterol, LDL cholesterol and triglycerides serum levels; and for *obesity*.

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9.a.2
Feed Blocks Supplementation as a Hedging Strategy under Drought Condition: Mashreq/Maghreb Project Experience

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In West Asia and North Africa region, the feeding strategies used for sheep during drought periods are to maximize survival rates and minimize a reduction of reproductive performance. There is considerable amount of agro-industrial by-products available in the region. These by-products are, however, not efficiently used in animal feeding. Opportunity in WANA region exists to fill part of the gap between the supply and demand for feed resources through efficient utilization of these by-products. Experience of the Mashreq/Maghreb Project has shown that feed-blocks manufactured from urea and agro-industrial by-products can be used as a supplement for improving the productivity of ruminants which are depend on low quality roughage as their main diet. High-energy feed blocks can be used as a strategic supplement during drought periods with the aim of compensating the shortage of cereal grain and minimize the use of roughage.

The results of on-farm experiments have shown that using feed-blocks enriched with undegradable dietary protein and vitamin AD3E as supplementary feed during sheep mating season, which coincides with cereal stubble, — resulted in considerable improvement in weight gain (52-360%) — conception rate (11-44%), lambing percentage (25-33%) and twinning percentage (15-18%).

Using feed-blocks during hand-feeding period as protein supplement has resulted in a significant reduction of barley grain (40%), whereas using high-energy feed-blocks resulted a significant replacement of costly barley grain (50-100%).

Many national programs have developed, within the framework of the Mashreq/ Maghreb Project various formulas of feed-blocks by using locally available agro-industrial by-products. In some countries (Iraq and Jordan), the feed-block technology was successfully disseminated and adopted by sheep owners and manufacturers (NGOs, private sector) through an efficient methodology involving researchers, extension service, policy makers and end-users. Socio-economic and impact studies conducted in

both countries indicate a high rate of acceptance of this technology, while the adoption rate by sheep owners ranged between 10% in Jordan to 28.3% in Iraq.

Production systems, flock size and the availability of extension services are main factors affecting the adoption process and, in addition to that, the fluctuation of prices of concentrates, especially in Jordan. The benefits of using feed blocks are tremendous for sheep owners, as it reduced consumption of concentrate by 17%. The feed-blocks were widely used by sheep owners during the period of late stubble grazing and hand feeding. Thus, feed-blocks contribute directly to improve feeding efficiency and effectively fill shortage of feed during different seasons.

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9.a.3
Intensification of Private Rangeland in the Northwest Coast of Egypt

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The farming system and traditions of the northwest coast of Egypt area are undergoing rapid change due to coastal development for tourism. Most of the land mass is a plateau 100-200 m above sea level adjoining a narrow coastal strip, with winter rainfall averaging approximately 140 mm at the coast and falling to < 80 mm per annum 60 km inland. Although the mean annual rainfall is low, it is sometimes of high intensity and the rocky surface of the plateau generates important quantities of rainfall runoff and, over the course of millions of years, a network of deeply incised wadis were created. The deep but gullied soils found in the wadis represent about 6% of the total arable surface area of the region and they are the focus of land reclamation techniques to intensify agricultural production using runoff farming and tree crops.

Two major development projects in the past decade (GTZ Qasr Rural Development Program (QRDP) and the Government of Egypt/World Bank Matrouh Natural Resource Management Project (MRMP)) have reduced poverty and generated income in the Bedouin community by shifting the farming system from small ruminant livestock and subsistence winter crop production to a more intensified mixed farming centered on horticultural crops, primarily figs and olives. A small and more recent project, taking place from 1996-1999, showed how a well-developed watershed (Wadi Ramla) could be further developed by exploiting unused terraces in the watershed to transplant properly grown seedlings of arid-land adapted fodder shrubs.

The project (1) used GIS as a tool for identification of the locations that are suitable for planting, having more soil and accessibility to moisture than on the plateau, but not competing with more economic crop production on the reclaimed areas of the wadi, and (2) focused on privately owned land to control animal access using traditional methods and property rights to avoid the need for fencing. In this pilot scheme during 1998/99, approximately 50,000 plants were transplanted on a total of 35 ha in ten selected locations of Wadi Ramla using several species (*Periploca angustifolia, Atriplex*

nummularia, Acacia cyanophylla, Atriplex canescens linearis, Cassia sturtii, Colutea istria, and cactus. The plants will be ready for use in two more years.

This method offers greater prospects for successful rangeland intensification than under open access conditions on the plateau because the investment focuses on privately owned land on more numerous sites with many farmers. A goal for the future will be to promote the use of direct seeding that builds upon this methodology and reduces the costs associated with the nursery production of seedlings and the transplantation program.

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9.a.4
Underground Vetch (*Vicia sativa spp. amphicarpa*): A Potential Pasture and Forage Legume for Dry Areas

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Subterranean vetch (*Vicia sativa* spp. *amphicarpa* [Dorth.] Aschers & Graebn.) is native to disturbed grasslands of the Mediterranean basin where heavy grazing, seasonal drought and erosion act as strong selection forces. It produces two pod types, above-ground and 5 cm below the soil surface. Unlike subterranean clover (*Trifolium subterranean* L.), which buries its seeds after flowering above-ground, subterranean vetch flowers and forms pods beneath the soil surface on underground stems. The aerial pods are produced after vegetative development ceases, while the underground pods are produced in ontogeny. The ability of this unusual vetch to survive in marginal lands with low rainfall (about 250 mm per year) and to produce nutritious herbage and pods are important characteristics which help address rehabilitation of degraded rangelands and increase feed production for small ruminants.

Research at the International Center for Agricultural Research in the Dry Areas (ICARDA) has assessed the productivity of herbage and seed of underground vetch, its ability to grow in rotation with barley in the marginal low-rainfall areas, and its capacity to regenerate after heavy grazing. Drier conditions in 1989 favored earlier underground flowering; the number of underground pods was higher than that of aerial pods. Grain yield of barley (var. Atlas) was around 2.0 t ha^{-1} after underground vetch and only 1.2 t ha^{-1} after barley. Grazing underground vetch had no effect on the productivity of the succeeding barley crop. The aerial and underground pods serve two distinct functions, aerial pods increase the dissemination within suitable habitats while underground pods increase the probability of plant survival under adverse conditions such as drought and heavy grazing. Potential use of underground vetch serves two purposes, namely the rehabilitation of marginal lands and production in rotation with barley.

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9.a.5
Kochia: A Real Option as a Fodder Crop

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Kochia scoparia L. Schrad belongs to the family *Chenopodiaceae*. It was established in America in the early 1990s and it has been growing in Mexico for the last 25-30 years.

Kochia grows well on soils with salinity problems, so it represents a good option as a fodder crop. This paper deals with the evaluation of Kochia under different climates and soils in Mexico. Kochia has a short vegetative cycle, 70 days to the time for cutting (at beginning of flowering stage); it has low water requirement (30-50 cm); and high yields (50-80 ton/ha) of green matter. It has high protein content (18-26%), it has good palatability. It has a ratio cost/benefit of 1:5 to 1:7. Results indicated that Kochia is a good option for soils with salinity problems; due to its low water requirement, it can be helpful in reducing aquifer over-exploitation; due to its high seed production, care should be taken in its control. It is necessary to reinforce research on animals' behavior with different concentrations of Kochia in the ration and to establish an interdisciplinary team of researchers, working together with producers and cattle breeders, in order to utilize Kochia safely and efficiently. With respect to the scarcity of forage crops, especially during the dry season, Kochia represents a good option as supplementary forage because it grows quite consistently under adverse ecological conditions. Many countries around the world are struck by devastating droughts, the livestock business is seriously affected and, most of the time, cattlemen do not find adequate alternative food supplies, especially at low costs of production. Kochia is a good option to prevent and combat desertification, because the main priorities for rural development are water and forage availability.

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Session 1.b

1.b.1
Natural Pastures Status and Methods of Increasing Productivity in Kyrghyzstan

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Kyrghyzstan is a mountainous country. The area of natural pastures is 8.9 million hectares and it occupies 46% of the territory of the country. Nowadays, more than 20% of the territory has strong degradation and erosion of soil cover, 35% more have medium level of degradation. Non-erodable areas occupy the small part of the territory. Almost throughout the whole pasture area, evaporation exceeds soil moisture and the average coefficient of moisture varies from 0 to 0.6, and in the foothills it does not exceed 0.3, i.e., evaporation exceeds available moisture by three times or more, which resulted in pasture devastation. The degradation process has been speeded by up the non-rational activities of land-users.

Presently, in connection with the reform taking place in the country, small farms with 50-100 heads of sheep cannot move to far away pastures, which are 150-300 km far from their area. That is why about 3-4 m. head of sheep and about 0.9 m. head of cattle and horses are kept all the year around in the foothills surrounding pastures on an area of 2.7 mi.ha. Hence, the carrying capacity reached 3-4 times more than it should be. Due to that, pasture degradation occurs everywhere. The palatable cereals and grass in the pasture have been reduced by two-threefold, and yield does not exceed 2-3.0 centner/ha per unit. The pastures are dominated by typical weeds as *Circium* and *Carduus*.

Due to the insufficient utilization of medium high mountain, pasture grass situated 1500-2800 m above sea level, the quantity of non-palatable and toxic high stem grass is increasing. They are: *Stipa capillata, Runex acetosa*, various burs, *Artemisia estragonum, Akonitums* and others. The main methods for stopping degradation of foothills pastures are: first, rational utilization in the system of pasture rotation;

secondly, creation of sown pastures and custing fields on the territories with inevitably degraded arable land (about 170 x 10 ha). The rational utilization of pastures with the introduction of pasture rotation involved:

a) livestock pasture with load not more than 70-80% of grass yield;
b) keeping up to 20 to 25% of the pasture at rest;
c) get rid of the weeds in the rested pasture by selective herbicides or physical methods.

As the practice of introducing pasture rotation and destroying weeds, the yield of pastures can be increased by 1.4-1.6 times. Sowing pastures with top-yielding, arid-resistant, perennial fodder plants such as *Kochia prostrata, Agropyron desertorum, Elymus junceus, Medicago sativa* and others, is the most efficient method to prevent land desertification and to stop grass degradation in desert, semi-desert and dry steppe zones of foothills surrounding pastures. The yield of such pastures is 3-8 times more than the yield of natural arable land, and it reaches 5-16 centner/ha per unit depending on the zone. In steppe zone with more than 350 mm of precipitation, good results are reached by creation of sowing hay fields using a combination of *Onobrychis vicifolia, Medicago sativa* and *Agropyron cristatum* instead of single species of *Medicago sativa* and *Onobrydhis vicifolia*. By this, yield of sown hay-fields increases by 15-25% and the hay quality improves, because carbohydrate protein proportion reached 0.8-0.9. All these activities can be efficient, provided the surrounding pastures become farmers' property or are for a long-term rent (50 years and more).

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1.b.2
Searching for Common Ground: Bridging the Gap between Conservation Agendas and Pastoral Livelihoods in the Arid Wadi Araba of Southern Jordan

Alan Rowe
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This paper raises a range of key issues relevant to the sustainable development of dry lands, notably, landscape and resource conservation, the selection of appropriate technologies for application to a specific development problem, working with an indigenous pastoral community, and the technical aspects of livestock fattening in an arid environment. The discussion focuses upon the development experience and early results of a project in southern Jordan seeking to harmonize the disparate interests of a conservation organization and a local pastoral community to the mutual benefit of both groups. The paper argues the general applicability of off-range intensive management of livestock as a method for both enhancing the viability of traditional pastoral communities and for optimal economic productivity in areas with limited resources and fragile natural environments.

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1.b.3
Impact of Man and Climate in the Sahel Abda-Doukkala, Morocco

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The Sahel Abda-Doukkala, is an Atlantic coastal band, semi-arid, to the west-center of Morocco. This zone is subjected for a long time to continuous pressure of man and cattle. The natural vegetation is currently reduced to the herbaceous state of dominated by annual species. The objective of this work is to show the dynamics of environments following the action of the man and its cattle amplified by unfavorable climatical conditions, as well as means used for the safeguard of these environments and the struggle against the desertification.

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1.b.4
Natural Restoration Potential of Overgrazed Slopes in Dryland Northwestern Syria

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Plant diversity, ground cover and total biomass production are strong indicators of the degree of degradation of natural grazing land. To gauge the potential for natural restoration of the lands, it is necessary to investigate plant diversity and degree of ground cover under protected and unprotected conditions. This will help to assess the potential regenerative capacity of the land. If, on protected sites, plant cover and plant diversity can recover quickly, then the effects of degradation (e.g., low productivity) can be reversed easily. Results are presented from *in situ* trials in a typical degraded dryland valley in the transitional zone between agriculture and rangeland with an average rainfall of about 200 mm. At six sites, protected (i.e., fenced) and open (i.e., grazed) plots were monitored. At the end of the dry season, plant cover on the grazed plots decreased to 5%, while on the protected plots, it had stabilized at around 20%. For the same period, observations also revealed that the total above-ground biomass production on protected sites was four to ten times higher than on grazed sites. Seventy-one plant species were identified in the monitoring areas; 75% of all the species were found on the protected plots, while only 32% of the species were found on the grazed plots. This high degree of diversity on the protected plots indicates that degraded grazing land in the area can be brought back to the potential productivity quickly. After a longer time, the protected plots will show the site-specific plant diversity under undisturbed conditions. This will then be the maximum possible protective plant cover, which can re-establish itself in the area without costly rehabilitation measures. Protected plots may also serve as plant-diversity pools for *in situ* conservation and seed multiplication.

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Session 7.b

7.b.1
Improvement of Rangelands in Al-Shagaya Area of Kuwait

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Rangelands, being an integral part of Kuwait's heritage, provide forage, green cover, meat, fiber, wildlife habitat, water, recreation, and when properly managed, can reduce soil erosion, halt sand encroachment and hence combat desertification. The majority of Kuwait's land is categorized under rangelands which are estimated to be 75%, compared to agriculture (3%), and oilfields (7%). The rangelands in Kuwait are deteriorating due to combined factors such as social pressure by overgrazing, uprooting of shrubby plants, off-road use by vehicles, increasing demand for recreation and natural processes such as drought. Additionally, the Gulf War in 1991, a man-made destruction of the environment, added more constraints on the desert development. This emphasized focusing on rangeland improvement and rehabilitation in Kuwait. The objectives were to develop methods which are both effective and can be used on broad scale.

To develop suitable method, a rangeland rehabilitation experiments is being started on a 6ha site at Al-Shegaya, representing 30% of Kuwait. The soil type is Typic Petrogypsid, high gypsum content (30-50% below 30 cm) and coarse fragments (approximately 15% or more), with a hardpan mainly at 30-60 cm. Multi-species seed mix of grasses, forbes and shrubs (23 species) were used for seeding. The seeds were sown as pelleted (with clay using the lignin-based glue) to attract moisture and to avoid threat from insects and birds, and unpelleted in ripped, pitted and undistributed soil treatment. Lignin-based glue was used to stick the seeds to soil surface and to minimize seed from blowing. Supplementary fertilizer (N, P) and irrigation was used at minimum rate. Germination tests were also conducted in petri-dishes and in soil; this helps to assess the viability and reference for identification in the field. The vegetation assessment is made by using quadrates. The experiment has shown promising results, which will be presented in this conference.

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7.b.2
Desert Forages of the Arabian Peninsula: A Solution to Sustainable Rangeland Production in the 21st Century?

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The native plant biodiversity of the Arabian Peninsula, which comprises over 3500 species, is being rapidly depleted. The primary cause is overgrazing, particularly by the large population of small ruminants, (24 million, and continually increasing). Some of the National Agricultural Research Systems of the Arabian Peninsula, working with the

International Center for Agricultural Research in the Dry Areas (ICARDA), have taken steps to address the resulting degradation.

The paper sets out to describe a step-by-step process that was started in 1997 with interviews with local Bedouin farmers in the United Arab Emirates; through a series of training programs held in the region, collection missions in the UAE, the Sultanate of Oman and the Republic of Yemen; to the evaluation and seed multiplication of some of the preferred forage species.

Herbarium specimens were collected, labeled and preserved and a database has been set up. A gene bank was established in the Republic of Yemen and others are being planned for the other countries that do not have them. A small working gene bank was set up in the UAE. Initial data shows that not only do the desert forages use less water than the introduced forages, but also their nutritive value is as good. Small enclosures have also been selected, in some of the countries, as sites for research on restoration and rehabilitation techniques. This research will not only benefit the Arabian Peninsula countries, but also all countries that are likely to face the increasing impacts of global warming, salinity and drought in the 21st century.

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7.b.3
Social Effects of Experience on Finding Food and Social Transmission of Information in Cattle

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Experienced members of a herd of cattle, referred to as social models in this paper, may play an important part in the searching pattern of naive animals. Naive animals may distribute themselves more evenly because their expectations of preferred areas are not as developed as those of experienced ones. We tested three treatments to investigate if social models tend to transmit information about places of grazing to naive ones, and if food distribution tends to be more uniform when animals have less experience with the area.

Three 55 by 55-meter paddocks (open to each other) were used to conduct this experiment. Each paddock contained an 8 row by 8 column-grid of plastic containers (total number of containers available was 192). The first treatment was the clumped distribution treatment (CDT). Food containers were placed as sets of four. The second treatment was the scattered distribution treatment (SDT). Food containers were placed evenly covering the whole area. In these two treatments, steers were allowed to find 32 containers with feed in the presence of a social model. In the control treatment (CT), steers were allowed to find 32 containers containing feed with no social model present.

Starting on Day 4 of the experiment, CDT had a higher FLNL (ratio of found locations by new location) than CT. This suggested that naive animals tend to be more efficient in locating preferred food locations in the presence of an experienced model. CDT had higher FLNL than SDT on Days 3, 6, and 7 of the experiment. This suggested that the initial distribution of food affected the searching efficiency of naive animals.

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7.b.4
Evaluation of Vetch Establishment under Supplementary Irrigation

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A field experiment was conducted during the 1997/1998 growing season at the University of Jordan Research Station near Al-Muwaqar village, to evaluate the performance of vetch crop grown alone or mixed with barley under supplementary irrigation. Al-Muwaqar location is characterized by low and erratic rainfall and a surface crust soil.

The treatments were randomly distributed in a split-plot design with four replications as follows:

a) Diammonium sulfate (100 kg/ha), and/or sewage sludge (30 t/ha)were placed in the main plot as follows: diammonium sulfate added alone, sewage sludge (SS) alone, DAP + SS together, control with nothing was added.

b) In the subplots, barely: vetch seeds were mixed in the following ratios:00% barley: 0% vetch, 75% barley:25% vetch, 50% barley: 50% vetch, 25% barley: 75% vetch, 0% barley : 100% vetch. Measurements were taken for fresh and dry weight(at heading), grain and straw yield at maturity.

The highest grain yield (3.9 t/ha) was obtained from the application of sewage sludge with a seeding ratio of 25 % barley: 75% vetch. While there were no significant interaction between the application of DAP and/or SS on straw yield, it was clear that the presence of barley in the mixture cause significant increase in straw yield, particularly when compared to pure vetch. The presence of barley in the mixture improves the herbage production. For example, at a seeding ratio of 75% barley: 25% vetch, the herbage production was about 10 t/ha compared to about 8 t/ha produced at a seeding ratio of 25% barley:75% vetch. It can be concluded that vetch can be grown in low rainfall areas, but with supplementary irrigation. However, mixing vetch with barley can improve the production of herbage, grain, and straw.

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7.b.5
Common Vetch to Reverse Long-Term Land Degradation and Alleviate the Feed Deficit in West Asia

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In West Asia, erosion-promoting crop rotations, due to demographic and economic pressures are having detrimental effects on the environment and have generated serious problems associated with declining soil fertility and inadequate feed supply for livestock. In order to reverse this situation, the International Center for Agricultural Research in the Dry Areas (ICARDA) started to develop the cereal/vetch (*Vicia sativa*) rotation technology for resource-poor farmers in a fragile and harsh production environment in Syria. Starting 1983/84, a series of on-station trials were established at ICARDA's research farm at Tel Hadya, about 35 km southwest of Aleppo. On-farm experimentation was conducted over a period of 15 years at El Bab, a town in Aleppo Province in northwest Syria. A natural resource management approach that combines

farmer knowledge and participation with current scientific knowledge was adopted. Both on-station and on-farm research has demonstrated that vetch is well adapted to the farming systems of northwest Syria. On-station, barley yields were lowest after continuous barley (1.39 t/ha), intermediate after lentil (2.11 t/ha), and similar with fallow (2.51 t), medic (2.63 t), and vetch (2.69 t). Organic matter and total mineral nitrogen were highest with vetch and medic, and lowest with continuous cereal. The wheat/fallow rotation, in general, show a lower efficiency than the barley/vetch rotation. On-farm, total crude protein output was twice as high from rotations that includes vetch; and barley/vetch rotation yielded most metabolizable energy. Realising the benefit of this multi-functional technology, farmers started to adopt the cereal/vetch rotation. The technology trials started in 1986 with a core group of eight farmers. The number of farmers growing vetch at El Bab increased in 1998 to 200 farmers in 20 villages, with an area of about 500 hectares. Efforts are ongoing for the scaling up of successful local experience with vetch, a crop that clearly adds to the productive potential of the soil while enhancing rather than depleting soil quality.

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Topic No. 6

Combating Desertification

Session 3.a

3.a.1
Networking of Institutions to Support Efforts in Combating Desertification

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Desertification is a major problem, having serious impact on the development of the countries of West Asia and North Africa, where the process is expanding and the ever-increasing populations are affected. Implications of desertification go far beyond the desertified areas. The relevance of desertification to food security, rural-to-urban exodus, and poverty of rural population signify the seriousness of the problem. Conventions, forums and consultation meetings were held in the last few years, which proposed guidelines, provisions and recommendations to combat desertification in the region. The implementation of the conventions related to combating of desertification requires the concerted and coordinated efforts of the national institutions regional and international organizations. The present paper integrates the potential activities, fields of cooperation, financial resources and mechanisms of networking among concerned institutions active in the region. The paper concludes with the prospects of future developments.

