

Ninth International Conference on Dryland Development
*Sustainable Development in Drylands – Meeting the Challenge of
Global Climate Change*
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Abstracts of Poster Presentations



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The International Dryland Development Commission (IDDC) is an autonomous nongovernmental nonprofit organization established in 1987 by the individuals and institutions interested in and concerned about the sustainable development of dry areas. It is promoting all aspects of dryland studies by fostering cooperation, collaboration and networking between various international, regional and national organizations. One of the important modus operandi of the networking of IDDC has been to hold a major scientific conference every three to four years to provide opportunity to participants from around the world to exchange research results and experiences in dryland development and combating desertification. In pursuance of this objective the IDDC has organized in the past eight international conferences.

The Ninth International Conference on Dryland Development (ICDD) with the theme “*Sustainable Development in the Dry Lands - Meeting the Challenge of Global Climate Change*” is being organized under the auspices of the IDDC and the Bibliotheca Alexandrina, and is sponsored by the Agricultural Research Center (ARC) of the Ministry of Agriculture and Land Reclamation, Egypt; the International Center for Agricultural Research in the Dry Areas (ICARDA), Arid Land Research Center (ALRC) of Tottori University, Japan; Chinese Academy of Sciences (CAS), China; Desert Research Institute (DRI), USA; Food and Agriculture Organization of the United Nations (FAO); Japanese Agency for International Cooperation (JICA); Japan International Research Center for Agricultural Sciences (JIRCAS); United