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3.a.2
Study on Sandstorms in Xinjiang, China

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Xinjiang, situated in northwest China, is characterized by windy and dry climate, and has the largest area of desert in China, which provides dynamic conditions and material sources for sandstorms. According to the meteorological data, Xinjiang is the region where sandstorms happen frequently. There are about five to eight sandstorm days in north Xinjiang and over 20 in southern Xinjiang every year. In the center of Gurbantonggou Desert, the largest fixed and semi-fixed desert in China, the sandstorm days reach 20, whereas it reaches 70 days in the Taklamakan Desert. In Xinjiang, 70% of the sandstorms appear in April, May and June. Sandstorms are considered as a serious problem for humans, causing injury and death to local people and heavy economical losses. It also causes a significant agriculture losses when it occurs during the sowing and growing seasons. This paper discusses the effect of a sandstorm, which occurred in April 1998 as a case study and the counter measures taken to reduce its effects.

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3.a.3
Combating Desertification and Utilizing Dry Lands through Water Harvesting in the Middle East and North Africa (MENA) Region: Technical and Economic Potentials and Constraints and Policy Implications

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The overall goal of the existing research paper is to investigate the experience and policy alternatives for carrying out development of desert environments using efficient water harvesting techniques. The paper addresses four questions: (1) What is the desertification? How to monitor the productivity impact of desertification processes? And how to monitor and interpret satellite data on vegetation cover of land surface? (2) What is the magnitude of desertification problem in the MENA region, both current and in the past. What is the current status of water-harvesting techniques used to control desertification in the region? (3) What are the major demographic, technical, social, and economic driving forces behind the observed problem and trends? (with special reference to Egypt). (4) What is being done to address desertification problems, both governmental and non-governmental efforts? The paper shows results of environmental data collected using satellite remote sensing system of last 17 years for the whole MENA region and for each country within the region. The NOAA satellite images of the MENA region showed no alarming damage to vegetation. We estimated that the vegetational boundary had moved at the cost of the desert margin in most of the MENA countries.

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3.a.4
Assessment and Monitoring of Desertification in North of Jordan

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The use of satellite remote sensing to provide environmental information on the earth's surface, and the geographic information systems (GIS) to manipulate and analyze the information provided by different sources, are becoming important tools for the understanding of desert conditions, desertification monitoring and assessment and natural resources assessment. This study applied remote sensing techniques to extract and evaluate the natural resources parameters related to land degradation and desertification such as water, vegetation, geomorphology, drainage system, soil etc. Also, the study used multi-temporal analysis of Landsat TM data to analyze the status of vegetation, as well as the increasing of irrigated area during the period of 1983-1994. The results of analysis show clearly the decreasing of vegetation cover. The phenomena of disappearance of palatable plants was seen and approved clearly during the field survey. We note also the presence of unpalatable species, which replaced the palatable ones. Then, GIS was used to analyze and combine these parameters, which resulted in form of thematic map layers including land use, geomorphology, drainage system, soil moisture, soil susceptibility to water and wind erosion, vegetation degradation and salinization map based on assessment of irrigated areas. A final stage of this research was the creation of desertification map describing the different types of land degradation occurring in the studied area.

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3.a.5
Water Management Challenges in Arid Lands: An Environmental Concern in Combating Desertification

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The global increase in desertified and degraded lands can often be linked to anthropogenic activities. Several types of activities including inappropriate land use, over-grazing, incorrect farming practices, overuse of limited water resources, deforestation, and urbanization can be held attributable. Additionally, the so-called man-induced climate change also exacerbates the situation. Significant efforts are being undertaken worldwide for reversing these anthropogenic impacts through development and implementation of technologies to combat desertification in accordance with the UN CCD. In most cases, presence of sufficient and sustainable water resources is the key to the success of these technologies.

In the absence of sufficient water resources, the implementation of these technologies may worsen the situation and create new environmental problems. Surprisingly enough, this realization typically remains in the back seat when evaluating these technologies. The discussion of placing a cost on water resources in the context of combating desertification also remains somewhat obscure. Ideally, the evaluation of water resources should encompass the regional hydrogeologic cycle, including an inventory of sustainable water resources available for combating desertification. This evaluation should include the existing and projected utilization of water for municipal, industrial or agricultural uses.

The primary focus of this paper is to investigate the utilization of water resources in North Africa for combating desertification, using some case studies. The paper also provides a focus on the North African perspectives in technology development and implementation to combat desertification. The comparative study explores, within selected countries, the availability of indigenous water resources, quantifying the volume available and the costs for utilizing it. This availability can, in turn, be compared against the demand for water placed by the various technologies. Based on this analysis, it may be argued that some technologies, although feasible in the short-term, are not truly sustainable options for combating desertification.

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Session 4.a

4.a.1
Characteristics of Techniques for Cartographic Estimation of Desertification

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A comparative estimation was made of existing techniques of desertification mapping, including an optimum choice of landscape parameters and their updating for soil forming conditions of Volgograd region. Peculiarities of soil cover, its agricultural use, conditions of soil formation (climate, relief, geology,) and changes of soil properties were investigated on the basis of literary facts and published maps. The following techniques of cartographic estimation of desertification were compared Harin et al., (1987); (1993); and GLASOD (1988). The territory of Volgograd region is

characterized by a high degree of agricultural use and by a continental climate. The zonal soils are represented Chernozems and by Chestnut soils. Solonetzes and salt-affected soils play a large role in soil cover.

In the technique of Harin (1987), types of processes, describing desertification, are allocated. Several aspects submit each of types: modern desertification, rate of desertification, internal danger, influence of the home animals on natural environment, degree of human impact. The qualitative and quantitative criteria for each of types are developed. Ecosystems are used as a unit of mapping. In the technique Kust, besides by a set of types of desertification, a circuit of cause-effect relations is offered, that allows deeper understanding of the desertification processes. Degradation of a soil cover is examined. Three aspects of the desertification reasons are distinguished: 1) Antropogenic and natural; 2) Global, regional and local; 3) Man-initiated. On the of antropogenic effect, five types are indicated: irrigation, non-irrigated agriculture, distant animal industries, destruction of tree-shrub vegetation, technogenic effect. For each type of antropogenic effect, the cause-effect relation and directions of degradation of soils and soil cover are found. The technique of GLASOD is not designed for the forecast of desertification; it reflects only modern conditions of a soil cover and rates of recent desertification. Except a determined set of desertification types, some reasons of desertification are allocated: deforestation, overgrazing and others. For an estimation of desertification risk in the Volgograd region is that the most suitable is a technique of Kust (1993). The technique of Harin can be used, if the facts of key sites are available. Use of a technique of GLASOD of technique gives interesting results on desertification rates.

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4.a.2
Landuse and Desertification in the North China

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Land desertification is one of the most serious environmental and social-economic problems in the North China. The processes of desertification have mainly being influenced by the interaction of human activity and fragile eco-environment. That means the methods and intensity of landuse are major factors for development or reverse of land desertification. Since the increase of human impacts on the landuse caused by the increasing pressure of population, the region of farming-pastoral transition in the North China has being pushed northwards, which changed landuse from grassing to cropping in a large area and destroyed the natural vegetation cover. The result is to let the wind erosion become easier and the desertification has developed very quickly as one form of land degradation. According to statistics of desertified land areas with different landuse purposes, the human impacts on the contributing to the sandy desertification were of over-cultivation 25%, over-grassing (28%), over-gathering firewood (32%) and of misused water resources (8%), accounting for 93% of causes for the sandy desertification.

During the last five decades, the sandy desertified land has expanded continually in the North China, whose total area has reached over 350,000 km^2 by the middle 1990's. Based on remote sensing monitoring, we found that the growth rate of desertified land has being increased decade by decade, i.e. annual spread area has increased from 1,560 km^2 during 1950's and middle 1970's to 2,100 km^2 of between middle 1970's and late 1980's, to 2,460 km^2 in late 1980's and middle 1990's, which had

brought about environmental deterioration and land degradation and caused heavy losses to the economy. But some successful models of combating desertification have improved that where the reasonable landuse has been adopted over some years, the sandy desertified land has reversed and can be used again for more effective farming or grazing.

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4.a.3
Wonderful Talkimakan Desert and its Bright Prospects

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It is well known that the Talkimakan Desert is the second largest shifting-sand desert in the world and the biggest desert in China. It is situated in the northwest of China, in Xingjiang Uygur Autonomous Region, and covers an area of 337,000 km^2, accounting for one half of the country's total desert area. The name of Talkimakan in the language of the local Uygurs means the "place you can enter but cannot leave".

However, scientific investigation and many years of prospecting and development prove that the vast desert is not a "Sea of Death". There are rich oil and gas deposits beneath the desert, giant underground water resources, many animals and plants, rich cultural relics and marvelous desert roads, etc. On the other hand, the Talkimakan Desert also brought desertification for the local people. In order to combating its hazards, scientists conducted research and practical works during past decades and made many important achievements. To give credit to their remarkable works, UNDP firstly presented two projects of our institute with the "Award for Outstanding Contributions in Combating Desertification and Controlling Land Degradation in Dryland Environment".

With the exploitation of oil-gas resources in Tarim Basin and the completion of Tarim Desert Road, our institute also carried out some research in current years. For example, the study on the construction of green base for oil companies, study on the vegetation rehabilitation in desert hinterland with desert salty groundwater, etc. All these have acquired good evaluation from each aspect. In the future, we will continue our main efforts to combating desertification, controlling salinization and improving the local eco-environment. According to the strategic policy of Xinjiang as "Black (oil) and white (cotton)" connecting its rich natural resources, the Talkimakan Desert will play a more important role on the sustainable development in Xinjiang.

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4.a.4
The Egyptian Action Program to Combat Desertification

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Egypt played an active role in the formulation of the United Nations Convention to Combat Desertification (UNCCD) which was concluded in Paris in June 1994. The Convention has come into force in December 1996, since the required number of countries completed the ratification process; Egypt stands number from the top of the list. Parties to the Convention have to meet their commitments, foremost of which is the

preparation of a National Action Program (NAP) to combat desertification. The main objective of NAP is to identify factors contributing to desertification, and the appropriate measures to combat it. The Egyptian Environmental Affairs Agency (EEAA) is the National Coordinating Body (NCB) of the UNCCD. Within the organizational structure of EEAA, a National Coordinating Committee (NCC) was established and a Focal Point (FP) was identified. The NCC is chaired by the Chief Executive Officer of EEAA and membership includes representatives from relevant Ministries, the People's Assembly, experts, the private sector, cooperatives, and NGOs.

The NCC adopted a rational agenda to formulate the National Action Program of Egypt. The first draft of the Egyptian NAP begins by outlining the environmental aspects of resource management, and then reviews the magnitude of resources and the strategic considerations for their utilization. The recent structural rearrangement of the national economic policies and the open market economy are relevant issues. The report cites examples of completed, current, and forthcoming projects concerned with combating desertification, then the report concludes by an outline on indicators. The selected projects in the draft were selected to reflect the wide range of Egyptian efforts to combat desertification within the context of sustainable development. The projects cover all types of land use, comprising irrigated and rainfed agriculture as well as rangelands. They also reflect work undertaken and/or planned to improve the physical environment and improve the institutional capacity of relevant stakeholders. Moreover, they represent work done and/or to be done on the local scale and work of regional and far-reaching consequences.

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Topic No. 7

Biodiversity Conservation

Session 2.b

2.b.1
Conservation of Biodiversity of "Caatinga" Landscape: A Necessity for the Survival of the Semi-Arid Areas of Brazil

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This paper reports research conducted aiming to determine the effects of the uncertain climatic conditions (low and erratic precipitation), which are the characteristics of Northeast region, on the biodiversity of "Caatinga" landscape (native vegetation), and erosion at the level of the field. Such a experiment was conducted on a private farm, near Irauçuba, 2309 kilometers from Fortaleza, in a semi-arid land zone, taking into consideration: that native vegetation is composed of a larger number of balance species, and with high variation in soil characteristics. Three hectares were divided into experimental plots. The study took place during both the dry and rainy season. For the diagnosis, land degradation criterium was used: present situation, speed and risk, classification which were evaluated. The paper will present the results of this research and give recommendations for future work.

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2.b.2
Micropropagation of Two Endangered Species of *Globularia L.*

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Two species of *Globularia* L. (Globulariaceae) *G. arabica* from Jordan and *G. alypum* from Tunisia, were evaluated for micro-propagation, in an attempt to protect and conserve the two species from extinction, since both species are endangered and about to disappear from the wild in the two countries, and well known for their medicinal value in folk medicine. The seeds of the two species were prepared to germinate in medium, and then shoots sub-cultured with 1.0 mg/1 BA (benzyladinine), and 0.1 mg/1 NAA (naphthaleneacetic acid). Growth was remarkable, and no contamination was observed. The phase of acclimatization was significantly successful.

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2.b.3
Genetic Diversity of Lebanese Wild Wheat Populations as Revealed by Rapd and Aflp Fingerprinting

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A study of the genetic diversity of wild wheats (*Triticum urartu* and *T. dicoccoides*) collected from 17 natural populations in Lebanon was made using the RAPD and AFLP

techniques. For the RAPD analysis, four primers have been chosen for the reactions of amplification. We have identified 44 polymorphic bands for *T. urartu* and 31 for *T. dicoccoides*. The dendrograms generated from the Jaccard similarity index matrix using the UPGMA method have shown the genetic diversity among and within populations. They gave an idea about the geographical and evolutionary patterns of the wild wheat genetic diversity. Amplified Fragment Length Polymorphism (AFLP) analysis for the same populations have also been studied to compare the results with those obtained with RAPD. The AFLP fingerprinting combined with appropriate statistical tools, offers several advantages over other available DNA marker techniques in evaluating genetic diversity. Differences between similarity matrices generated from the RAPD and AFLP analyses were significant. The present study has brought new information on the genetic diversity of wild wheat populations in Lebanon, which will be used for optimizing the collection and conservation strategy. The better knowledge of wild wheat genetic diversity will also enhance their utilization in wheat breeding.

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2.b.4
Use of Plant Agro-Biodiversity for Desert Development

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Around the world, deserts have been always perceived as land devoid of biological resources where mineral or gas extraction ultimately represent the only possible exploitation. This perception is, however, gradually changing as deserts and areas exposed to increasing high level of aridity are seen more and more as source of valuable plant genetic diversity that can be successfully used in the development of these marginal lands. Such new interest in desert areas is due *inter alia* to the acquisition of new technologies that allow better understanding of the potential of plant genetic resources and their patterns of distribution; use of novel gene-transfer techniques which have eliminated natural barriers in the gene flow among distant related species and genera, thus opening the way for the exploitation of hundreds of desert plants so far largely neglected and underutilized by the research community; the increasing number of specialist collections of desert plants that facilitate their own exploitation by the users-community at large; the discovery of the important role of traditional knowledge by local communities which contribute ultimately to enhance the sustainable use of these genetic resources. This realization has however still not resulted in adequate changes at decision-making level concerning, choice of crops and species to grow in desert development projects. Policy instruments are also needed to translate such potentials into concrete benefits for the local populations living in the desert areas still largely dependent upon costly agricultural inputs and exotic germplasm. A careful analyses of the desert and its stakeholders indeed reveals that useful genetic diversity does occur in the desert, although in patterns and degrees unfamiliar to the eyes of most researchers. Enhancement of the use of this diversity cannot be achieved without the closer involvement of local communities. The objective of this paper is to provide a methodological approach for policy-makers and desert development agencies to assess ways to enhance use of plant genetic resources for achieving a sustainable desert development.

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2.b.5
Biodiversity Protection in Egypt by Establishing an *in vitro* Micropropagation System for Some Endangered Native Plant Species

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Work carried out in our laboratories to establish an *in vitro* micro-propagation system to some natural endangered plant species due to overgrazing and/or unsustainable agricultural practices and tree cutting. Tissue culture was used for micropropagating the palatable forage natural plants. This palatability causes the lack of seeds and lack of plant material. Among such plant species studied were: *Nitraria retusa, Prosopic chilensis, Rhamuns lyciodes* R. Oleiodes, and *Maerua crassifolia*. Some medicinal plants, especially those of economic value due to containing active ingredients, became very rare due to cutting to fulfill needs of the pharmaceutical companies. Among such plant species are: *Capparis cartieaginea, Juniperus phoenicea, Rhus tripartite,* and *Jinkgo biloba*. Some plant species responded to growth *in vitro*, while other plant species still need more trials to achieve success.

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2.b.6
Phyto-amelioration as a Method of Biodiversity Rehabilitation of Desert Rangelands of Uzbekistan

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The Republic of Uzbekistan is situated in the Central Asia. One of the traditional kinds of agriculture is sheep breeding. The Kyzylkum desert is the main rangeland in the Republic. Diversity of landscapes and climatic desert conditions have formed various types of rangelands on its botanical composition. The existing biodiversity makes it possible all the year round to graze sheep, giving more favorable rangelands for every season: spring, summer, autumn and winter. Upon violating the rational system of using the rangelands, the desertification process occur: biodiversity reduction, replacement of dominating species by less valuable and nutritious plants. The reclamation of desert rangelands, directed on the rehabilitation of biodiversity regeneration of degraded rangelands, have been worked out and rangelands are successfully used in Uzbekistan.

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2.b.7
Rehabilitation of War-Damaged Wildlife Habitats in Kuwait's National Park

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The misuse of renewable natural resources through uncontrolled activities, such as overgrazing, uprooting of shrubs, off-route use of vehicles and hunting of wild animals has caused irreversible losses of native biodiversity and potential recreational facilities in Kuwait. Realizing the need for preserving the native flora and fauna, the Kuwait

Institute for Scientific Research (KISR) conducted studies to generate baseline information on the native desert ecosystems and, recommend suitable protection measures for preserving the biodiversity, reintroduction of indigenous and exotic plants and animals, land-use zoning, and administration and management framework for the National Park. These studies enabled Kuwait Municipality to establish the first National Park covering an area of 330 km^2 in the northeast of Kuwait.

In 1990, the National Park was completely destroyed during the invasion of the country; the external fence was damaged, many bunkers and military observation points were established, and mines were placed at several locations. In the post-liberation period, the Ministry of Defense cleared the area from ammunition and mines and demolished the ordnance in underground pits. All of these activities resulted in a severe land and vegetation degradation. In view of this, KISR recently initiated a study aimed at the restoration of wildlife habitats in war-damaged areas of the park. Based on the preliminary assessment of damaged, two sites measuring 10-12 ha have been selected for the pilot study. These areas will be re-seeded with a mixture of grasses and forbes, or planted with shrubs and trees with consideration on rate of seeding, planting depth, timing, seed distribution, soil type and soil moisture for plant growth. Success of these rehabilitation measures in restoration of damaged habitats will be ascertained based on survival rates and biomass production of introduced species and, the recovery of native vegetation in the study area.

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Topic No. 8

Renewable Energy

Session 10.a

10.a.1
Use of Terrestrial Heat as a Renewable Energy Source in Environmental Conditioning of Greenhouses

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Since soil temperatures below the surface are normally out of phase with ambient air temperature during different seasons of the year, the present research reports of the efficiency of an earth-tube heat exchanger for heating and cooling the greenhouses by using the deep soil temperatures as a new and renewable source of energy.

An instrumented earth-tube heater exchanger was designed, constructed, installed, and operated as a single-pass heat exchanger. The system consisted of 50-m, 14-cm diameter galvanized metal duct buried at 200-cm deep in clay soil at Rice Mechanization Center (RMC), Meet El-Dybe, Kafr El-Sheikh Governorate. The system was connected with two different structural frame greenhouses (modified quonset and gable-even-span frames). Air temperature and peripheral deep soil temperatures were measured at the inlet, center, and outlet end of the earth-tube heat exchanger. The outlet air was employed to heat and cool the ambient air of the greenhouse for cucumber production during winter and summer seasons.

The results obtained revealed a promising potential for earth-tube thermal performance in both heating and cooling modes. Thermal performance of earth-tube heat exchanger was directly proportional to temperature difference between outlet and inlet airflow, and inversely proportional to temperature differences between tube surface and inlet airflow during winter season; the air peripheral wall temperature (19.96 °C) remained sufficiently high for effective heating mode performance. The seasonal average thermal efficiency of the earth-tube heat exchanger was 81.84%, whilst, the peripheral tube wall temperature during summer months (22.04 °C) remained sufficiently low for effective cooling mode performance. The seasonal average thermal efficiency of the earth-tube heat exchanger was 85.83%.

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10.a.2
Development of Solar Energy-Driving System for Crop Cultivation Using Saline Water

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In arid and semi-arid areas adjacent to sea and in regions with underground storage of saline water, desalinization will furnish an adequate source of water for agricultural and other domestic development. Establishment of desalinization system for agricultural purposes should account for the cost and the efficient use of available water by the plant.

In this study, establishment of a desalinization system for plant cultivation was investigated. The system basically was composed of a solar still and cultivation pot. The

solar still was a pool with a mix of saline water and sand, from which water evaporates during the daytime when temperature increases. The evaporated water condenses in the cooler cultivation pot, where the roots of the plant absorb it directly. The effects of transparent plastic film cover of the pool and mulching of the soil surface in the pot, using transparent plastic film, or aluminum film, were investigated. Furthermore, the mechanism of water desalinization in the system were studied. The temperature of the saline water and sand mix in the pool covered with a transparent plastic film was higher than that in the non-covered pool, by about 8 °C during the daytime and about 3 °C during the night. This higher temperature produced more water condensed in the cultivation pot of the pool with plastic cover, which about 6-fold of that produced by the non-covered pool. During the daytime, mulching of the soil surface with transparent plastic film resulted in soil temperature higher by about 6 °C than mulching with aluminum film. During the night-time, the aluminum night-time mulching produced soil temperature higher by only 1 °C than the plastic mulching. Hence, the water condensed in the cultivation pot increased under the plastic film mulching by about 3-folds compared by that under aluminum mulching.

The results showed that the system performs better when the temperature of the cultivation pot is lower than that of the pool, especially during the night-time. Cultivation of *Brassica sp.* was successful from seed to harvest by using desalinization system, in which the transparent plastic film used to cover the pool and mulching the soil surface of the pot.

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10.a.3
Solar Plastic Dryers for Desert Communities

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A variety of field crops, medicinal plants, fruits and vegetables are successfully grown in the areas. They are harvested with high levels of water content which need to be reduced immediately to low moisture levels, safe for storage, appropriate for processing and economical in transportation. In addition, drying is a most economical preservation operation for such high-moisture crops in arid lands. Solar energy, on the other hand, is abundant in the arid land and most efficient and economical when used as a source for thermal energy for heating water or air, using appropriate solar collectors. The thermal performance of plastic solar collectors, infiltrated with forced air and greenhouse types were tested at the DDC/AUC site in South-Tahrir. For a 30-meter long inflated plastic solar collector, the day-average temperature was increased above the ambient by an average of 18C, 15C and 13C for 10, 27 and 43 m^3/min of airflow rate. The day average air temperature in the plastic greenhouse was about 45 °C. (about 15 °C above the ambient).

The inflated plastic solar collector was used for drying peanuts in thick layers and sesame in bundles. Peanuts were dried from 43.6% to 9% in 6 days. Grapes were dried in the plastic greenhouse for processing grapes into raisins. The average moisture content was reduced from 84% to 22% in 288 hours. Sesame was dried from 50% to 10% in 9 days. Preliminary cost-analysis of the plastic solar collectors revealed that using such collectors can reduce the cost of drying significantly compared to glass-solar collectors and other conventional gas-and electric-drying systems.

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10.a.4
Features of Wind Climate over Egypt

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Hourly data of wind speed and direction in the period 1981-1995 at 23 surface meteorological stations have been used to depict climate features of wind over Egypt. Distribution of mean wind speed and vector, persistence, and rough estimates of available power intensity of wind energy have been investigated. Besides, Gumbel distribution has been used to deduce a model to forecast extreme wind speeds.

It was found that mean annual wind speed ranged from 2 to 7.5 m/sec with maximum centers at coastal areas at Port Said, Hurghada, Ras Benass, and Elowainat. Centers of minimum speeds have been found at Siwa Oasis, El-Arish, and Luxor. The same thing can be said about magnitude of mean wind vector. Persistence ratios range from 70% to 25%, with high values at coastal areas of the Red Sea, Middle Egypt, and around Nasser Lake up Elowainat region. Lower persistance was found over the Delta, around El-Arish, and the Oasis of Siwa. For this reason, wind blows from a steady direction (300°-330° from north) over most northern parts of Egypt and blows from southwest to southeast (260°-120° from north) at southern boundaries of Egypt. Over the Delta and around Siwa Oasis, it has a variable direction. Computing power intensity of wind has indicated that promising areas of wind energy are located at Port Said, Hurghada, Ras Benass, and around Nasser Lake. In these promising areas, energy intensity ranges from 550 watt.m^{-2} to 350 watt.m^{-2}.

A deduced model using Gumbel distribution showed that extreme wind speed might be more than 25 m/sec in the future, especially in the promising areas. Also, the model can be used to predict extreme speed at any location in Egypt.

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10.a.5
Development and Testing of a Greenhouse Type Solar Dryer

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Pakistan has an ideal climate for development of solar energy use. There is wide scope of using solar energy in drying of agricultural crops before either storing or marketing. Generally solar dryers are fabricated using glass as a heat transmitter, but obviously glass is expensive to install and difficult to maintain. In the present study, a greenhouse-type solar dryer was fabricated using polythene as a solar energy transmitter. A dryer temperature of 65 °C was obtained at mid day when the outside temperature was 35 °C. Various crops such as wheat, maize, bitter gourd, chilies and apricots were dried in the dryer and also in the open sun at the same time. The dryer was twice as fast as open sun in drying. Further experimentation on temperature and humidity ranges suitable for faster and efficient drying of different crops of the region is underway.

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Topic No. 9

Biotechnology

Session 3.b

3.b.1
A Modified Procedure for Rapid Recovery of Transgenic Wheat Plants

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Five-day-old calli derived from immature embryos of wheat (*T. aestivum*) cultivar Hiline were bombarded with the plasmid pAB5 containing bar (phosphinothricin acetyl transferase, PAT) gene, as a selectable marker for the herbicide bialaphos resistance, driven by CaMV 35S promoter and uidA (-glucuronidase, GUS) gene, as a reporter gene, driven by rice actin-1 promoter. Selection pressures of 0 and 5 mg/l bialaphos were carried out during the callus induction period of 4 weeks, only. Regenerable calli from both categories were transferred to 1 mg/l bialaphos for regeneration, and 2 mg/l bialaphos for rooting. The performance of roots under selection was the first reliable criterion we used to identify the putative transgenic plants, which was confirmed by bar gene expression assays, e.g., leaf painting (200 mg/l Basta) and PAT. Three tranformants were obtained, but from no-selection category during callus induction. In general, we found that bialaphos selection during callus induction markedly reduced the regenerability of wheat calli. Besides, bialaphos selection takes 6-8 weeks to likely identify bialaphos resistant calli.

The PCR followed by southern blotting indicated the presence of the introduced foreign full-length genes in the genomic DNA background of the three transgenic plants. The histochemical GUS assay was negative in transformed shoots and roots, while strongly positive in pollen grains (1:1 segregation). Therefore, GUS expression in shoots and roots of our three transgenic plants was proven by using dot blot and quantitatively by using ELISA. Since actin-1 promoter was frequently reported as a strong promoter to induce expression in different plant systems, we think that histochemical assay is not sufficient to identify GUS expression in transgenic wheat (*T. aestivum*) plants.

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3.b.2
Construction of a Gene Bank for an Extremely Halophilic Bacterium (*Halobacterium halobium*) in *E. coli*

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Soil salinity is becoming a major threat to agriculture, especially in the arid and semi-arid regions of the world. A long-term project was developed with the aim of studying the molecular basis of salinity tolerance of an extremely halophytic bacterium (*Halobacterium Halobium*), isolated from highly salt-affected soil in the southern part of Iraq. For this purpose, an efficient gene bank was constructed in the replacement bacteriophage lambda EMBL vector. This was done by the isolation of bacterial

chromosomal DNA which was then partially digested with Sau 3a restriction enzyme. DNA fragments ranging between 10-20 *KB* were ligated to the double digested vector arms. The *in vitro* recombinant phages were plated on a genetically selective strains of *E. coil* (NM539).

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3.b.3
Characterization of Dehydrin Gene in Wild Egyptian Germplasm

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A dehydrin gene (585 bp) was isolated, for the first time from *Vicia monantha,* a wild leguminous plant which grows naturally in the northwest coastal region of Egypt. The gene was isolated by rapid and efficient direct cloning of PCR product into Bluescript vector. Forward and reverse specific primers were constructed corresponding to the nucleotide sequence of pea dehydrin gene. PCR amplifications were carried out at high annealing temperature (52 °C) to ensure specificity and to avoid primer mismatch. Verification and confirmation of PCR products was performed using internal primers constructed corresponding to the consensus boxes of dehydrin proteins. Nucleotide sequence of the isolated clone showed 89 % similarity to pea dehydrin gene.

The deducted amino acid sequence indicated the presence of the three consensus sequences common for all dehydrin proteins. The isolated gene was induced for expression in *E. coli* and dehydrin protein (approx. 21 KDa) was characterized on SDS-polyacrylamide gels. Western blot analysis was carried out using dehydrin antibodies to study the expression of dehydrin gene in *Vicia monantha* seedlings in response to drought stress.

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3.b.4
Construction of a PCR-Based Linkage Map in Tomato

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This work was carried out to provide a low-density genetic map of *Lycopersicon* using random amplified polymorphic DNA (RAPD) markers and to develop sequence tagged sites (STS) around genes of agronomic importance. The basic mapping population used in this study was an F_2 derived from an interspecific cross between *Lycopersicon esculentum x Lycopersicon pennellii.* Fifty random primers were used to screen the parents, twenty-two of which were further used in screening the above-mentioned F_2 population. These twenty-two primers generated 105 RAPD markers (with an average of 4.8 markers per primer) and were used to construct a linkage map covering a distance of 1481.1 cM using the MAPMAKER computer program.

Ten pairs of primers, each primer, about 25 base-pairs long, were designed from the published tomato nucleotide database sequences. Each primer set was used to amplify a sequence tagged site (STS) from the total DNA of *Lycopersicon esculentum and Lycopersicon pennellii*. Informative primers were then used to screen for polymorphism in the F_2 progeny of the same cross. Segregation databased on PCR amplification from STS's were entered and analyzed for linkage with the data for RAPD markers.

The availability of a low density genetic map of tomato will be the foundation towards achieving a more detailed saturated map, which will provide markers as starting points for map-based cloning and/or for marker-assisted selection of agriculturally important genes such as diseases, insect or abiotic-stress resistance genes in this important crop.

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3.b.5
Physiological, Biochemical and Molecular Genetic Markers in the Prediction of Stress-Tolerant Genotypes

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From twenty-six flax genotypes (*Linum usitatissimum* L.) evaluated for salt tolerance at germination, vegetative, and maturity stages, two genotypes were selected, including the most tolerant (S.162/3) and the most sensitive (Giza 6). Physiological, biochemical and molecular studies were achieved for both parents, their F_1 and F_2 progeny. F_2 plants were sorted into ten groups according to four yield-related traits and a visual rank for plant vigor; the most tolerant and the most sensitive groups were examined as individual plants.

The tolerant parent accumulated more proline than the sensitive one, the same behavior was observed in F_2 tolerant group. Bands No. 1 and 16 in the SDS-protein banding pattern was found to be associated with salt tolerance in flax. Zymograms of peroxidase, acid phosphates and esterase showed good polymorphic differences with salt treatment, which may be used as biochemical genetic markers for salt tolerance in flax. Bulked Segregant Analysis (BSA) for each of F_2 sensitive and tolerant groups were used to generate a RAPD-marker (Randomly Amplified Polymorphic DNA) using Ploymerase Chain Reaction (PCR) which confirmed these results.

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Topic No. 10

Stress Physiology

Session 4.b

4.b.1
Response of Tomato to Mycorrhizal Fungi and Salt Stress

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High salt levels in soil and water can cause limitations to agricultural production and land development in arid and semi-arid regions. Arbuscular mycorrhizal fungi (AMF) are known to increase plant growth in saline soils. The objective of this study was to examine the growth and mineral acquisition responses of a greenhouse grown tomato to infection by AMF under varying levels of salt. The NaCl was added to soil through irrigation water to give ECe of 1.4 (control), 4.7 (moderate) and 7.4 dS m-1 (severe salt stress). Plants were grown in sterilized, low P silty clay (Typic Xerochrept) soil-sand mix.

Mycorrhizal infection was higher under control than under saline soil conditions. Shoot and root dry matter (DM) yields and leaf area were higher in mycorrhizal than in non-mycorrhizal plants. The enhancement in shoot DM due to AMF inoculation was 44, 30, and 38% for plants grown under control, moderate and severe salt stress conditions, respectively. The total accumulation of P, Zn, Cu, and Fe were higher in mycorrhizal than in non-mycorrhizal plants and higher under control than under saline soil conditions. Sodium was lower in mycorrhizal than in non-mycorrhizal plants. The improved growth and nutrient acquisition in tomato demonstrate the potential of AMF colonization for the protection from salt stress of plants grown in arid and semi-arid areas.

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4.b.2
Yield Response of Some Wheat and Barley Varieties to Saline Conditions in South Sinai

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Two field experiments were conducted on wheat and barley at Beer Abou Kalam Experimental Farm, Tour Sinai, South Sinai Governorate. Seven wheat varieties and six barley varieties were sown in saline soil (5.6 mmhos/cm) and irrigated with underground saline water (about 2800 ppm). Some growth attributes and the final yield were determined. The results showed that the growth and yield of Sakha 8, Giza 163 and Giza 164 varieties of wheat seemed to surpass other varieties under saline conditions. The results also showed that Hybrid-89 of barley surpassed other varieties in grain yield. It was concluded that relative salt tolerance of wheat and barley varieties should be taken into consideration if successful yield have to be produced under saline conditions in South Sinai.

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4.b.3
Ecophysiological Indicators of Water-Use Efficiency in Cropping Dry Lands of High-Thermal Regime

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Water Use Efficiency (WUE) by crop plants to be cultivated in dry lands is a determinant key tool for the success of amelioration of such areas. The importance of WUE becomes crucial under limited water resources (e.g., using underground water resources). Both high-thermal regimes and limited water supply drastically affect WUE. Considerations of habitat thermal amplitudes and impact of radiant energy (heat and light stresses) on plant productivity is essential. Recognizing and identifying the effects of edaphic and climatic drought on plant metabolism and productivity is also crucial since maintaining normal metabolism is one of the two variables determining WUE. Prospective salinization of surface ground water resulting from over-discharge and its impact on plant productivity must be considered. Interaction between two or more factors of the arid lands environmental complex in their effects on water use by plants and/or plant metabolism, and hence WUE, should be evaluated. Occurrence of such interactions is the rule, rather than being an exception, especially under desert conditions. The research data presented here by the investigators allows for discussing and clarifying the consideration outlined above.

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4.b.4
An Index for Salt Tolerance in Barley (*Hordeum vulgare* L.)

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The use of salinized fields in the screening of cultivars/genotypes of a given crop have always been an obstacle to the identification of truly salt tolerant breeding materials. According to this, a screening methodology for testing genotypes under naturally salinized field conditions was proposed earlier and has been employed for this purpose. This methodology, which involved planting frequent checks alternated with the genotype under study, was used to study the phenology of five barley varieties under naturally salinized field conditions (with an electrical conductivity ranging from 20 to 25 ds/m) compared with that under non-saline fields. Plant samples from both the saline and non-saline fields were taken at two-week intervals throughout the season.

Measurements involved number of leaves, leaves dry weight, leaf area index, total fresh and dry matter weights, number of spikes/m^2, spikes fresh and dry weights, number of seeds/spike, 1000-seed weight and grain yield. Performance of the barley varieties varied within and between environments. Generally speaking, most of the characteristics showed more than 50% reduction under saline as compared to that under non-saline conditions. Data on leaf area index and total dry matter accumulation showed curvilinear relationship with time under non-saline environment, whereas under saline environment, the relationship becomes somewhat linear. Correlation among the various characteristics varied in the two environments.

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Session 6.b

6.b.1
Selection of Barley Lines for Drought Tolerance in Low Rainfall Areas of Jordan

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An experiment was conducted at five locations in Jordan i.e., Khanasri (150 mm), Ramtha (225 mm), Muwaqar (150 mm), Rabba (350 mm) and Ghweer (250 mm) during the 1996/1997 growing season, to evaluate yield performance and some of the agronomic traits of 84 barley breeding lines and three long-term checks: Zanbaka, Arta and Klaxon for drought tolerance. An (lattice design with two replication and six incomplete blocks for each replication was used.

No grain yield was obtained at Muwaqar. The genotypes were found to differ in their biological, straw and grain yields, indicating the necessity to practice selection in the target environment. Genotype no.6 (WI 2291/Tadmor) was found to be superior in grain and biological yield, especially to the best check (Arta) at the two wettest locations (Rabba and Ghweer). Genotype no. 21 (Mo.B1337/WI2291/5/Emir.) out-yielded the best check (Arta) at the driest location (Khanasri) while genotype 61 (Salmas/Arabia Aswad) produced a higher grain yield than the best check (Zanbaka) at Ramtha.

The correlation between grain yield, biological yield, straw yield, plant height and harvest index was always significant and positive, regardless of the location. The correlation between days-to-heading, days-to-maturity and grain yield was significant at the two driest locations only. This would suggest that a different phenology is required to maximize grain yield in the wet and dry environments. Also, the relationship between grain yield and the length of grain-filling period was positive in the wettest location (Rabba), negative in the driest (Khanasri), not significant in the driest (Khanasri), and not significant in the two intermediate locations. These results emphasis the importance of selection in the target environment and show the necessity to develop early-maturing genotypes as a way to escape from drought and high temperatures during grain filling period.

Combined analyses showed that a highly significant in varieties variance component indicates that genotypes differed in their genetic potential for grain yield. There were also a high significant variety x location interaction, but less than that of variety, indicating that there were consistent location effects for differential variety responses.

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6.b.2
Ethylene Regulates Tomato Fruit Transition from Cell Division to Cell Enlargement Causing Fruit Size and Yield Increase but Delays Ripening

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Tomato (*Lycopersicon esculentum* Mill.) plants cv. Castle Rock were sprayed with 100 ppm ethrel, 0.5 mMAOA (aminooxyacetic acid) or water (control) two days after anthesis. Fruit period of cell division (CD) was extended up to 16-18 days after

antithesis with ethrel application but reduced from 10-12 days (control) down to only 6-8 days with AOA application. In an opposite trend to AOA application, fruits that received ethrel treatment were of higher ethylene and ACC (1-aminocyclopropane-1-carboxylic acid) levels than control. This was noticed not only during the first two weeks after anthesis, but also during fruit climacteric phase. Misocarp cells of ethrel-treated fruits were greater in number/mm^2 but smaller in size than control, while an opposite trend was obtained with AOA application. This was observed for a period of 18 days after anthesis. Only by that time or at earlier ages, fruits of AOA treatment were larger in size and heavier in weight than control and both were larger and heavier than ethrel-treated ones.

When 5 weeks passed after anthesis and therefore, fruit response to all treatments was totally reversed, since early ethrel-treated fruits became significantly larger in size and heavier in weight with ripening delay by about 10 and 15 days than those of control and AOA-treated ones, respectively. When the same treatments were applied to the whole plant, similar results were obtained since early ethrel application increased fruit yield by about 15% over control with a pronounce ripening delay while an opposite trend was obtained with AOA application. No significant differences were found among all treatments in terms of flowers of fruit abscission or fruit number/plant.

The data suggest that ethylene regulates tomato fruit transmission from CD to cell enlargement (CE). In addition, fruit CD is terminated only when endogenous ethylene decreases to its basal level allowing CE to dominate and proceed as in the case of early AOA application. The ripening delay of ethrel-treated fruits may be due to the longer time required for the increased number of cells to reach maturation. Low level of ethrel application at tomato early fruiting stage may used for increasing fruit size and consequently its quality.

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6.b.3
Conjugate Resistance of Wheat to Stresses

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One of priorities in learning the physiological and biochemical base for resistance of wheat grown up on arid and semi-arid lands of Kazakhstan to stresses is the development of methods of complex resistance against abiotic and biotic factors of an environment. Such a method has been developed and the rights are protected for determination of conjugate resistance of different grades of wheat against the low temperatures in winter time, high temperatures during a period of irrigation and corn growing up at low provision of moisture in soil, and also at infection by pathogen micro-organisms.

It is revealed that the activity increase of cathode isoperoxidaze is directly proportional to a degree of frost resistance and in inverse proportion to resistance against pathogens. The accumulation of marker component in an electrophoretic spectrum of gliadine proteins reflects the degree of wheat resistance against the high temperatures on dry lands. The possibility is now considered to supplement a method by protein markers of wheat resistance against the influence of heavy metals, such as Cd, Cu and other, that is especially effective for an estimation of ecological resistance in our region.

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6.b.4
Selection of Pearl Millet (*Pennisetum americanum* L.) Genotypes for Salt-Tolerant Cells *In vitro*

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Pearl millet is recognized as an important crop for arid and semi-arid regions. It is also grown most widely in Upper Egypt as a forage crop in summer season. Six genotypes (ICMP, Nigeria 1, USA, Ghana, Egypt local variety, and Nigeria 2) were selected based on field performance. The six genotypes were cultured on Murashige and Skoog (1962) MSI medium supplemented with (1) NAA + (1.5) 2,4 – D + (0.1) Kin. mg/l, 2g/l gerlite (phytogel) and 30 g sucrose for callus induction. MSII medium containing (2.5) 2,4 – D + (0.5) BA + (5%) CM for embryonic callus formation and MSIII medium plus (1.0) BAP for regeneration of embryonic callus.

The six genotypes were exposed to four NaCl concentrations (0%, 0.75%, 1.5% and 2% v/w) for five subcultures. Callus fresh weight decreased with increasing the NaCl concentrations. ICMP genotype had the highest callus fresh and accumulative dry weight than other genotypes. Ion uptake showed that ICMP and Nigeria genotypes obtained the highest ions concentration within the cells at all levels of NaCl concentrations. Same genotypes also had the highest water contents and praline concentrations. Our data suggested that the six genotypes were responded differently at different NaCl levels. ICMP and Nigeria genotypes exhibited salt-tolerant genotypes and proved to be successful in salt-stress environments. Another genotypes were considered to be a moderate stress. The salt-tolerant genotypes exhibited some salt stress mechanisms such as ions exclusion, dilution of ions and proline accumulative as osmotic adjustment mechanisms.

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6.b.5
Moisture Stress Physiology of Sunflower Hybrids for High Productivity

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A field experiment was conducted with five full season hybrids viz., MSFH-8, MSFH-17, KBSH-1, JWALA and PAC-36 of sunflower (*Helianthus annuus* L.) along with a popular varietal check GAU-SUN-1 under rainfed conditions. The experiment was conducted during rainy monsoon season of 1997 under both fertilized (F) and unfertilized (UF) environments. The objective of the study was to identify a best performing hybrid and also the physiological characteristics conferring tolerance to moisture stress. The crop experienced moisture stress for a continuous spell of 35 days from 21 to 56 days after sowing (DAS), which is a critical stage of bud initiation and flower development. Observations were recorded at 45 DAS wherein the crop was under severe moisture stress for 24 days.

The seed yield of PAC-36 was the highest and significantly higher over GAU-SUN-1 under both F (20%) and UF (11%) conditions. It registered lower stomatal conductance than the check at 45 DAS, yet maintaining higher photosynthetic rate under UF condition. With higher fertility, it was equal to the check for both the physiological parameters.

Interestingly, though the head diameter of PAC-36 was lower than the check, the hallow center was significantly lower than the check percentage-wise, showing that the later character is more important than former for realizing higher seed yields. PAC-36 also recorded higher leaf number with relatively lower leaf area over the check due to the narrow and tapering leaves with a higher petiole length, which might have led to a better radiation and water efficiency with lower transpiration rate. The nitrogen percentage in stem of PAC-36 was significantly higher than the check under both F and UF conditions showing the pivotal role of this character for stress resistance.

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6.b.6
Comparative Study of Drought-Resistance Potentiality of Six Tunisian Olive Trees Cultivars

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The Tunisian climate is mostly arid and semi-arid. Likewise, is caracterized by a frequent drought and poor water and soil potentialities. Olive provided the best capacity in improving these potentialities. Nowadays, olive production is encountering difficulties consisting of drying of traditional olive groves and drought damages which becomes serious with the degradation of practices affecting water economy. In saving the olive sector, more attention must be paid to limitation of drought damages, production suitability of olive trees during favorable periods and to the conception of a better bio-geographical distribution of the olive species taking into account drought and the environment potentialities. Thus, this work aiming at studying the analytical and comparative morphological, anatomical and ecopysiological strategies of olive leaves related to drought resistance.

The study of the morphology and the anatomy of field olive leaves shows differences for their drought-resistance capacity. These characters are: density of *Stomata trichoma*, thickness of leaves and palissadie tissues, the internal and external surface ratio of leaves and the proportion of wall cell in contact with inter-cellular space.

The stomatic regulations study of hydrous losses shows that the daily evolution and level of stomatic resistance are different between varieties and, for any variety, it depends upon origin. The general synthesis of the water-deficit effect related to the different morphological, anatomical and ecophysiological parameters studied allows a clear-cut distinction between cultivars and treatments studied for their drought resistance. Thus, the *Chemchali* variety has the most characteristics to develop in dried conditions. *Oueslati* is second. Both (*Chemchali* and *Oueslati*) should be observed in other moisture situation; *Chemlali* variety follows. These adaptive potentialities could be performed with suitable production environments. The *Chetoui* variety seems to be adapted to rainy areas.

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Topic No. 11

Socio-economics and Anthropology

Session 9.b

9.b.1
Resource Management: Perceptions and Strategies of Households in Bershaya Village, El-Bab District, Syria

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Poverty alleviation has become one of the most important issues that concern the international community. In agriculture, natural resources are progressively being degraded from a great threat of rural people whose life depends mainly on land and water. Poor farmers have no alternative but to use their available resources intensively in order to survive. Intensive field visits were undertaken in Bershaya village throughout a 3 year-period. The research aimed at examining the way households in the village manage their resources in order to respond to their daily needs. ICARDA devoted great part of its research in developing new technologies to overcome drought conditions and water scarcity. The working program of ICARDA includes soil conservation. Important work was done on crop rotations and their benefits for soil fertility and conservation. The introduction of legumes and forage legumes constituted an important component of the work pertaining to soil conservation. ICARDA is intensively working in Bershaya village as part of its comprehensive plan to help farmers in arid areas. The objectives of the research were set:

- Evaluate the farming households' strategies in resource management.
- Speculate the impact of ICARDA's assistance on these strategies.
- Identify the constraints that face households and their impact on farmers' strategies.
- Problem identification related to resource management at the community level.
- Insure resource sustainability through appropriate management.

The research found that due to their high appreciation of land, rural people were keen on keeping their resources productive as long as possible. The high value farmers put on land appears from the way they manage their income; they use most of their revenues from off-farm activities in agricultural investment. They rarely sell their land under any pressing conditions. They also look for ways to avoid the fragmentation of land. There was a paradox between women's right of inheritance and land management. Male heads of households were convinced that giving away the land to their female members will lead to land fragmentation, a fact that will give the opportunity to a stranger of the family interfere in the family's business. Inheritance of land by women does not benefit farmers, and goes against the way they manage their holdings. In most cases, households deal with the land as a family enterprise. They use it and manage it as a group. It is interesting to know how women approve this opinion and feel proud about it as well. Women are also the major human labor in agriculture, where men usually are directed to take off-farm activities. Compared to men, women did not have equal chances of education or any other potential for development.

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9.b.2
Land Use Dynamics and Farmer-Perceived Land Degradation Processes and Causes: A Case Study from the Agro-Pastoral Village of Im Mial, Northwestern Syria

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The degradation of drylands is a result of complex processes and developments. In the context of a typical agro-pastoral village in northwestern Syria, the effects of demographic and social changes, reduced soil productivity, changes in agricultural technologies, and historical events on land use and the natural resources degradation are examined. Decreasing yields, mainly the result of reduced fallow periods and a reduction of soil productivity, and the deterioration of the grazing resources are the two main signs of land degradation in the area.

The growing number of consumers forces the villagers to practice continuous rainfed barley cultivation with no or only occasional fallow, and without any application of manure or fertilizer. Also, technological changes, from the use of donkey ploughs and hand-harvest to less labor and time-consuming cultivation practices with tractors and combine harvesters, and the increased importance of stubble in the livestock diet have contributed to the reduction of the fallow periods. The villagers attribute the yield decreases to the low rainfall in the area, but first of all to the lowering of the groundwater table. The high rainfall variability discourages the fallowing of fields, because continuous cultivation maximizes the chances for good harvests in years with high rainfall.

Another effect is that the arable land now expands even onto sloping areas, which are subject to high erosion risk. Population growth, increased numbers of livestock and the expansion of cultivated land into grazing areas also has put pressure on the grazing resources of the village and caused their deterioration. The possession of livestock is seen as a sign of wealth and the villagers aim to have large flocks of animals. For them, livestock is also an important means for investment of cash earned from off-farm work, which is the main income for most of the households in the village. The stabilization of the natural resources in this dry environment requires the combined and interdisciplinary effort from both the land users and the policy-makers.

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9.b.3
Rural poverty in Jordan

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A national socio-economic field survey has been conducted in 1996 in Jordan including 2738 rural households from which about 45% were classified as poor and 12% as agricultural poor. Definition of poverty, distribution and characteristics of the rural poor have been identified in terms of employment, income consumption, expenditures, access to agricultural services, resource endowments, economic activities, use of new technology, resource management, farming system diversification, constraints and means to achievement of poor alleviation through use of new technologies.

A nutrition survey showed a relative shortage in total and animal protein as well as in fats intake. Qualitative and quantitative statistics have been applied by using

computer. Abject and absolute poverty lines have been estimated by JD 73 and JD 165/household/month, respectively, while the average income is about JD 101. About 34% of the rural labor force are employed by the public sector, 16% by the private sector, and 22% by the agriculture sector. About 66% of the total income of the poor generate from the public sector, and about 14% from agriculture. About 66% of the poor farmers manage a farm less than 20 dunums (1 dunum = 1000 m^2). About 42% of the rainfed area are left as fallow land. About 76% and 24% of the rainfed area are used to produce cereals and fruits, respectively. New technologies are used at minimum level. The animal production is characterized by small-holdings whereby 64% of the poor producers manage a holding smaller than 20 heads. About one-third of the rural poor received loans. Commercial banks offer 77%, the ACC 18%, relatives 5% and NAF 4% of the total loans. The statistical analysis showed a significant consistency between income on one hand and the agricultural sector, employment and expenditures on the other hand. Employment, income and expenditures are affected by agriculture. Use of new technologies affect productivity, employment and income. Minimum productivity and optimum size of agricultural holdings have been identified.

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9.b.4
Population Dynamics Impact on the Natural Environment of Tunisian Saharan Zone

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The study was carried out in El-Faouar, a representative village community of the Saharan zone of Tunisia, to describe and analyze the socio-economic situation changes and their impact on natural environment. To meet these objectives, statistical information were collected from local people; land use and cover types were measured from a map produced from satellite imagery; and vegetation characteristics were measured in selected units; and mathematical models were developed relating these characteristics with the distance from the village.

The sedentarization of ex-nomad local population, after the creation of irrigated areas, was accompanied with changes of their practices in exploiting the natural environment. Free communal grazing, coupled with severe cutting of woody vegetation for several uses, especially charcoal production, were the main causes of the degradation or even the disappearance of some common vegetal species at specific places. About 80% of the variation in cover, species composition, height and biomass were accounted for by distance from the village. Some nomadism practices are still related to the population of El-Faouar. Therefore, they need to be maintained after becoming more rationalized and friendly to the environment.

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Session 11.b

11.b.1

The Role of Economics in Designing Policies to Reduce Waterlogging and Salinization

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An economic view of waterlogging and salinization in arid areas would suggest that these problems arise, in part, because two essential resources irrigation water and the assimilative capacity of unconfined aquifers are not priced or allocated correctly to reflect scarcity values and opportunity costs. As a result, farm-level decisions regarding irrigation methods and water volumes are not consistent with decisions that would maximize the sum of net benefits generated throughout an irrigated region. Polices that modify farm-level prices or allocations of irrigation and drainage resources may be useful in motivating farmers to improve water management practices in ways that reduce the rate of increase in waterlogged and saline areas.

Policies that can motivate farmers to consider the off-farm and long-term impacts of irrigation and drainage decisions include volumetric water pricing, water markets, tradable water allotments, adjustments in area-based cost recovery programs, and incentives for farmers to use irrigation methods that reduce deep percolation. Several of these policies have been implemented in recent years, with mixed success, as governments and water resource agencies have increased their use of economic incentives in the design of irrigation and drainage policies.

In some cases, such as the promotion of private tube-wells in India and Pakistan, efforts to improve the efficiency of water use can exacerbate problems of waterlogging and salinization. For example, a subsidy that reduces the price of electricity to encourage tube-well pumping may reduce water table pressure in some regions, while increasing the salt load applied on irrigated land in others. In Egypt, the national Irrigation Improvement Project may increase the volume of water available to farmers in some regions, while reducing the volume available in others. The net effect on waterlogging and salinization is not clear in the absence of appropriate pricing and allocation policies for irrigation and drainage resources.

This paper describes the role of economic incentives in designing innovative policies that may reduce the rate of increase in waterlogged and saline areas. Practical issues, such as the ability to implement economic incentives in regions with limited ability to control and measure water deliveries accurately are given special attention. The paper includes: 1) a conceptual framework describing the role of economics in generating problems of waterlogging and salinization; 2) recommendations regarding appropriate policies; and 3) a review of policies and programs implemented to date, in selected regions.

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11.b.2
Fruit Tree Orchards and Well Irrigation for Household Incomes in Dryland Farming Systems of Northern Syria

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In Syria, nearly all land suitable for rainfed agriculture is already under cultivation today, and emphasis has been given to intensification of production and resource use. Farmers reduced the use of fallow in crop rotations, increased areas under irrigation through the digging of wells, and established fruit tree orchards. The barley-growing area of El Bab district, Aleppo Province, was chosen as the study area and interviews with 100 randomly selected farm families were conducted. Once dominated by traditional dryland farming based on integrated barley livestock systems, olive orchards and pump irrigation have changed the landscape of the area. Surveyed farm households were grouped, according to characteristics of their resource bases and use, into three farming systems, namely the 'Irrigated', 'Resource Rich' and 'Resource Poor' systems, allowing analysis and comparison of the income structure and economic success among systems. The prospect of higher yields, more reliable harvests and the production of high value crops have made the high investment and operating costs of irrigation economically attractive to farmers. Farmers bear the full risk of their investment in a situation where amounts and future availability of ground water are uncertain.

The system appears to be unsustainable: diminishing ground-water reserves will mean higher drilling and pumping costs, and failure of many existing wells. Economic incentives and technical assistance, made available to farmers for the establishment of tree plantations, encouraged their decision to convert cereal production area into tree orchards. Under the environmental conditions in the study area and current management practices of farmers, yield development and economic returns from these slow-maturing perennial crops have lagged behind farmer's expectations of higher future incomes. As profitable irrigation expands to its limits, rainfed farming will remain the predominant land use, supplemented through off-farm income sources. The challenge for the existing barley livestock systems requires research, and strengthened educational and financial institutions to develop more effective and sustainable alternatives to improve and secure family incomes and the livelihood of the farming community.

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11.b.3
Social Impacts of Land Degradation in Egypt Old Reclaimed Desert Lands: The Case of South Tahrir and Mariout Areas

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This study aimed to clarify the pattern of relationships that might exist between some social variables and the land degradation started to occur in some old reclaimed desert lands in Egypt. A sample survey was applied in two stages on two different areas in the Western Desert in Egypt. The first stage was considered an exploratory to test the methodology and data collection tools recommended. The second stage was undertaken in a different area.

The unit of study was the farm/household unit. A stratified quota systematic random sample was selected to represent both affected and non-affected groups in each area. The sample size was 119 and 170 in the South Tahrir and Mariout areas respectively. The variables studied included the main demographic variables such as age, gender, marital status, educational status, occupational status, family type and family labor. All the components of the socio-economic status; educational status, labor status, housing conditions, size of land holding, house appliances and capital assets were also studied. The social variables studied included group action to solve the problem, rise of conflicts between the affected and the non-affected groups, political participation at the community level, general satisfaction, the change of some technical agricultural practices, opinion towards future action in farming under the prevalence of the environmental problems and priority of problems.

Statistical analysis was undertaken to test the significance of differences related to some social variables between the two groups of farm-holders; the affected and non-affected by the environmental problems mentioned before in the two areas. Results showed that in both areas of study there are highly significant differences in connection with the following variables; group action to solve the problems, rise of conflicts between the affected and non-affected groups of farm-holders, and political participation at the community level. Significant differences were also found between the two groups in the assets of household appliances and capital tools. Further significant differences were found between the two groups in one area but not in the other in the change of agricultural practices, opinion towards future action in farming and priority of problems.

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11.b.4
Rural Development in Dry Areas: Southeastern Anatolia Project

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The Southeastern Anatolia Project (GAP) is one of the largest and the most comprehensive regional development projects not only in Turkey but also in the world in terms of the physical structure involved, the area covered and the objectives that it seeks to achieve. The Project has been transformed into an integrated regional development scheme spanning many sectors with the introduction of the GAP Master Plan. In addition to dams, hydroelectric power plants and irrigation systems, investment which complement each other for regional development in areas of agriculture, industry, rural and urban infrastructure, transportation, education, health and culture have been incorporated in the project in an integrated manner.

The GAP region has a very important place for agricultural production thanks to its natural sources and geographic situation. Agricultural sector is still the main economic sector in the region according to statistical data and as a lifestyle. There are 3,923 villages and 4,840 hamlets in the GAP region and the 35% of the total population is rural population. The GAP Region has 3.1 million hectares of agricultural lands. It covers about 10% of cultivable agricultural land of Turkey. Rainfed agriculture is predominant in the region, crops diversification is limited, and productivity is low. The value of total agricultural output of the GAP region is estimated as equivalent to 120 million US $ and the contribution of the GAP region, to the agricultural GNP is about 10% in 1997. As agriculture is by far the dominant sector in the economy of the Region and rural development is one of the most important issue of the GAP. The project will

lead to fundamental changes in these areas as "development" is not only a matter of economic growth but also a process of upgrading the living standards of individuals and society. As a direct result of the GAP investments, the living standards of many inhabitants have already started to increase. With progressive implementation, more and more people will become direct beneficiaries of the Project. In the process of realization, GAP has already achieved some important results from the completed and ongoing projects. The objectives of those projects are training of farmers, creating possibilities to ensure such developments as the elimination of regional disparities, enhancement of the income level of the people, reduction of unemployment, removing the income differentiation between farmers in dry land and irrigated land by introducing new fields of income generating activities.

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11.b.5
Women's Response to Environmental Problem in Old Reclaimed Desert Lands in Egypt: The Case of Mariout Area

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This study aimed to investigate the impact of an environmental problem on rural women's livelihood, and to clarify their responses toward soil salinity and rising ground water level in their family land holding.

A sample survey was applied on a sample of farm holders Mariout area in the Western desert in Egypt. The unit of study was the wives of the farm household, a stratified random sample was selected to represent both those who had been affected by the environmental problems and the non-affected. The sample size was 169 women. The objective of the study components were: a) to clarify women's role in farm activities, and the increasing burden inside and outside their houses due to environmental deterioration b) women's responses to their family economic hardship and the coping strategies they have used to sustain their families' well-being, and c) to investigate the impacts of the environmental problems on women's health and their perception of general satisfaction of the social services and facilities in these areas. The investigated variables included the main demographic variables as age, education, family type and occupation. The socioeconomic status include size of land holding, house appliances, housing conditions, capital assets and family labor.

The statistical analysis have been used to test the significance of differences between the two groups; the affected and non-affected by the land degradation as related to the above-mentioned social variables. To examine the impact of some socio-economic independent variables on the families coping strategies including objective household adaptations and subjective coping strategies.

Results showed that there are highly significant differences between the affected and non-affected groups with regard to the increasing burden of farm activities, their feeling of economic hardship, their satisfaction of the services and facilities in their community and their role in the decision making process. The relationship between the independent variables and family coping strategies were significant. There was significant relationship between the housing condition, family size, family landholding and the subjective coping strategies the family have used.

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11.b.6
A Model for Integration of Women to Development Process: Catom

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The Republic of Turkey Prime Ministry Southeastern Anatolia Project Regional Development Administration (GAP-RDA) has identified and started a project to improve the status of women in the GAP region since 1992. In the framework of this project, Multi-Purpose Community Centers (ÇATOMs) in which the training programs for women and young girls on literacy, health, family planning, maternal and child health, nutrition, home economy, income-generating activities have been implemented, and social and culture activities have been organized and established in squatter settlement and central villages since 1995.Participatory, holistic and integrated approach are the basic policy of all ÇATOMs. The contexts of the basic activities carried out in the center are being determined by the participation of the target groups, and their participation and contributions are essential in the applications. In this paper, the process of project implementation and the outcomes of the project is presented.

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11.b.7
The Use of GIS and Geostatistical Analysis in Measuring the Sustainability in El-Hamam Area, Egypt

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One of the most important indicators that illustrate the success of the sustainability in the newly reclaimed lands in Egypt is the increase of the stabilization. In this study, a set of villages represents a small part of Nubaria region known as El-Hammam zone, will be monitored as one cluster. This study depends on the use of GIS for the correlation between the geostatistical analysis and the analytical approaches. The effective soil depth, Ec, available moisture content and altitude data of the different villages have been used to determine their impact on community stability, agricultural production and economic social status as indicators of sustainability. Our analysis of the above-mentioned aspects, with emphasis on their availability and efficiency, will be used to interpret the rate of stability in the different villages and identify factors promoting or suppressing the sustainability of these communities. The decision-makers at local and regional levels can use these geo-information products in planning sustainable land management and sustainable development.

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Topic No. 12

Sustainable Development of Oasis

Session 5.b

5.b.1
Moisture Capturing by the Desert Mountains and its Effects on the Oasis Environment

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In order to utilize the natural environment for human benefit, many efforts have been striven through the history. However, we cannot regard the present global status as successfully attained yet. Instead, adversary conditions have been resulted, leading us into the worse. In the arid region we can count some of such cases. It has been long since the first organized attempt were tried for the development of world desert by UNESCO, i.e., the Arid Zone Research. The research included coastal desert in its later stage, but unfortunately the scheme was terminated without allowing research to enter into the depth, and left many potential subjects of importance. In the Arabian Peninsula there are three regions where the arid coast closely walled by the high altitude terrestrial mass; the Hejaz on the Red Sea Coast, the Dhofar Mountains on the Arabian Sea Coast and the Hajar Mountains on the Gulf of Oman Coast.

Due to the highly heated conditions of the lower atmosphere, these coasts are arid in a relative sense. But in reality, the local air can be one of the moistest ones in the world, when absolute humidity is considered. The local air of these regions is often forced to ascend the walling slopes to more than 1000 m, and even 3000 m at the maximum case. Simple calculation shows 10 to 40 grams of water to be separated as liquid from each 1 cubic meter air during the ascent. Such separation is tangible in the field, and we recognize that due water resources are dissipated by the destruction of vegetation which could capture the wind-blown droplets: the separated liquid. Rejuvenated study of coastal desert and recreation of vegetation on the coastal mountains are required to derive the potential resources for the drastic improvement of the local hydrological cycle; the improvement of oases.

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5.b.2
The Experimental Research on Controlling Drifting-Sand in Edge of Cele Oasis

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The Cele Oasis is located in the southern edge of Taklimagan Desert with adverse natural conditions and serious hazard of wind-drift sand. Since staring this study work in 1983, very good effect has been realized. This paper contains the research work and the outcome of the project. In the process of controlling drifting sands experimental study in Cele Oasis, the main fovus is as follows:

1- Research on renewing, protecting and using natural vegetation.
2- Research on techniques of fixing drifting-sand with summer flood.
3- Research on techniques of planting and rational using fuel forest.
4- Research on rehabilitation and utilization of sandy land.
5- Research on introduction and growing seedlings.

During the process of experimental research on controlling drifting-sand in Cele Oasis, the main methods are as follows:

1- Obstructing sand resource by washing sand canal.
2- Establishing herbs zone protecting sand drifting.
3- Silviculture on wind gap.
4- The network of forest belt change microclimate.
5- Clearing dunes with separating method.
6- Reform soil with green manure.
7- Utilization and benefit.
8- Planting Tamarix spp. by silting sand.
9- Setting up wind barriers.

After six years, the controlling drifting-sand in Cele Oasis gained preliminary success, and made marked benefit:

1- Establishment of typical areas (700 ha) controlling drifting-sand and comprehensive protecting system has made a model for controlling drifting-sand that has an important social effect.
2- The establishment of typical areas of controlling drifting-sand and comprehensive protecting system has gotten distinct ecological effect in fixing drifting-sand and protecting wind, and changing microclimate of the oasis.
3- The establishment of typical areas (700 ha) for controlling pattern and comprehensive protecting system has gotten enormous effect.

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5.b.3
Oasis Ecology and Desertification Control of the Southern Margin of Taklamagan Desert

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By analyzing the oasis ecological characteristic of southern margin of Taklamagan Desert, the article uncovers the double characters of the oasis ecology and the inevitability that the oasis ecosystem should be threaten by the desertification.

Through the analysis of the courses, the author concludes the fundamental courses into two factors including artificial factors and natural factors and three respects, namely: population, water resource, and plants. Furthermore, the author provides a good model of desertification control for this area.

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5.b.4
Pest Suppression of Date Palm Insect Populations for Yield Effects and Component of Sustainable Development of El-Bahria Oasis, Egypt

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In El-Bahria Oasis (Giza governorate), date palm plantations suffer heavy infestation by *Arempses sabella, Batrachydra amydraula, Cocctrypes dactyliperda, Ephestia calidella, Deudoris livia* and *Carpophilus spp.* These insect pests cause 20 – 73.3% loss

of tamr annually. An integrated control program including mechanical, chemical, agricultural practices and biological treatments was evaluated against insect pests of date palms under field environment. Orchard sanitation and pruning of palms were highly effective in protecting palms and dates against *B. amydraula* infestation, while using date – bunches isolators significantly limited date infection by *A. sabella, E. calidella* and *M. ceratoniae* Delfin (bacteria biocide) gave better results than nemazal 5%. On the other hand, basodin 60% EC was superior in controlling *B. amydraula* and *E. calidella* while sevien 85% WP + sulphur effectively controlled *A. sabella* and *C. hemipterous*. Sumethion 50% gave the best results for controlling *C. dactyliperda*. Yield assessment of dates showed significant increase of treated palms compared with untreated ones. Field sanitation, palm pruning and employment of date-bunches isolators resulted in 31.9% - 58.6% yield increment. The highest rate of yield increment (73.7%) was achieved by spraying date palms by a mixture of sevien 85% WP sulphur and the least (18.1%) was obtained in sumethion 50% EC treatment.

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5.b.5
Study on Construction of Ecological Environment in the Hexi Corridor

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The Hexi Corridor is located in the western part of Gansu Province of China. It was once an important thoroughfare of the ancient "Silk Road", and has been a major base of commodity grain and raw and processed materials industries of the province. It is also a ties for the state's large-scale exploitation of the big northwest region at the beginning of the next century.

The Present Situation of Ecological Environment and its Evaluation The regional economy and Oasis have developed greatly since Liberation in the Hexi Corridor. The general trend of the ecological environment in the region is that the imbalance of natural environment will mingle with the worsening of the artificial environment, and that the ecological destruction and environmental contamination will coexist. It mainly manifests as follows: (1) The secondary salinization of land caused by excessive irrigation is very serious at the middle reach of interior river basin. (2) The sharp decrease in water resources at the lower reach leads to aridness and desertification of land. (3) The excessive felling, grazing and reclaiming of the forests and grasslands at the upper reach give rise to soil and water losses in mountainous regions. (4) The mineral resources have been exploited irrationally. (5) The atmospheric and water contamination are serious in some cities.

The Characteristics of Regional Economy and Industrial Structure Resources are very rich in the Hexi Corridor, with favorable conditions for the development of agro-natural resources and raw and semi-finished materials industries. The industrial structure remains to be readjusted and the tertiary industries remain to be strengthened. The ecological strategy in the region is that the land and Water resources should be allocated optimally; while developing the economy great attention should be paid to the environment rehabilitation and adhering to resource-saving principle. The economical increase should be coordinated with the environmental rehabilitation, in order to implement the sustainable development. This paper suggests that: (1) The river-basin planning should be made seriously. The land and water resources should be allocated optimally. (2) Great efforts should be made to develop and set up the national economic systems of resource-saving type, with water-saving as its priority. (3) The shelterbelt

network should be improved around the oasis and the desertified lands should be rehabilitated actively. (4) The environmental planning should be made seriously. The industries should be arranged rationally and the environmental contamination should be controlled. (5) The development of resources should be combined with the environmental protection.

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5.b.6
Creation of New Oasis in Xinijang

S.Y. Tong
China

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5.b.7
Integration of Oasis Agriculture in Pastoralist Husbandry in Semi-Arid Areas of Africa

M. Ferry
Elche, Spain

Numerous pastoral groups in Sahel and in East Africa own date palms. But, they are considered as picking trees although date fruits are of great importance for these societies. The droughts of the last thirty years have had tragic consequences for these societies. Oasis agriculture development could be one of the securing strategies for pastorals to face these crises. The ecological and socio-economic challenges and research needs for this development are presented.

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5.b.8
An Artificial Oasis in Dry Lands: Application of Shimanto Method to Reuse Treated Waste Water for Sustainable Social Development

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Security and scarcity of water resources has become a serious problem in many of water short countries, in both quantity and quality. The advanced waste water treatment system as Shimanto method, which was developed in the local government and industry in Kochi prefecture reusing the waste disposals such as plastics, organic carbon, activated carbon, calcium ball and zeolite, is put in a core technology of water recycling in Japan, aiming at 1) conservation of water resources, 2) preventive measure of environment protection <zero emission>, 3) conservation of energy and material resources, 4) educational initiatives to demonstrate the efficient water use and environment management, and 5) preventive measures to avoid the conflict among different sectors. The treated waste water with 1 mg/l of BOD is being used for toilet flushing, garden irrigation and source of the artificial lake in the campus. The small-scale distributed waste water treatment system would make feasible to reuse the treated

waste water in the region, comparing with conventional large-scale expensive urban sewage system.

The Japan International Cooperation Agency (JICA) has just offered the training course in the Kochi University of Technology such as "regional water environment management" to transfer the technology of small scale distributed treatment system and recycling with Shimanto method in the arid countries. The training program aims to create small scale man/woman made artificial oasis in the dry lands by introducing the Shimanto method to sustain the life, environment and society in the 21st century. The temporal result of water quality monitoring in 1997-1999 is also shown to demonstrate the viability of recycling treated waste water in a small scale distributed treatment system at the small towns or villages with weak finance building capacity.

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5.b.9
Evolution of Sahara Oasis

A. Benkhalifa
Algeria

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Topic No. 13

Role of NGOs and Indigenous Knowledge

Session 10.b

10.b.1
Integrating Indigenous Knowledge, Land Evaluation and Farming Systems Analysis to Support Participatory Technology Development for Dryland Agro-Pastoral Systems

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As a result of political, economic and environmental factors, the agro-pastoral systems in low rainfall non-equilibrial ecosystems of the Middle East have experienced significant increases in small ruminant populations with feeding of cereal grains/concentrates as a result of government subsidies and pricing policies and extension of low yield/minimal input barley cultivation into rangelands. Sedentarization has lead to breakdown of traditional controls on grazing lands. These factors have resulted in major degradation of rangelands and increased dependency of producers on imported or domestic feed sources from other higher rainfall or irrigated areas.

The development of appropriate and acceptable technologies to address this increasing 'feed gap' is complicated by a number of factors. Temporal and spatial variability in rainfall results in temporal and spatial variability in natural resource productivity. Producer's land resources involve various forms of common property and fragmented cultivated plots. Land has multiple functions, which change with seasonal and annual climatic conditions and land used by members of a community often involves multiple watersheds, frequently non-contiguous.

Given the nature and constraints on current production systems, a central issue in the development/introduction of new technologies in such areas is what modifications are possible/feasible in such areas and what would the potential impact of such changes under various precipitation scenarios at the household and regional level be? Answers to these questions will assist in the process of adaptive research and participatory technology development as well as area planning for dryland communities.

To illustrate the process, techniques of land evaluation, watershed planning and management, farming systems analysis and indigenous knowledge/local knowledge and management systems involving spatial (GIS) and non-spatial modeling are used to examine the potential impact of possible rangeland improvement and various types of fodder shrub cultivation on the feed gap of a selected area of the North West Coast of Egypt.

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10.b.2
Traditional Architecture in Different Parts of the Egyptian Desert

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This paper will present the results of studying and analyzing different Egyptian desert traditional architectures. Egypt, covering about one million square kilometers, has 96% of its area as desert which is distributed over five different parts; namely: North Eastern, North Western, Southern, South Eastern and South Western. Architectural designs,

symbols and patterns, use of natural building material, plans and facades, window openings, colors and finishing material for human shelters located in each of these desert parts reflect the prevailing climate, social, cultural and environmental conditions.

In North Eastern desert, indigenous architecture of the Sassanian, Phoenician, and Byzantine eras was clearly reflected in the traditional buildings of this area as seen in El-Arish city and Sinai in general. In the North Western desert (e.g., Siwa Oasis), the indigenous architecture is a reflection of neighboring Libya due to the interaction between the two cultures. As for the Southern part of the desert, the Nubian architecture prevails and reflects old independent tribal cultures such as the "Fadoga", "Konooze", and "Matoaka". On the other hand, the South Eastern part is known for its "Elbaga" migratory tribes who live in tents made out of goat hair fabric, while the South Western part of the desert (Dakhla and Kharga Oasis) is characterized by the "Dome and Vault" architecture, which is the traditional architectural system adopted by the original residents of this area.

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10.b.3
The Center for Agricultural Services (TCAS): An NGO Example to Develop the Arid Lands in Palestine

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We are a non-governmental organization and non-profit, work in the fields of agricultural and rural development, environmental protection, and promotion the role of women in agriculture sector. We implement and execute different projects and activities related to agricultural sector. Land reclamation is one of our activities, which based on implementing different practical steps, that aim to develop the land, so that it will be suitable for cultivation, and to protect it from desertification and confiscation, as well as to increase the total area of cultivated lands.

In land reclamation program, priority is given to dry and semi-dry lands, lands that not used before and could be cultivated, and lands closed to borders. By conducting different projects related to dry and semi-dry lands, significant results have been obtained such as halting the spread of building over the agricultural land, increase the total green area by planting the reclaimed land with appropriate crops and trees.

It also increases the households income of the targeted beneficiaries. Project execution depend upon the active participation of local communities in steps of planning for the projects, and site selection.

The beneficiaries also bear and contribute a part from total expenses of the project. The land reclamation program is distinguished by a high participation of the local people, because it depends on participatory approach in implementation. TCAS have identified the development and reclamation of dry and semi-dry lands as one of its strategies that need an urgent response in order to stop desertification in the region, and increase the total area of cultivated lands.

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10.b.4
Sustainable Development of Dry Lands: The Role of NGOs

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The low productivity of livestock in dry lands would recommend promoting non-agricultural activities, one of which is agro-processing of local wool and camel hair into improved articles for local and export markets. Agro-processing would help farmers to increase the opportunities available for adding to the farmgate value and improve the quality of their farm produce. Small scale industries, operated by local women, as spinning and weaving of local animal fibers, and improvement in the quality of their products, such as cloaks, covers, blankets and floor coverings together with some tourist attractions, would ensure the optimal use of the available resources. This would permit farming in dry lands to be sustainable as means of improving the standard of living of local inhabitants.

It is suggested to establish a revolving fund, from part of the sales, to provide credit to women to enable them to start a small-scale business, for product development and marketing crafts. Women NGOs would provide market outlets for their products.

NGOs would play an important role in socio-economic development, especially that of women in desert areas, hence more participation of inhabitants in realizing the aims of development.

Database of NGOs and promoting their activities in training, management of quality control and in marketing of products of local environments would contribute to sustainable development of these areas.

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10.b.5
A New Eco-Desert Settlement in Sinai: The Case of New Basaisa

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New Basaisa is a new eco-desert community constructed at Ras Sudr, South of Sinai, Egypt. The project is a grass-roots initiative aiming at the construction and development of a new productive settlement in the Sinai desert. It is a living model for organized internal migration and redistribution of the population. In 1993, the Basaisa community development association (Basaisa CDA) started a participatory program with the objective of solving the problems of unemployment facing the educated youth. This was accomplished through providing training and capacity building to create employment opportunities for newly graduates. Upon collaborate efforts; the association encouraged Basaisa village youth to move to the desert. The objective was to cultivate the land, to provide working opportunities for the youth, to assist in the national efforts to move people out of the overcrowded Nile Delta to the wide deserts in Sinai and south of the Valley, and to start a productive human settlement in the deserts of Egypt.

The community has a total area of 700 feddans (one feddan = 0.42 ha). and is located at the 10^{th} km from the town of Ras Sudr and at the 50^{th} km from Ahmed Hamdy's Tunnel, on the main road between the tunnel and Ras Sudr and overlooks the Gulf of Suez. The New Basaisa community is about 200 km from the Old Basaisa village of El-Sharkia Governorate and about 180 km from the center of Cairo. The new community depends on the principal of cooperation in production, services and

marketing. The buildings abide to the architectural philosophies of Architect Hassan Fathy that fit with the desert conditions. The community is determined to use new irrigation technologies and renewable energies as well as to preserve culture and the environment.

The paper presents the development of the project and highlights the participation of the local people and the role of the non-governmental organizations in such a unique grassroots project. The paper also presents general guidelines for moving people out from the Nile Valley and Delta to the new desert areas and for facing the challenges of the 21st century.

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Poster Sessions

P1
The Use of Agro-Meteorological Data to Calculate Fertilizer Requirement

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FERTICLAC is a software developed by the Central Laboratory for Agricultural Climate (CLAC) aiming at estimating fertilizer scheduling, mainly nitrogen, potassium, phosphorus and magnesium, as well as iron and manganese. The program has several forms including crop, location and soil (as in IRRICLAC), in addition to previous crop, soil problems (salinity, alkalinity and carbonates), fertilizer available (organic and inorganic) and nutrient response curve. The user will have the option to select from a list any available fertilizer to estimate units of each individual nutrient form in that fertilizer as well as its physical and chemical properties. The user also will be capable of editing the response curve for the above mentioned nutrients. The program calculates the fertilization schedule according to the crop type and age, soil type, location, and available fertilizers. The software has options to run basically in Arabic or English, with capabilities to be adapted to any other languages after translating a list of words from English during installation.

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P2
Phenotypic Stability of Yield and Yield Components in Some Wheat Genotypes under Egyptian Conditions

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Fifteen genetically diverse bread wheat genotypes were tested in two field experiments during two winter successive seasons, at Zagazig in two different locations i.e. El-Khattara desert area Fakkus sandy soil, and Om-Elzain village, Zagazig which considered clay soil. The randomized complete block design with four replications was used. The obtained results could be summarized as follows: Concerning number of spikes/m2 regression values were above 1.0 for wheat genotypes, Giza 162, Sakha 8, Sakha 69, Giza 164 Sakha 8 x Hattri 48, Sakha 8 x Hattri 51, Giza 157x Hattri 23, Giza 157x Hattri 14 and Sakha 8 x Hattri 46, revealing that these genotypes were sensitive to environmental change (below average stability) and could be grown in specific environment. For grain yield (ardab/feddan regression coefficients were below 1.0 for wheat genotypes Giza157 (bi=0.93) Sakha61 (bi=0.90), Sakha92 (bi=0.95) Giza 163 (bi=0.96), Sakha8 x Hattri 33 (bi=0.93), Sakha8 x Hattri 48 (bi=0.99) and Giza 157 x Hattri 14 (bi=0.95), suggesting greater resistance to environmental changes (above average stability) and, therefore increasing specificity of adaptability to low-yielding environments. Yield components characters were also discussed in the presentation.

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P3

Productivity of Green Cowpea Yield in Sandy Soils as Influenced by Different Organic Manure Rate and Sources

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To investigate productivity characters of cowpea green yield *(Vigna sinesis)* cv. Cream 7 under sandy soil conditions at the experimental farm of El-Bossaily region, Beheira governorate, field experiments were carried out in 1998 and 1999 seasons. Each experiment included eight treatments, seven of which represented different combinations of cattle and chicken manure fertilizers, i.e. 30+0, 25+5, 20+10, 15+15, 10+20, 5+25, 0+30 m^3/feddan, respectively, in addition to the control treatment (recommended mineral fertilizer). All investigated organic manure treatments overcame the control, with respect to vegetative and reproductive growth characters as well as pod nutritional characters, except for fruit earliness. However, 10 m^3 cattle manure + 20 m^3 chicken manure/feddan treatment was superior, indicating the favorable effects of chicken manure, followed by cattle manure.

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P4

Response of Some Tomato Hybrids to Organic Fertilizer under Newly Reclaimed Soil Conditions

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Tomato seedlings (*Lycopersicon esculentum*, mill) were transplanted at the experimental farm of El-Bossaily region, Beheira Governorate, in 1998 and 1999 seasons, to investigate the response of some tomato hybrids to fertilizer. Ain Shams, Dokki, and CL-150 hybrids, were used in the study. Three fertilizer treatments, i.e. control (30 m^3 organic fertilizer + recommended rates of the mineral fertilizer), 45 m^3 organic fertilizer + half of the recommended rates of the mineral fertilizer and 60 m^3 organic fertilizer only, were used. Results showed the superiority of Dokki hybrid followed by Ain Shams, for vegetative growth and yield characters except for average fruit weight; however, CL-150 was the least. Increasing organic fertilizer rates improved vegetative growth characters, flowers and fruits numbers as well as fruit acidity and ascorbic acid contents; however, average fruit weight was decreased.

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P5
Effects of Delta mix^{TM} and Organic Matter on Growth and Productivity of Some Vegetable Crops Grown under Sandy Soil Conditions

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Field experiments were carried out during two successive autumn seasons (1997-1998) at the experimental station of El-Bossaily, in order to study the effect of the application of Delta mix^{TM} (0, 150, 300 kg) organic manure (10-20 m^3/feddan) and NPK (50%-100%) fertilization on the growth and yield of snap beans (*Phaseolus vulgaris* L.) and potato (*Solanum tuberosum*) plants under sandy soil conditions. The experiments were designed in split plot design and statistically analyzed according to Snedicor and Cochran (1980). Delta mix^{TM} was applied before planting of rates of (0.150 and 300 kg/feddan).

Plant growth parameters, quality and chemical composition were recorded for both beans and potato plants. Data showed that the highest snap bean vegetative growth and yield were obtained by using the highest level of Delta mix^{TM} (300) combined with the highest levels of organic manure (20 m^3/feddan) and NPK (100%) The lowest results were obtained when the organic manure and NPK were used without Delta mix. Similar results were obtained with potato plants. The highest vegetative growth and the best tuberization were obtained using the highest rates of Delta mix combined with organic manure and NPK, while using the organic manure and NPK without Delta mix did not give the same results. On the other hand, there was no effect of the different rates of Delta mix concerning the chemical composition of potato tubers. It can be concluded that using Delta mix^{TM} produced vigorous plants and better growth with higher quality of pods and tubers. Also, using Delta mix^{TM} can compensate the organic matter deficiency under sandy soil conditions.

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P6
The Use of Plastic Bags for Growing Cucumber under Plastic-House Conditions

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Growing cucumber, *Cucumis sativus* L., under plastic houses in normal soil culture has been facing several problems related to cultivating the same soil for more than a decade without sufficient soil aeration. Efficient equipment could not be used to solve this problem due to the metallic construction obstacles. Another difficulty was associated with soil-borne diseases accompanied with restrictions on the use of soil fumigation

chemicals. This study, therefore, was conducted to avoid the above-mentioned problems and to test the best growing conditions for bag culture under local plastic-house circumstances. The experiments were carried out at Dokki greenhouse station during the 1997/98 and 1998/99 growing seasons. Six treatments using plastic three plastic-bag sizes filled with washed sand and 10 or 20% organic material have been evaluated. Vegetative growth parameters in terms of plant height, leaf number and leaf area as well as reproductive parameters in terms of fruit number and weight were monitored. The results will be discussed in relation to the local conditions.

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P7
Effect of Improved Natural Ventilation of Plastic House on Cucumber Grown in Egypt

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[2]Faculty of Agriculture, Ain Shams University, Cairo, Egypt

The experiments were conducted in El-Bossaily Protected Cultivation Unit during 1998 and 1999. Cucumber (*Cucumus sativus*) var. Primo, seedlings were transplanted during February in both seasons in the plastic house. Two methods of natural ventilation were tested in comparison with standard greenhouse for cucumber grown under plastic houses. The first method was side ventilation from both sides of the plastic house, and the second method was the upper ventilation on the plastic house. The resulted showed that side ventilation reduced the temperature in the plastic houses by about 2-3 °C in winter and about 4-5 °C in summer time comparing with control. The relative humidity was also lower by using the side ventilation followed by the upper ventilation then the control. Plant height, number of leaves, number of flowers, number of fruit and total leaves area were increased when the plant grown under plastic house with side ventilation. This reflected on the early and total yield where, the highest early and total yield were obtained by using the side ventilation followed by the upper ventilation then the control. No fungal diseases were noticed in the side ventilation. In contrary, the highest infection was in the upper ventilation comparing with control.

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P8
Integrated Natural Resources Management System

I. A. Hussein

El-Sheikh Zuwayid Station, Desert Research Center, Cairo, Egypt

El-Sheikh Zuwayid Station was established in 1995. The Station is situated at the North-East Coast of Egypt. The site is one of the outer research stations of the Desert Research

Center, Cairo, Egypt. Due to the prevailing environmental condition of the location; the Station is facing water shortage, water salinity, sand dune encroachment and plant genetic erosion. Therefore, an integrated natural resources management system represents the state of the art technology has been approached to meet these challenges. This paper describes the techniques and technologies being developed in El-Sheikh Zuwayid Station in order to create an integrated natural resources management system under North Sinai conditions.

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P9

Adaptation of Some Wheat Genotypes to Nitrogen Deficiency under New Lands Conditions

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Nutrient deficiency limits crop yields at almost all newly reclaimed areas in Egypt. Twelve wheat genotypes; two landraces, seven bread wheat and three durum wheat genotypes were evaluated at El-Bustan desert under two N levels; low (70 kg ha^{-1}) and high (240 kg ha^{-1}). Grain yield response index (GYRI) was calculated to classify wheat genotypes into four groups; (i) ER efficient and responsive, (ii) ENR efficient and non-responsive, (iii) NER inefficient and responsive and (iv) NENR inefficient and non-responsive.

The results indicated that N fertilizer significantly increased grain yield and biomass from a mean of 1.6 to 2.5 and 5.4 to 8.1 t ha^{-1} under low and high N levels, respectively. There was also a progressive increase in number of tillers bearing spikes and 1000-kernel weight with increasing N supply. In contrast, number of kernels per spike and harvest index did not increase.

Our results reported that there were substantial differences between entries in their response to increasing N fertilizer rate. GYRI separated the studied genotypes into four groups: ER (Sakha 69, Sakha 93 Gemmeiza 5 and Gemmeiza 7), ENR (LR 20 and Gemmeiza 9) NER (LR 9 and Bani Sweif 3) and NENR (Giza 164, Giza 168, Bani Sweif 2 and Sohag 2). From a plant breeder point of view, genotypes falling in the ER group are most desirable because they produce high yield at low as well as at high levels of N genotypes under ENR are also desirable because they produce higher yields at low N levels.

This study indicates that there are considerable differences between genotypes in wheat crop in their ability to take up nutrients from deficient soils. Breeding for N efficiency could consist of the selection and breeding of genotypes adapted to low nutrient availability in the soils and with a high efficiency in the utilization N fertilizer applied.

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P10
Transmission of Heat Temperature in the Soil over Giza Agro-meteorological Station (Egypt)

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The temperature of soil is important as it is one of the limiting factors to root growth. Knowledge of soil temperature may be useful in determining the suitability of planting sites, length of growing seasons and periods of most rapid growth. In the present paper the maximum and minimum of daily soil temperature at different depths (2, 5, 10 and 20 cm) at El-Giza station were analyzed and discussed. These data also were correlated with the screen air temperature at 1.5 meter above the ground. A general idea is also given of the transmission of heat soil from three fields (dry, moist, and grass). Also, thermal diffusivity of the three fields at different depths has been calculated.

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P11
Sustainability of Soil Resource Base by Native Vegetation in the Semi-arid Region in Northeast Brazil

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The area used for this experiment is located in Irauçuba municipal district at the north of the State of Ceará, Brazil. This area presented Solonetz, and "Planosol" soils occur in association, and BSW climate, that is, warm and semi-arid. The *"caatinga"* landscape is the predominant vegetation, several botanic families are represented in this vegetation, the number of small landscape species is close to 26, and the sub-tract can be designed by *bromeliaceas* of small tree type and herbaceous species in the abrasive type. However, this potential in addition to floating annual climatic conditions, presents local variations in large number. Antropogenic disturbance of the fragile ecosystem under arid and semi-arid conditions, together with periodic droughts, has caused a severe degradation. This study summarizes the results in an area of six hectares, sub-divided in groups. The experimental design utilized was a randomized block design with three replications. Depending on the conditions of the species present there, the vegetation can be classified as excellent, regular or poor. We conclude that studies show the limited growth of the vegetation through adverse climatic conditions.

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P12
Technologies for Improving Productivity of Degraded Lands

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Land degradation is the foremost problem of sustainable of dryland farming system in India. Besides, inherent natural resources constraints, land abuse and over exploitation of resources by the farmers are equally responsible for this scenario. Cultivation of marginal and sub-marginal lands, over grazing and cutting of vegetation, for fodder/fuel constitute the way of life in the quest for meeting the ever increasing demands for food, fodder and fuel. Besides other land degradation issues, physical loss of soil and water through soil erosion by runoff has been causing progressive decline in soil fertility and productivity. Lack of adoption of appropriate crop management practices further adds to it. The dryland production system in vogue is thus not sustainable.

The strategy for management of such degraded and fragile eco-systems needs to be two pronged i.e. soil and water conservation, enhancement and maintenance of soil fertility. The soil and water conservation measures constitute the basic step. This is achieved by mechanical or vegetative measures or by a combination of the two. As the benefits of these measures are intangible, farmers do not invest on them, so Government support is warranted. The next step is the improvement of soil quality. In case of severely degraded lands; reclamation of whole area may neither be feasible nor economically viable. However, such lands can be made productive by improvement of point locations. In this context, a micro-site improvement technique developed at the Central Research Institute for Dryland Agriculture, Hyderabad, India has been found feasible and cost effective.

Silvipasture system with suitable tree and compatible grass/legume species is another option for rehabilitation of these lands. If the tree is a hardy leguminous species like *Leucaena*, microsite improvement may not be a prerequisite. Such species can be planted in contour furrows opened at appropriate row distances. In the inter-spaces grass/legume pastures can be grown. It has been observed that with such a system, the soil fertility is markedly improved over a period and the land can then be put to ley farming i.e. 3-4 rotation of arable crops with pasture grasses. Application of these techniques with involvement of farmers can help arrest further land degradation and make these areas productive on a sustainable basis. Results of studies carried out on these aspects are discussed in this paper.

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P13
Desertification Indicators of Arid Territories in Central Asia, Uzbekistan

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Water and wind soil erosion, vegetation demolition, deflation and soil salinization, reduction of organic substances content are the main natural processes, causing desertification. Irrational human economic activity has essential effect on desertification. Desertification processes cover many natural-climatic zones of the planet, but only arid conditions favor the desertification because of the peculiarities of hydro-meteorological processes.

Environment quality depends on mutual interaction of biotic and abiotic components. Their change caused external impacts disturbing ecological balance, and resulting in unpredictable consequences. Halo-geochemical cycle is disrupted most essentially in the Central Asian region. It is explained by the fact that at present the Aral Sea cannot be a natural salt-receiver with surface flow because of the Sea drying out. As a consequence, increased atmospheric precipitation of minerals in surface water is observed all over the territory, soil salinization is rising, and concentration of soil-origin aerosol is augmented in the atmosphere of the region. Aerosols are being transported with air masses all over the region and fall on the underlying surface of adjoined territories. Thus, desertification development in the region can be defined with the indicators characterizing dynamic of salt concentration change in the objects of biosphere: soil, vegetation, atmospheric dry and wet fall out, aerosols, surface and underground water. Taking the Aral Sea basin as an example, the possibilities of the suggested indicators are considered to evaluate the desertification development.

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P14
Proposed Classification for Pan Layers in Desert Soils, Suez Canal Region, Egypt

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A new classification for pan layers of arid and semi-arid regions was proposed. Pan layers are one of the most common limiting factors for land use in Suez Canal region. The selected samples from the soils and associated pan layers were subjected to physical, chemical, mineralogical, micro-morphological and unconfined compressive strength analysis. The proposed classification is based on qualitative field clues and quantitative laboratory data include; degree of slaking, particle size distribution classes, cementing materials, degree of induration, unconfined compressive strength, thickness, soil moisture regime, mineralogy classes and depth. Therefore, pan layers are classified to 25 families.

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P15
Soil Resistance to Soda Salinization

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The ability of the soils to precipitate lime was studied using five alluvial, two desert and five calcareous soils. The soil resistance to soda salinization was significantly correlated with soluble calcium and magnesium in the soil solution. Multiple regression showed that 78% of the soil resistance to soda salinization could be accounted for by soluble calcium and magnesium content in the soil. Removal of soluble salts decreased the soil resistance of alluvial soils by 50%, whereas it has no effect on calcareous ones.

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P16
Organic Residues as a Substitute for Chemical Fertilizers

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Clean and sustainable agriculture nowadays is mainly dependent on natural treatments instead of the chemical ones. Therefore, using the farm residues and other residues instead of chemical fertilizer could be a preferable means in this respect. Three types of composted residues were evaluated as possible substitutes for chemical N fertilizers. They were produced from bagasse (B) beet tops (BT), rice straw (RS) and sewage sludge (SS). The residues were mixed at weight ratios of 3 (B): 1 (BT): 2 (SS) to make up co-comp. I; 5 (B): 4 (SS) for co-comp. II and 4 (RS): 2 (BT): I (SS) or co-compost III. The produced composts were partly substituted mineral N fertilizer as a source of N for wheat plants grown in pots packed with two light textured soils of low and high lime content. The treatments involved were a control that received the recommended rate of N requirement as a mineral source (120 kg/N/feddan), and increasing rates of compost N at the expense of the mineral source.

Results showed that wheat of grain yield produced under the soil of the high $CaCO_3$ content was significantly greater than lower $CaCO_3$ content. The highest yield of wheat grain as well as the straw yield of both soils was achieved with the combined treatment consisted of 90 kg mineral N source and 30 kg N from organic compost. The productivity of both wheat grain and straw was higher in Soil II of heavier texture and higher lime content as compared with Soil I. In general, Compost I showed the highest significant positive effect over the other types of composts tested with respect to the total content of P and Cu of wheat grain, the second for Zn and Fe while Compost III showed superiority for N,K and Mn total content of plants. Soil II, as well as Compost III showed the highest values of total content all the tested nutrients in wheat straw.

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P17
Hydraulic Conductivity of Salt Affected Soils in the Northern Areas of Nile Delta as a Function of their Mechanical Analysis

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The exploitation of soils which are often salt affected under arid and semi-arid conditions, due to lack of rainfall, represent a corner stone for planning the strategy of land use under such conditions. The most suitable means and practices for soil and irrigation water management are of prime importance in the concern. In a previous paper, owing to the unique of characteristic of Nile Delta soils, models of salt affected soils were prepared by salinizing and/or sodication sand and clay soil mixture to state the different relations dominating such soils. This investigation was conducted to investigate the possibility of using the previously developed equations to characterize the relative hydraulic conductivity (k) of natural salt affected soils scattered in the northern areas of the Nile Delta. The obtained results confirmed the reliability of developed equations to signify and characterize the salt affected soils in Nile Delta which is of prime importance for planning the water irrigation policy of such areas.

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P18
Land and Water Management in Semi-Arid Highlands Area in the Republic of Yemen

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Republic of Yemen has varied agro-ecological regions, the highlands, coastal and plateau. This study will concentrate on the highlands region. In the highlands the arable land is distributed between terraces, wadis and inter-mountain plains. Northern Highlands vary between 1000-3700 m above sea level. The annual rainfall is 200-500 mm. In the Northern Highlands, the total arable lands are 384,500 ha of which 258,200 ha are under well irrigation, 7500 ha under spring irrigation and 10,000 ha under flood irrigation. The rainfall, and 108,800 ha region can be divided into three categories according to water deficiency (WD); first wet weather with 20%-30% WD, semi-dry with 30%-50% and dry weather with 80-90% WD.

Factors of land leveling and moisture are considered to be the most limiting factors on land and water management soil and thus crop production. Rainfed irrigated terraces, water harvesting and spate irrigated fields are considered the main water and land management methods. Terraces have been traditionally built to grow crops since ancient times. The purpose of constructing terraces was to expand the arable lands. Crops

grown in the terraces depend on soil depth in the terraces, rainfall and water harvest as source of irrigation. However, soil moisture in terraces is only enough to grow one crop per season. And moisture content and cropping pattern may varied according to terrace location. Water-harvest Irrigation Method 2 is practiced under agricultural conditions where rainfall is high (>5000 mm), under which water courses are built to collect running waters from the concave slopes of surrounding mountains. Streams of water are guided by farmers into reservoirs or directly into the field. In spate irrigation, water floods (run-off) that are collected from high rainfalls over nearby mountains and catchment areas is collected through a wide earth course called a *wadi*. Floodwater (spate) is then guided through main, secondary and field canals. Earth dikes of about 1-2 m high surround fields that are irrigated under such system in order to collect about 50-150 cm per planting single spate irrigation dose.

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P19
Crop Sequence Effect on Desertification Compact under Rainfed Conditions

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A series of field experiments were conducted in 1996/1997 season as part of the Nile Valley Research Program on a sandy soil at El Barth-North Sinai, which represents a rainfed area with an average annual rainfall of 100 mm. The objective of this study was to evaluate the effect of crop sequence on the compact of desertification under rainfed conditions. The percentage of aggregates 10-25 mm diameters in surface layer (0-30 cm) was improved when legume crops were included, three proposed rotations being (barley/lentil, lentil/barley, barley/pea. Pea/barley and barley/fallow, fallow/barley) were conducted in comparison with the prevailing rotation; barley or wheat (monoculture). After two years crop rotation, soil samples were collected at 0-30 cm depth and were analyzed for soil salinity (EC), alkalinity (ESP), pH, CaCO3% and soil aggregates stability.

The obtained results indicated that, no clear-cut difference was observed between zero-time data and after two years crop rotation with respect to pH and $CaCO_3$ % values. Introducing food and forage legumes (pea and lentil) in barley rotation decreased salinity and alkalinity hazards. The percentage of aggregates 10-25 mm diameters in surface layer (0-30 cm) was improved when legumes crops were included in the rotation. The highest values of 10-25 mm diameter in the top 30cm soil layer were found under the condition of pea/barley and barley/fallow sequences, respectively. While the lowest values were found under continuous cereal crops barley/barley and wheat/wheat rotations. The values of 10-25 mm diameters under different crop sequence were in the decreasing order; pea/barley> barley/fallow> fallow/barley> wheat/wheat≥ barley/barley≥ lentil/barley. The domination of this aggregates diameter in the soil is an indication of improving soil physical properties.

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P20
Soil Mulching under Different Irrigation Methods: Soil Temperature Effects

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A greenhouse experiment was conducted to study the effect of different mulch treatments: control (c); 50; 100g/m2 bituminous emulsion (B; B2) white; black plastic sheets (WPS;BPS) and 0.5;1.5cm thick gravel layers (G1;G2) on soil temperature under subsurface (SSI), surface (SI) and drip (DI) irrigation. Corn was planted in sandy soil and temperature was measured once a week during 63 days at 10 am and 2.30 pm at the depth of 5 cm. The increase in the mean soil temperature during the growing period ranged from 1.0-2.0, 0.8-1.7, and 0.2-1.2 °C at 10 am and 5.2-6.2,1.1-2.2 and 0.4-1.6 °C at 2.30 pm., under SSI, SI and DI, respectively. The minimum and maximum increase in soil temperature were achieved with (B1;G2) and (B1;WPS) under both SSI and SI, and DI, respectively.

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P21
Water Losses Because of Deep Percolation in Agricultural Fields during Irrigation Applications

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The agricultural sector is the principal consumer of water among different water users. The irrigation in the world (mainly in the arid zones) annually uses about 80% of a total human consumption of fresh water. Unfortunately, the efficiency of water use in agriculture is very low. Only about 40% of water extracted from the nature (from rivers, lakes, aquifers) is using to produce a crop yield. Another 60% is lost annually in the systems of irrigation channels because of filtration through the channel beds (40% approximately) and in the agricultural fields because of deep percolation through soil profile (about 20%). The agricultural residual waters frequently are contaminated with pesticides and fertilizers and have harmful impact on the environment. So, water conservation in agriculture is one of the principal present problems to prevent water recourses exhaustion and their contamination in arid zones. The purpose of this investigation is to understand how much and in what forms the water losses take place in the agricultural fields because of deep percolation through soil profile during irrigation applications. This is one part of the water losses because of deep percolation in agricultural fields. The other occurs between applications and between crop seasons. In general, the water losses because of deep percolation are realized in two forms: one q_1 with, and another q_2 without change of soil moisture along the soil profile. The form q_2 is

difficult to measure in the fields. Therefore, this investigation was realized by means of simulation of the infiltration process considering different soil textures, methods of water application (gravity or sprinkling with different intensities) for the fields with deep or shallow water table, different depths of root zone, different desirable soil moisture regimes.

The results show that the "invisible" water loss q_2 can be significant. It can achieve more than 50% of the accumulated infiltration in sandy soils during sprinkling with low intensity (around 0.5 cm h-1) and about 30% even in clay soils when the initial soil moisture is maintained at the high level (about 0.8 of field capacity). This kind of loss is reducing when the initial moisture is much less. However, in the last case the water loss up to 20% could take place in form principally of q_1, especially in the heavy soils when the gravity irrigation or sprinkling with rather high intensity is applied. The losses in form of q_2 do not depend on the depth of plant root zone. The losses in form q_1 slowly growing with increase of the root zone. In order to reduce the deep percolation during irrigation applications the smaller amount of each application but more frequent is preferable.

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P22
Approach to Verify Annual Irrigation Requirements in Order to Prevent Soil Degradation by an Indirect Way

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The physical, chemical and biological properties of soils and their fertility in agricultural lands could be changed by means of two basic ways: a direct way as a result of fertiliser application and plant, soil and water management. An indirect way as a result of change of natural hydrothermal conditions of soil formation processes. These conditions could be expressed in form of local hydrothermal index (HTI) as a ratio between annual values of solar net radiation and accumulative infiltration of water (precipitation minus surface run-off).

The direct changes of soils occur during relatively short term (some years) and can be predicted, for example, with the existed mathematical models like CENTURY, SCUAF, EPIC, etc. The indirect changes of soils occur during much longer periods. The approach to predict them is based on the theory of energy of soil formation by Volobuyev and on the geographic law of soil zonification. Regional average numerical data of some soil chemical, physical and biological characteristics representative for the areas with certain types of soil were used in the analysis. The data were selected for the areas with the same topographic conditions, similar subsoil texture and mineralogical composition, and zero or minimal land use. These data were compared with the index HTI. In general the procedure of treatment of the set of geographic data is the following: climate-topography-subsoil composition-land use-soil properties.

The graphic relationships between available data of soil properties and the local index HTI were obtained for the Mexican Republic by the authors of this presentation and earlier for the European and Asian parts of ex-USSR from tundra to desert zones by Aydarov I.P. In order to develop such relationships for Mexican conditions the set of geographic maps on climate, topography, subsoil composition, land use, soil types and their properties with the scale 1:250 000 were used. The soil with the same geomorphology and only with zero or very small (less than 0.001) surface slope were considered in the analysis. The plane surfaces with very small slope were preferred to exclude the necessity to take into account surface runoff and soil erosion. In arid zones, the index HTI in irrigated lands is reducing because of huge increase of annual accumulative infiltration of water to soil profile (precipitation plus irrigation requirement minus surface runoff) although the annual value of net radiation is growing as well. So, according to obtained relations between properties of soils and HTI for the conditions without agricultural land use it is possible to estimate how will be changed the soil properties because of change of HTI in irrigated lands.

This approach was used to verify the annual water requirements of irrigation in Mexican arid zone in order to prevent soil degradation by indirect way during long periods. The analysis permitted to conclude that in some irrigation districts the annual amount of water application should be reduced (up to 40%) to prevent slow soil degradation in long term according to change of HTI. It means that in those lands is expected gradual reduction of the crop response to the present practice of irrigation and fertilization if the annual water requirement would not be decreased.

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P23
The Balance between Supply and Demand of Water Resources and the Water-saving Potential of Agriculture Development in the Hexi Corridor

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The Hexi Corridor is a important base of agriculture development in NW China. According to recent statistics, there are 65.94×108 m3 of water resources available in the Hexi Corridor. At present, net consumption in development and utilization is 43.33×108 m3. Water supply and demand reach a balance on the recent level of production, but loss of evaporation and evapotranspiration as much as 25.69×108 m3. So net utilization efficiency of water resources is 59%. Based on analyzing balance between water and land considering ecological environment, there exists serious water shortage in the Shiyanghe River system where irrigation lands have overloaded. There is a comparative balance between supply and demand of water resources in the Heihe River system; and the Sulehe River system has some surplus water to extend irrigation land. Use of agriculture water accounts for 83.3% and ecological forest and grass for 6.9%.

The Hexi Corridor has a great potential for water-saving in agriculture production. Water-saving efficiency of irrigation is about 10% by using furrow and border-dike irrigation and small check irrigation etc. Common technologies, and saving water with

plastic film cover and techniques of advanced sprinkler and drip irrigation etc. can gain more than 60 % of total water resources. Water-saving potential of the Hexi Corridor has been estimated as 30-197 %. So the second water sources can be developed from saving water of agriculture in the Hexi Corridor. This potential can be carried out step by step under the following conditions: developing the water-saving agriculture, improving the ecological agriculture of oases in the river systems, and optimizing allocation of water resources.

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P24
Water Conservation in Different Soil Types:Compaction

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Water conservation depends on soil compaction even under irrigated crop management. This aspect was studied under semi arid conditions in Algeria. A two-year trial was carried out, the first year (total rainfall 341 mm) with three supplemental irrigation and the second season without any additional irrigation (rainfall was high 608 mm). Four levels of watering were compared in the first year, on eight variation of winter cereals (the most used in the region). Preliminary results indicate a compaction of the soil when irrigation is applied. The second year, the trial was conducted under rainfall conditions with the same varieties; the soil showed less compaction than under irrigation. Under irrigation compacted soil showed less field capacity which seems to confirm that soil water conservation is the most important factor for increasing cereal production, since soil is considered as a "reservoir" under semi-arid climate where rainfall is variable and precarious. Lack of water in the soil profile due to soil compaction and limited root development had a negative effect on cereal grain yield. Grain production under supplementary irrigation was 1.7 t/ha, whereas under rainfed conditions yield was over 3 t/ha.

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P25
Evaluation of Some Climatic Factors for Soil Erosion in Egypt

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Wind and water erosion are two main factors causing soil degradation due to removal of the soil surface containing the main plant nutrients. Rainfall has its effect on soil aggregates leading to local transport of small particles into pore spaces, hence, increase erosion and mass transport of soil materials. The aim of the research reported in this article is to evaluate some models of wind and rainfall erosion.

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P26
The Response of Egyptian Cotton Cultivators to Drip Irrigation by Treated Sewage Water in the Sandy Soils of the Northern Coast

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Field experiment was carried out in the sandy soils of northern coast, Marsa-Matrouh governorate, Egypt, in order to evaluate the growth and yield of eight Egyptian cotton cultivators (*Gossypium barbadense* L.) were grown under drip irrigation system by using treated sewage water. The experimental design was randomized complete blocks with four replications. Each plot was resembled by one bed of 30-m long and 1.45-m width. Planting cotton was on both sides of the bed in hills of 25 cm spacing and leaving two plants per hill. Planting date was March 31, 1992. The cotton cultivators used were extra long staple (Giza 45, Giza 70, Giza 76 and Giza 77) and long staple (Giza 75, Giza 80, Giza 81, and Dandara). The data obtained revealed that final plant height was relatively taller for Giza 45, 80 and 81, shorter for Giza 77 and medium for the rest of cultivators. Number of fruiting branches per plant and interned length were insignificantly affected. Number of open bolls and yield per plant were increased in favor of Giza 77, Dandara and Giza 45, lower for Giza 75 and Giza 80 and medium for the rest of cultivators. The higher yield of seed cotton was obtained from Giza 80 due to higher plant stand at harvest, followed by Giza 45, Giza 80 and Dandara, while it was lower for Giza 81, Giza 70 and Giza 76. However, the differences between yield means did not reach the level of significant limit percentage was higher for Giza 80, Giza 81, Giza 77 and Giza 75, lower for Giza 75. Seed index was relatively higher for Giza 77. Drip irrigation increased fiber maturity without affecting the rest of the fiber characteristics.

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P27
Engineering Properties of Zea Maize Kernels under Different Irrigation Systems

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An experiment was conducted for two growing seasons at Shalaqan Experimental farm of Faculty of Agriculture, Ain Shams University (loamy clay soil), to study the effect of different irrigation methods on physical–engineering properties of zea maize. Sprinkler, pivot, surface and sub-surface drip and modified surface irrigation systems were selected for this study. Data revealed that kernel dimensions, length and width were better when using sub-surface drip than those under other irrigation methods. Meanwhile, the best kernel thickness was obtained when zea maize was grown under sprinkler irrigation. Geometric diameter and spherecity which are considered the main criteria for grain separation and sieving operations show no significant effect due to methods of irrigation. Hectoliter weight, specific weight and porosity were not affected significantly due to

different methods of irrigation or other agricultural practices tested at the site. These properties are quite important characteristics concerning kernel storage, aeration and drying. Moisture content of kernel as the main storage quality parameter was higher under pivot and drip than under solid set sprinkler and surface drip irrigation methods.

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P28
Engineering and Biological Properties of Faba Bean Seeds under Different Irrigation Systems

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This investigation was carried out at Shalaqan Experimental farm of Faculty of Agriculture, Ain Shams University (loamy clay soil) to study the effect of irrigation system on engineering and biological properties of faba bean seeds, which are very important for mechanization processing and handling. Data indicated that the better seed dimensions were obtained when using subsurface drip irrigation system compared with the other irrigation systems. Irrigation systems had a significant effect on seed moisture content, friction coefficient, and germination percentage and vigor percentage while there are no significant effect on seed hardness. Modified surface irrigation system had high significant effect on seed germination percentage while center-pivot sprinkler and modified surface irrigation systems had high significant effect on seed vigor.

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P29
Impact of Uniformity of Center Pivot Distributed Water and Contribution of Ground-Water on Crop Yield

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A daily center-pivot irrigation water depth of 7.06 mm on the average was applied for corn and wheat in 1997 and 1998 at Salmia farm in west Nubaria Zone. The system precipitates 9.97, 6.96, and 5.70 mm depth on locations of 35, 188 and 382 m distance from the center of rotation, respectively. The soil surface elevation differences are 2.22 and 1.25 m at the first and the second location, respectively, compared to the surface at the third one; 0.00 m. Corn evapotranspiration amounted to 5.8 and 6.1 mm during July-August peak use in 1997 and 1998, respectively. It equalled 2.9 mm in March for 1997/98 wheat. The corn yield in 1997 from the third location amounted 83.3 and 135.1% of that of the first and the second location respectively. Whereas it amounted 70.9 % and 77.5 % of them in 1998. The wheat yield 1997/98 from the third location amounted to 106.1 % and 115.3 % of that from the first and the second location, respectively.

An upward capillary flow from a ground water table oscillated between –2.43 and –2.49 m during July–August 1997 raised the soil moisture content. It reached 15.8% of the Available Moisture Content (AMC) in the soil layers of –0.70 to –1.80 m depth in July and 16.2 % AMC in –0.80 to –1.80m layers in August. In 1998 the ground water table oscillated between –3.02 and –2.97 m during July and August. Water content reached 13.3 % AMC in –1.30 to –1.80 m layers in July and 13.4 % AMC in –1.20 to –1.80m layers in August. The ground water table oscillated around depth of –2.45 m in March 1998. The soil water content reached 15.2 % AMC in –0.6 to 1.80m layers. The upward capillary flow is more enriched with ammonium nitrate and total nitrogen at the third location than at first and the second location. Such limited increase of available moisture content and nutrient element nitrogen caused the unexpected yield results.

The studied center-pivot system is insufficient. It should be replaced by one designed to maintain suitable distribution uniformity. It is useful to utilize the upward capillary flow to save irrigation water and costs and to alleviate waterlogging problems.

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P30
Irrigation Technologies for Improving Maize Production Function in the Arid Ecosystem

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In Egypt, aridity is the prevailing climatic condition. Water resources are therefore the limiting factor for agricultural activities and consequently, on farm water management is the most important practice in crop production in the arid ecosystems. Fertilization policy and salinity control are also crucial under such conditions.

The objectives of this work are; to determine water requirements for maize under sprinkler, surface and subsurface drip and modified surface irrigation systems, to develop water production function for maize for optimizing yield under different irrigation techniques and to develop simple and easy to use irrigation scheduling techniques for maize selected irrigation and fertigation systems. To realize the research objectives a series of field experiments were implemented at three sites in Egypt. Shalaqan in the Nile Delta, (old land) and Bustan and Maryout in the new reclaimed lands.

Data of Shalaqan site indicated that the highest plants irrigated daily by subsurface drip followed by maize plants were under the pivot system. The 100 % Etc was the best treatment. The higher grain yield was obtained when using subsurface drip irrigation (4.4 ton/feddan) followed by surface drip, then modified surface and the least yield (3.8 ton/feddan) was for pivot sprinkler system, showed that daily drip irrigation using 100 % of Etc gave the best yield, (4.2 ton/feddan). Water and fertilizer use efficiencies were highly significantly affected by the tested treatments such as irrigation system, water consumptive use and irrigation scheduling. Daily drip irrigation so far, is the best irrigation management when using 100% of the calculated Etc.

The experimental site of Maryout, with calcareous soil and poor water quality, used only modified surface irrigation with gated pipes and long furrows. Two treatments

of irrigation water requirements with different leaching fractions, T_1, 15% and T_2, 25%. Control plot C was considered for comparison. Data revealed that none of the growth parameters were significantly affected treatments, except the ear diameter. Grain yield was highly significantly affected by the tested treatment, T_2 produced 4.04 ton per feddan comparing with 3.43 and 3.16 in both T_1 and C plot respectively. Water use efficiency was significantly affected by the treatments T_2 realized 1.24 kg per cubic meter irrigation water while T_1 and C realized only 1.11 and 1.12 kg per cubic meter of irrigation water respectively.

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P31
Effect of Irrigation with Low Quality Water on Some Chemical and Mineral Logical Properties in Fayoum

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The current study deals with two soils in Fayoum governorate differing in their textu. . i.e. sandy and clayey. The former soil was subjected with sewage water, while the latter one was subjected to saline drainage water continuously for 10 years. Variations due to such treatments that occurred in considered characteristics were quantitatively evaluated. Results reveal that although the pH was increased annually by about 0.1 unit in the soil irrigated with saline drainage water, it tended to be reduced in the soil treated with sewage water. Both soils showed appreciable increments in soil electrical conductivity, caution exchange capacity as well as in their content of smectites on expense of micas and kaolonite clay minerals. The rate of annual increments in such parameters i.e., EC, CEC and clay minerals semectites averaged annually to about 0.20 and 0.61 unit dS/m, 0.6 and 0.25 meq/kg and 0.7 and 0.81 for soil irrigated with sewage water and saline drainage water, respectively.

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P32
Evaluation of Some Sources of Irrigation Water in Egypt: A Comparison Study on Water Efficiency in Reclaiming Saline Soils

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The increase use of more water for land reclamation and irrigation has become so pressing that, the use of low quality water supplies such as drainage, well and sewage water for these purposes has to be explored. Water suitability depends on what can be done with it under specific conditions of use. Numerous schemes have been proposed for classifying water with respect to their suitability for irrigation. From those, the

classification proposed by the US Salinity Laboratory (1954) is the most widely used. The main objectives of the present work were to: Evaluate the quality of some sources of waters used in Egypt, i.e. Nile drainage, well and sewage waters, and assess the efficiency of these waters in leaching of salt affected soils. To fulfill these objectives, water samples were collected from different irrigation canals to represent fresh (Nile) water in Cairo, Giza, Kalubia, and Sharkia governorates. Also, drainage, well and sewage waters were collected from different locations in Egypt. Five soil samples, differing in their texture, representing saline, saline sodic and magnesium affected soils, also, were collected the soils were packed in PVC columns and leached in the laboratory using a representative water sample from the different water sources under study.

The obtained data show that:

1. The EC values of water are ranging from 0.31 to 1.0, from 0.41 to 9.33, from 0.70 to 13.25 and from 1.18 to 1.30 dS m-1 for fresh (Nile), drainage, well and sewage water, respectively.
2. The SAR values range from 0.8 to 2.73, from 1.37 to 18.51 from 0.32 to 19.40 and from 2.14 to 4.49 for fresh (Nile), drainage, well and sewage water, respectively.
3. The magnesium ratio value range from 21.39 to 50.32, from 28.27 to 71.05 from 0.1 to 64.12 and from 32.7 to 54.60 for fresh (Nile), drainage, well and sewage, water, respectively.
4. The RSC value range from –0.81 to 1.90 from –22.70 to 1.60, from –52.7 to 4 and from –3.80 to 1.0 for fresh (Nile), drainage, well and sewage water, respectively.
5. The CIP value range from 10.64 to 43.40 from 17.94 to 82.71, from 14.84 to 54.18 and from 38.05 to 51.55 for fresh (Nile), drainage, well and sewage water, respectively.

According to the criteria of U.S. Salinity Laboratory (1954), the fresh water, drainage water, well water and sewage can be classified as C_2S_1- C_3S_1,C_2S_1-C_6S_3, and C_3S_1, respectively. With respect to the effectiveness of the above-mentioned water sources in leaching saline soils, the obtained results showed that there is not much difference between the different sources of irrigation water, in the efficiency for salt leaching from soil. However, the efficiency of different water sources in leaching salt can be arranged as follows: Fresh (Nile) water >sewage water>drainage water>well water. The efficiency of leaching, i.e. the time needed for leaching the soil till EC value almost comparable to that of irrigation water, is dependent mainly on soil texture, the initial soil salt content, and the EC of the used water. Also, the results show that the EC of the final leachate, in all cases is almost equal to the EC of the used water except of the high saline high sodic soil, where, the final EC lasted higher than that of the used water.

It could be concluded that, low water quality, especially when it has low salt content can be used successfully in leaching saline soil and irrigation crops with little risk of adverse effects from the salinity and sodicity viewpoints, provided that some precautions are taken into consideration. With respect to magnesium-affected soil, the process failed as the water could not pass through the soil column.

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P33
Issues of Improving of Karakul Sheep Production Technology in Arid Zones of Uzbekistan

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Karakul sheep production in the Republic of Uzbekistan depends largely on the rangeland as the major source of feed. The paper is based on the results of a long-term research, which has been conducted to find out the feed available at the pasture during the grazing season and the need for supplementation by other feed sources. The research covers areas of grazing, scheduling, feeding on farm by products, flock management as well as other technologies. Measurements on some production parameters were taken and presented in the paper.

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P34
Productivity of Some Fodder Crops in the Irrigated Zone of South-Western Kizilkum

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Productivity of some fodder crops was evaluated in a five-year research program in Kizilkum Desert under irrigation from artesian wells. Yield and economic return were estimated for winter rye as compared to some other winter crops. Results show that the hay yield of the tested fodder crops ranged between 1.8 to 9.5 t/ha. Also, mixture of cereal and legume fodder crops was as high as 10.5 t/ha, when *Avena* L. was planted in mixture with *Vicia villosall.*

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P35
Creation of Improving Pastures in the Kizilkum Desert Conditions Using Different Fodder Crops

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Low productivity of natural pastures in Kizilkum Desert (0.15-0.2 t/ha) and the poor variety of plant species causes great difficulty for developing the Karakul sheep farming. Research was conducted to develop different agroghytocenouses based on natural plant species. This study reports for the performance of several promising varieties tested for five years: *Halaxylon aphyllum, Iellenia subophylla, Artemisia difusa*, and annuals. Results show that, there is variation between the tested varieties with respect to density,

plant light and yield. It can be calculated that yield could be increased 2 – 3 times by using newly developed, improved pasture varieties.

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P36
Chemical Compositions and Nutritive Value of *Ceratoides Eversmanniana* (stschgl. Et Losinsk.) Botsch. et Ikonn

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Teresken is an important fodder plant in the desert regions of Uzbekistan, with its high ability of adaptation to the desert conditions and existence over wide areas. This article presents results of a study conducted to evaluate the chemical compositions and nutritive value of teresken. Contents of raw proteins, raw fat. raw cellulose, raw ash and nitrogen-free extractive compounds (NFEC), karotin and ascorbic acid were estimated. In balanced experiments carried out on Karakul sheep, data show that the energetic fodder unit (EFU) is 0.52, and exchange index of energy is 3.05 MDj/Kg.

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P37
Which Alternatives to Improve Feed Security for Livestock in Low-Input Pastoral System? The Case of Arid Lands

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Livestock production is in some parts of the arid Andean highlands the only possible agricultural activity due to the combination of frost and aridity, which largely hinder crop growth. In this adverse environment, people developed highly adapted livestock production systems, usually composed of mixed camelid-sheep herds. However, these systems face high sensitivity to major climatic events such as a prolonged drought or heavy snowfalls, and are characterized by a very low productivity. Rangelands constitute the exclusive source of feed for livestock. They are dominated by so-called pajonales composed of coarse bunchgrasses from genera (*Festuca orthophylla*), the most widespread species in the arid steppe. It is intensively grazed year around by range herbivores, despite a low value. In this paper, we explore the possibility of treating paja brava hay with dung ashes for increasing its digestibility in llamas and sheep. Results from digestion trials showed that paja brava hay treated with a 20% dung ashes solution and 3% urea resulted in a significant improvement in dry matter digestibility, both in llamas and sheep (52.2 % and 49.7 % against 4.7 % and 39.4 % for non treated dry standing paja brava, in llamas and sheep, respectively). These result were comparable to the ones obtained from the treatment of paja brava with 3% NaOH+3% urea. Nutrient-digestion coefficients showed the effectiveness of the alkali treatments for improving

forage quality for both llamas and sheep. The significance of these findings is discussed in relation to feeding management strategies for low-input subsistence systems.

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P38
Parameters of Basis for a Reasoned Management for Sylvo-Pastoral Perimeters in Semi-Arid Atlantic Zone in Morocco

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In the Sahel South Doukkala (Morocco), the intensive and uncontrolled farming of pastures, added to the climate aridity, has led to the strongest decrease of the natural vegetation. More than 84% of land in this area suffers actually from the erosive actions of wind which is increasing the desertification process. Perimeters of improvement sylvo-pastoral, constitute the main action in this zone aiming the struggle against the desertification, the re-establishment of environment and the contribution to provide the food needs of the livestock, management of such perimeters necessitates the mastery of the functioning of their components. Interactions between strata of vegetation as well as their reactions to climatical and station are studied. They constitute parameters as a basis for best management.

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P39
Effect of Clipping Date and Height on Fodder Yield of Acacia saligna and Atriplex nummularia under Rainfed Conditions of the Northwest Coast of Egypt

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Two experiments were carried out for two seasons, 1996-97 and 1997/1998, to investigate the effect of clipping date and height on forage yield of *Acacia saligna* and *Atriplex nummularia* under rainfed conditions of the Northwest Coastal Zone (NWCZ) of Egypt. The fodder shrubs were planted in 1990/91's winter season, and were not utilized until the date of the experiment. *Acacia saligna* shrubs were planted on a site, 30 km west of Sidi Barrani, and the other site for *Atriplex nummularia* was 5 km south of Marsa Matrouh, Matrouh Governorate. A split-plot design was used for both experiments. Five clipping dates started from August until December were the main treatments of the two experiments. The sub-treatments for clipping height were 40, 80, and 120 cm above the soil surface for the *Acacia* shrubs, and 20 and 30 cm for *Atriplex*.

Research results indicated that the highest forage, dry matter, and crude protein yields were obtained in November and December at the clipping height of 80 and 120 cm

for *Acacia saligna*, and at 30 cm for *Atriplex nummularia*. Crude protein and ash contents for the intake by the animals were not affected by clipping date or height of *Acacia saligna*, while the crude fiber content was increased by increased clipping height. Crude protein and ash contents were very low in the remainder of *Atriplex nummularia* compared to the intake by animals, while the reverse was observed for crude fiber content.

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P40

Management System of Globe UNCCD Construction Projects for Effective Implementation of "UN Convention to Combat Desertification"

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The UNCCD was formulated by international society based on the summary of experience of desertification control in the world for several decades. Unfortunately, the situation of desertification was not yet improved, even tended to be worse. Therefore, it is necessary to formulate a new UNCCD to solve the problem. It is not denied that the UNCCD has promoted and guaranteed activities and international cooperation and assistance on desertification control. However, it can't secure achievements and certify the efficiency of investment in the world. For example, United Nations had announced that the situation of globe desertification had still tended to be bad in 1991 since the "Operating Plan to Combat Desertification " was agreed to adopt during the United Nations Conference in 1977. Subsequently, it is necessary to make a management system of construction projects, which deals with technological investment, construction plan, finance management and project acceptance. It can ensure the efficiency of construction project of desertification control. The system should be directly leaded by the Secretariat of UNCCD. The Committee of Construction Project Management has to input technologies, manage construction projects, and check quality of construction in region assisted by UNCCD or desertification control area. If so, construction projects can be completed with high quality, and the investment from assisting country can produce as high efficiency as possible on desertification control.

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P41

Manifestations of Man-Made Desertification in Southern Russia

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Arid degradation in southern regions of Russia have some specific features, the most significant of which are: local degradation of lands typical of deserts (Black earth, Kalmykia, eolian desert "Sarykum", Daghestan); formation of options of natural and

man-made desertification, progressing degradation of semi-desert, steppe and thistle ecosystems affected by droughts and their consequences. Study of a combination of desertification and steppization at accelerated effects of droughts has revealed advisability of a conceptual approach that provides for evolution of arid lands into a category of lands subject to man-made desertification.

1 Formation of various combinations of desertification and droughts are characterized by:1. Increase of albedo of a territory connected with widening of areas devoid of vegetation and increase of a reflection capacity of soils, thus, enhancing inversion of air compression over the earth 's surface and weakening of atmospheric convention.
2 Decrease of ecosystem biomass and soil moisture supplies that are responsible for reverse dependence of atmospheric precipitation from that part of moisture that evaporates from a soil surface.
3 Extension of areas occupied by industrial man's activity as a result of which a content of dust and sand in the atmosphere increases. There is certain relationship between quantity of suspended matter in the atmosphere and land areas used for industrial activity. By extending industrial land use and decreasing land biomass, Man facilitates steppization, dessication of land and high return of droughts. Eolian deposition and secondary salinization of soils are developing and their influence is in direct dependence on the scale of anthropogenic impacts. A steadily progressing desertification in Caspian Lowland and the Lower Volga more frequent occurrence of droughts in the South Rural, Siberia and Transbaikal have revealed an ascending tendency that does not resist desiccation of a soil profile and scarcity of a biological diversity of landscapes.

Major features of desertification in southern regions of Russia are a consistent transition of drought consequences to a category that characterizes a desertification and a direct dependence of this phenomena on a dust content in the atmosphere, a reflection capacity and a moisture content in soil, and extension of industrial land use.

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P42
Protection Effect on Vegetation Cover of Desert Ecosystem in Southern Tunisia

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The study was carried out in the natural region of Nefzaoua, Southwest of Tunisia, which belongs to the Mediterranean desert bioclimate. It was dealing with the dynamics of vegetation cover in these zones. Four sites, located all along a region presenting a gradient of aridity, were subject to evaluation of their vegetation cover both in fenced areas since ten, eleven and twelve years and in unprotected areas. The evaluation of plant covers, species composition, density, biomass and vegetation mean height in protected

and unprotected areas were followed. The results showed that: 1. The beneficial effect of protection decreases with the gradient of aridity; 2. After a protection of ten years, vegetation dynamics become very slow or even regressive in dry areas; and, 3. Whatever the duration of protection, desert ecosystems may not return to their original state if they have been subjected to serve perturbation.

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P43
Sahara and Sahel Observatory Contribution to the Convention for Combating Desertification in Africa

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The countries of circum-Sahara Africa adversely affected by desertification, their sub-regional organizations, their Northern partners and the concerned international organizations of the United Nations System have created the Sahara and Sahel Observatory (OSS) in May 1992. OSS's mission is conducted within the international framework of the Convention to Combat Desertification (CCD) and Agenda 21 and aims to favor the development and the optimization of its African partners' information wealth, for an optimal use of the means for combating desertification. With this aim in view, OSS programs intend to: 1. Contribute to the success of certain aspects of the action programs defined in the CCD; 2. Capitalize implemented programs and enhance the performance of African actors (national institutions, civil society, NGOs, sub-regional organizations, etc.); 3. Promote the dissemination of results and products to the benefit of its partners wherever there is a need for scientific and technical knowledge and innovation; and, 4. Promote African and international scientific and technical cooperation, in compliance with Articles 16 and 17 of the CCD.

OSS's presentation will focus on the following programs:

A. Support to the CCD implementation in Africa. This program gears around three axes:

1. The activities directly related to the priorities outlined by the Science and Technology Committee (STC) of CCD, i.e.: CCD monitoring indicators, inventory of local technologies and know-how, inventory of networks, scientific organizations and institutions able to support CCD implementation,
2. Innovative reflections with OSS's partners on topics of common interests related to key-aspects of CCD, and
3. Contribution to other OSS's programs with a view to meet the priorities of CCD.

B. Contribution to the implementation of a mechanism for the observation, monitoring and evaluation of desertification (DOSE). Knowledge and understanding of environmental and development problems in the OSS zone involved, on the one hand, the identification of the real causes of disfunctioning, and on the other, the

development of preventive-predictive-corrective actions. This requires finalized, multidisciplinary, live-scale diagnoses of the interactive dynamic functioning of socio-economic systems, agro-ecological systems and institutional systems.

C. Initiation of the concept and support to the implementation of systems for the circulation of information on desertification (SID). The objective of the SIDs is to facilitate access to the data and information required for the implementation of the CCD Action Programs at the national, sub-regional and regional levels. They are built as a series of items accessible in dedicated kiosks through the use of Internet services: Institutional kiosk, thematic electronic forum, virtual library and cartotheque, meta data bases. Prototypes have been developed at national and regional levels and are in progress at sub-regional level.

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P44
Conservation of Rare Reptiles in the Deserts of Middle Asia

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The total area of deserts in the Middle Asia occupying the Turan lowland is over 210 million hectares. To help protect natural complexes, the deserts of Middle Asia contain 14 nature reserves. But how well do they reflect the natural diversity of the territory? One of the important factors to be considered in the establishment of a network of reserves is the presence in protected areas of rare species listed in the "USSR Red Data Book" (1984); 16 species of rare reptiles occur in this territory, while four of these are not protected in reserves (2 of these are endemics of this region (*Alsophylax laevis, Phrynocephalus golubewi*)). There are six zoogeographical provinces in this region. The coverage by reserves of these provinces is uneven. Betpakdala province has no reserves. Pre-Balkhash and Badkhyz-Karabil provinces have a single reserve. There are two reserves in the North-Pre-Caspian and two reserves in the Ustyurt-Aral province. At first glance, the territories in Karakum-Kyzylkum province appear to best protected, with eight reserves, but in fact the majority of them only protect intrazonal areas.

The following urgent measures are proposed for the deserts of Middle Asia: 1) provision of protected areas for endemics of Turan deserts: a) in Messerian Plateau for the conservation of *Alsophylax laevis*; b) in vicinity of Bami for *Phrynocephalus golubewi*; 2) provision of protected areas for all species listed in the "USSR Red Data Book" that are not yet protected. There are two such species: *Ptyas mucosus* distributed in Murgab valley, and *Tenuidactylus turcmenicus* distributed in Badhyz. Territories occupied by both species can be connected to Badhyz reserve.

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P45
Why Use Plant Genetic Resources for Sustainable Desert Development?

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The poster to be presented at the Sixth International Conference on Development of Dry Lands in Cairo, Egypt from August 22-27, 1999, will explain why plant genetic resources are indispensable for sustainable desert development. The poster will be of A0 size. It is divided in three sections, each dealing with characteristics of plant genetic resources that illustrate why they are vital for desert development. The three characteristics are: Appropriateness, Applicability, and Adaptability. Each section will be illustrated along with reference to relevant activities of the International Plant Genetic Resources Institute (IPGRI) in this area.

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P46
Biogas Production and Disposal for Kitchen Wastewater by UBF and Activated Sludge Process

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The biogas production from cooking food wastewater by UBF reactor was used in the present study. The performance of the reactor was tested under the conditions of constant temperature of 35 °C and UBF reactor volume of 9 liters. During the steady state operation period, the reactor reached (Chemical Oxygen demand) COD removal efficiency of about 81.89-85.18% with an average of 83.7% which indicated an effective treatment by this process. The maximum COD removal efficiency, COD removal rate and biogas production rate reached 86.07% 14.67 g/Ld and 6.55 l/Id respectively. The organic loading rate reached the maximum value of 17.32 g/Id during steady operation the reactor operated steady as reflected by normal pH within 6.9 for influent and 7.94 for effluent. The effluent concentration by UBF was as low as 2078.18 mg/l which suggests the need to use active sludge process as post-treatment required meeting the demand of discharge standard. An aerobic reactor was used for this post-treatment. The performance of the reactor was tested under conditions of ambient temperature and reactor volume of 7 litters for the two units with an active volume of 6 lit. for the first unit. During the steady state period the average of COD removal efficiency was 79.6% and effluent concentration was kept around 200 mg/lCOD.

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P47
Estimation of Diffuse Solar Radiation over the Arab World (Eastern Region)

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The number of stations which measure diffuse radiation is very little in the Eastern Region in the Arab World. In a project for making an Atlas for solar energy sponsored by ALECSO (Department of Sciences), we use a data of 25 stations for measurements of diffuse radiation to make interpolation of the data by using empirical formulae. These formulae have been used to estimate diffuse radiation as a function of global solar radiation which is available for regular observation for a long time at sufficient number of stations located in different climatic regions.

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P48
Comparative Molecular Studies on Some Species of Genus *Vicia*

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The present study was carried out to determine the genetic diversity between faba bean and its related wild species. Thirteen taxa of wild germplasm representing six *Vicia* species (*V. sativa, V. villosa, V. monantha, V. narbonensis* and *V. cinerea*, in addition to *V. faba*) were collected from north-west coastal region of Egypt. Electrophoretic protein patterns indicated clear differences among different *Vicia* species as well as within the taxa of the same species. Three isozyme systems (amylase, esterase and glutamate oxaloacetate transaminase) were examined in dry seeds and showed that *V. faba* and *V. narbonensis* had specific isozyme patterns different from those of other species. Variability on the DNA level was investigated through RAPD-PCR analysis, which indicated clear differences among different *Vicia* species and similarities within the taxa of the same species. From the above results, it can be concluded that *V. Monatha* and *V. Villosa* are most closely related to *V. cinerea*. It was also found that *V. faba and V. narbonensis* are completely distant. The marked differences between *V. faba* and other wild species indicated that none of the latter can be considered as the wild progenitor of *V. faba*.

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P49
Evaluation of Some *Pisum* Genotypes on the Morphological, Biochemical and Molecular Levels

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4Agricultural Research Center (ARC), Giza, Egypt

The aim of this work is to characterize the genetic diversity within 17 wild and cultivated *Pisum* genotypes on the morphological, biochemical and molecular levels, as the first step towards the development of a complete gene map of the most diverse genotypes. Overall performances of the studied pea genotypes for different quantitative morphological characters showed that genotypes Montana, Billinder, Lincolin and Victory Freezer had a highly significant means across the most economically important characters. The dendrogram based on qualitative morphological characters separated the studied pea genotypes into three main clusters.

Seed storage protein profiles as well as the two isozyme systems (ADH and MDH) showed polymorphism among the studied genotypes, except for the two accessions of *P. fulvum*. While the third isozyme (GDH) indicated identical patterns across all the pea genotypes. The dendrogram resulted from RAPD-PCR as well as across the three levels of study provided conclusive results regarding phylogenetic relationships among the studied genotypes. The high number of markers specific to wild taxa scopes the light on the possible use of these markers in detecting different germplasms conferring resistance to stress environmental conditions. Linkage between RAPD and morphological characters on one hand and dehydrin genes and the other markers on the other hand was conclusive.

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P50
Influence of Planting Media and Promoting Treatments on Rooting of Fig (*Ficus carica*, L.) Cuttings

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Rooting media affects both rooting percentage and adventitious root quality. This research aimed to evaluate the effect of sex media, physiological age, and collecting dates of fig cuttings on rooting and survival of fig cuttings. This study was carried out in an open nursery at Ras El-Hekma of Matrouh Governorate, Egypt, during the two successive seasons of 1994/1995 and 1995/1996. Terminal, median, and basal cuttings were soaked for 24 hours in 2000 ppm IBA, 10000 IU penicillin, and in 2000 ppm IBA + 10000 IU

penicillin. Soaked cuttings were then placed in six different rooting media: local soil (A), sand (B), cistern sediments (C), mixture of local soil + sand (D), mixture of sand + cistern sediments (E), and mixture of local soil + sand + cistern sediments (F).

Results indicated that successfully rooted cuttings were significantly affected by I.B.A. and antibiotic treatment, planting media and time of collecting cuttings, in addition to a noticeable interaction effect between both treatments. However, soaking different cuttings in the antibiotic + growth regulator resulted in the highest survival value regardless of rooting media. January was the best time for preparing the terminal and median cuttings, while December was the best for the basal. In addition, sand was the most suitable media for all of cutting types regardless of promoting treatments. Generally, it could be concluded that the best results obtained by soaking terminal and median cutting (collected in January) and basal cutting (collected in December) and planting them in sandy soil.

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P51

The Sensitivity of Shoot, Fruit, Root Growth, and Photosynthesis of Apple Tree to Water Stress, Early in the Season

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Empire apple trees grown in two-sided Plexiglass pots were subjected to water stress early in the season during the cell division. This was to study the sensitivity of shoot growth, fruit growth, root growth and single leaf photosynthesis of apple trees to water stress and their recovery after rewatering. The results during the stress period and after rewatering indicated that the sensitivity to water stress, starting with the most sensitive process, is in the following order: shoot growth, fruit growth, photosynthesis, root growth.

When water stress developed during the middle of cell division stage, final fruit size and weight of stressed trees was less than that of the well-watered control trees significantly. But when water stress developed during the end of cell division and beginning of cell expansion stages, final fruit size and weight of the two treatments were similar. The results of this study can be used to improve water management in water limited regions because it integrates the water stress responses of the most important growth and development processes in the apple tree. Water stress is harmful during the fruit cell division, therefore, early regulated deficit irrigation in dry areas will reduce fruit size and yield. Water stress at the end of cell division did not reduce final fruit size; therefore regulated deficit irrigation may be used after the stage of fruit cell division.

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P52

Studies on Soybean Plants Grown under Water and Salt Stress Conditions and its Responses to the Application of the Polymeric Soil Conditioner "Barbary Plant": I. Growth, Flowering, Yield Attributes and Water Use Efficiency

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Two pot experiments using soybean cv. Crawford were carried out to study the effect of different levels of water stress (100 control, 85, 70, 55 and 40% of field capacity) as well as different levels of salinity (0.0, 0.50, 0.75, and 1% NaCl) alone or in combination with the polymer "Barabary Plant, BP" mixed with sandy soils at rates 0.0, 0.02, and 0.04% (w/w). On the growth behavior, flowering, yield and its components and water use efficiency. The obtained results showed that both water deficits as well as salinity levels caused significant decreases in all vegetative growth characters. Moreover, it was found that the effect of salinity especially at higher rates was more harmful than that of water deficit effects.

Mixing the polymer BP with soil at different rates significantly enhanced all above growth characters. The rate of 0.04% was best where it gave an increase ranged from 1.6% (NAR) to 107.4 and 157.6% for the fresh weights of roots and leaves of plants grown under natural conditions, from 7.3% (Shoot/root ratio) to 581.3% (NRA) in the plants irrigated with the lowest water level (40% FC), from 23.4% (No. Leaves) to 153.6% (NAR) for the plants received the highest salt level (1%) when compared with corresponding controls

Number of flowers and pod set percentage as well as number of pods and seed yield per plant, seed index and shelling percentage were significantly decreased with increasing stress levels and reached the minimum values at the drought level of 40% FC and the salinity level of 1%, whereas the total shedding percentage was increased. Application of BP alone or in combination with stress levels of water and salt significantly enhanced flowering, pod setting and productivity of soybean plants. Also, the seed protein and oil percentage was improved. Under stress conditions, a significant increase in plant water use efficiency was achieved as a result of BP application.

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P53

Studies on Soybean Plants Grown under Water and Salt Stress Conditions and its Responses to the Application of the Polymeric Soil Conditioner "Barbary Plant": II. Photosynthetic Pigments, Leaf Water Relations, and Some Biochemical Aspects

A.H. Selim

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The present work evaluated the effect of different levels of water stress (100 (control), 85, 70, 55 and 40% of field capacity) as well as salt stress (0.0, 0.25, 0.50, 0.75 and 1% NaCl) on leaf pigments, water relations and some biochemical constituents of soybean

plants grown in sandy soils mixed with gel polymer "Barbary Plant, BP" at rates 0.0, 0.02 and 0.04% (w/w). It was found that the concentrations of chlorophylls: a, b, and total as well as cartenoids were slightly increased with increasing the drought stress levels up to 55% FC.

Leaf water deficit (LWD), bound water percentage (BW) and bound/free ratio (BW/FW) as well as osmotic pressure of leaf cell sap were raised under both stress conditions, meanwhile free water percentage (FW) and relative water content (RWC) were decreased. Total water content (TWC), as well as transpiration rate were significantly decreased in the leaves of plants grown under drought conditions. The reverse was observed under salt stress conditions. Marked increases in the concentrations of total free amino acids and proline were occurred in the leaves of plants exposed to both water and salt stresses, and tended to be higher in the salt stressed-leaves than that of the droughted one. The concentrations of soluble sugars were found to be higher under drought conditions, but lower under saline conditions. Adversal trend for the total and non-soluble carbohydrates was noticed. Leaf-N and –P in the drought stressed-leaves were increased but decreased in the salted one. Leaf-K and –Ca as well as K/Na and Ca/Na were decreased in both drought and salt stressed-leaves. Leaf-Na was decreased in the drought stressed-leaves but increased in the salted one.

Application of the polymer BP to the soil under the non-stress conditions improved most physiological and chemical characters. Under water deficits and salt stress conditions, it was found that the polymer BP could regulate the most processes related to the photosynthetic pigments, water and mineral status as well as metabolic products leading to a great improvement in the above mentioned characters which in turn resulted in an increase in the tolerance of soybean plants to water deficits and salt stress.

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P54
Interactive Effects of Reduced Water Potential, Temperature and Boron on the Seed Germination of Hot-Desert Plants

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Seeds of *Lagonychium Farctum* and *Calotropis procera* were germinated under different treatment combinations of: reduced water matric potential (ψ_m), temperature (T) and boron concentration (B). The effect of each of the single factors on radicle emergence was greatly modified by the level of the other factors in both plants, referring to the strong interaction among the factors. This was more pronounced in the elongation of the radicle and hypocotyl in both. This affects the establishment of seedling development, where hypocotyl elongation particularly controls the projection of cotyledonary leaves above the soil surface (hence utilizing radient energy) in such seeds. This interaction is also reflected on dry matter allocation from the storage tissue to such growing seed organs.

Although all single factors and their interactions have highly significant effects on radicle emergence in both plants, ψ_m plays the dominant (governing) role in this respect.

However, temperature has the subdominant role in this respect in *Lagonychium* (together with ψ_m x T interaction), whereas boron (together TxB interaction) has the subdominant role in *Calotropis*. Temperature and (ψ_m x T) have greater control on radicle and hypocotyl elongation in *Lagonychium*, whereas boron and (ψ_m xB) have greater control in *Calotropis*. Greater differences in the role of single factors and interactions are reflected in dry matter allocation to growing seed organs. The impact of interactions on the success of seedling establishment (and comparably in plants to be cropped in such habitats) is discussed.

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P55

Effect of Soil Salinity on Yield, Growth, and Element Concentrations of Some Fruit Species

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The effect of soil salinity on yield, growth and contents of date palm, olive and grapevine in a 2-year field study was studied. Geographic soil database for Ibshwai District was built in ILWIS GIS system, where the main soil characteristics were stored. Quarries, followed by field check, were done to select similar soils despite of their salinity status. The fruit yield found to be declined with 3.1 %, 4.8 % and 7.7 % for each unit increase in soil salinity above 4.5, 2.2 and 2 dS/m for date palm, olive and grapevine respectively. The results place date palm in highly tolerant category, olive in moderately tolerant and grapevine in moderately sensitive category. Vegetative growth was more tolerant to salinity than fruit yield production for all the three fruit species. Na and Cl concentration in the leaflet of date palm, leaf of olive and petiole of grapevines increased as soil salinity increase.

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P56

Salinity as a Limiting Factor for Improvement of Crop Plant Productivity

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One of the main problems in the arid and semi-arid regions of the world is salinity. Using of saline water for irrigation in some areas due to shortage of fresh water and low rainfall add to the problem. Integrated management of salt affected soil could be achieved through different practices. The article deals with the effect of saliently on some physiological processes in some plants and new strategies to improve salt tolerance in several economic crops such as cotton, rice, fodder beet, oil rapeseed and barley.

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P57
Research Aspects in the Study of Salinity: Brief Overview

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The problem had attracted the attention of the author among other plant physiologists questioning, what do we need to study to face such a problem? and who is to be involved in research to have an end result for the utilization of saline water with an economic feedback. The present paper is trying to introduce a summary on the aspects to research from literature concerning the problem. It explains a point of view on the interconnection of the basic research and adopted laboratory techniques to the practical application. It covers the studies on: testing species to salinity stress; physiological and genetically adaptation of tolerant species, physiological and biochemical characteristics of saline-resistant plant organisms, naturally salt-tolerant species as genetic sources for relevant genes. Changes in root structure and function under salt are of main interest of the author. The results on some economic monocotyledon and dicotyledon plant species will be discussed to shed the light on the above-mentioned point of view.

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P58
Effect of Salinity Stress on Potato Plants Modified by Calcium Application

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[2]*National Research Center, Cairo, Egypt*

This trial was designed to test the effect of calcium nitrate on reducing the injures effects of saline water irrigation on the growth and productivity of potato plants CV. diamant. Seed tubers were planted in pots (30 cm diameter) into sandy soil at Ain Shams University, Faculty of Agriculture for two spring seasons (1997 and 1998). The sea salt (Rashidi) at concentration 4000 ppm was used. The salt treatment was started 30 days after planting. Calcium concentrations (0.25, 0.5, 1 and 2 gmCa^{++}/plant) were added as calcium nitrate 19% Ca^{++} for plants treated with saline water irrigation (4000 ppm). The results indicate that irrigation of saline water affected negatively all growth parameters such as plant length, number of leaves, total leaf area, fresh and dry weights of haulm and yield of potato plants were 7.7, 4.5, 5.7, 7.2, 8.8 and 5.4 ton/feddan for the treatments: non-stressed, control (4000 ppm salt), 0.25, 0.5, 1 and 2 gm Ca^{++}/plant.

Using Ca^{++} at lower connections reduced the harmful effects on plant growth and productivity of potato plants while the highest level of Ca^{++} (2gm Ca^{++}/plant) under saline conditions reduced productivity of potato plants.

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P59

Impact of Communication in Adoption of Agroforestry Technology in an Indian Desert Village: A Case Study

R.N. Singh
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This paper dwells on effectiveness of communication for adoption of agroforestry in an Indian desert village - Sar, inhabited by 2614 population in 362 households. Since 1990, the author has been educating the villagers in Sar about agroforestry. Sar represents an exclusively dryland agriculture dominated by loamy sand, prone to wind erosion. A well tailor-made communication was to transfer the agroforestry technology in the village. It has the following features: limited number and simple practice, timely and meticulous use of channels, all section of society as target group, concentration of effort in mission mode approach and flexible target.

Despite no trees in existing farming systems, the farmers readily adopted tree plantation program around the boundary of the field when they were approached in 1990.This made us to start the nursery in the village itself in 1991 to fulfill the great demand of the saplings. Two farmers raised the nursery successfully each year. Between 1990-1997, 301 farmers planted 85775 saplings with festivity along with the family members. One row tree plantation was adopted rather three rows plantation advised. They are firm not to fell the tree owing to several benefits from the boundary plantation. In contrast to tree plantation, the farmers developed interest toward agro-horticulture (*in situ* budding of improved cultivator of *Z. rotundifolia* on local Jujube) after seeing impact of this system at one farmer's field. During 1990-97, 45 farmers adopted it and *in situ* budding was done on 2976 of which 1674 survived. They have been following the management practice namely pruning and insecticide spray religiously. The fields present a different look with luscious fruits. So far four farmers have taken fruit to the market. Others are happy to use the produce for consumption in the family. Later, when the produce is more, they look forward for selling it.

Improved varieties of guar (var. Maru guar) and moth (var, Maru moth) were provided to 21 farmers in 1991. Fifteen farmers out of 21 farmers interviewed in 1995 disclosed that 66% farmers were adopting only Maru guar, while 93% Maru moth. They sold 680 kg of guar and 185 kg of moth to 103 and 29 farmers respectively. This experience provided stimulus and confidence to the Cazri Jodhpur to extend the program in 12 desert villages.

The study pointedly reflects the importance of relevant communication mechanism for adoption of agroforestry technology -- improved land use system -- by the masses of illiterate small holders in resource-poor desert area.

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P60
Some Social Aspects of Farmers: Irrigation Practices in Reclaimed Desert Lands in Egypt

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Reclamation of desert lands is considered a new avenue of agricultural development in Egypt to overcome the problem of imbalance between the high population growth rate and limited land resources. Yet, the scarcity of water resources available for such purpose necessitate more emphasis on irrigation efficiency. Hence, irrigation efficiency in reclaimed desert lands is considered a vital factor in the success or failure of farming and agriculture enterprises in such arid areas. Efficiency of irrigation is determined in great part by the farmer's irrigation practices aside from the conditions of irrigation system used. Many social aspects such as the type of social network of relationships between farmers and officials and the farmers' involvement in the decision making process related to selection of and operating the irrigation system are from among the important variables affecting these practices.

Accordingly, this study aims to clarify the pattern of relationships that might exist between some social variables under the different irrigation systems used in specific reclaimed desert lands. A sample of 109 farmers representing the users of surface, sprinkler and drip irrigation systems in four different areas in the Western desert in Egypt were selected.

The social aspects investigated are: the previous farm manager training and experience in agriculture, the farmers' involvement in the decision making process related to the selection of irrigation system used, the criteria of this selection, frequency of occurrence of irrigation problems among farm holders, willingness of farm holders to collaborate in organizing the irrigation process in their area, their willingness to collaborate with the officials in solving encountered irrigation problems, the officials and other agencies role in solving irrigation problems and leadership in organizing irrigation process.

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P61
The Narratives of Pastoral Development in Algeria: Towards Participation of Local Populations

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For not less than three decades (1962-1991), the pastoral development in post – independence Algeria was seen as state obligation. Based on top-down, centrally planned and managed approach development actions negatively impacted the pastoral resource base, out coming a decline of its acreage by 25 % and decreasing its feeding capacity by 75% This dramatic situation played an important role in experimenting since 1992 a new

approach based on the active participation of the local population and communities. This new framework base on a dimension of institutional building aimed at achieving two main objectives: 1. To promote social organizations not clashing with traditional settings in form of professional association which were seen as an adequate response to the concern of institutional building by the establishment of favorable institutional environment for a sustainable pastoral development; 2. To redefine the new role and level of the state intervention in the development process by identifying a new forms of partnerships, public organizations and pastoral communities determining the rights and obligations of each party. This paper begins with a brief discussion of the institutional building, setting the debate about the institutional development in the pastoral areas. Then, a comparative study of the two aforementioned development approaches is examined. Drawing lessons from these experiences, the paper concludes with key principles for an active role of institutional building in the frame of pastoral development.

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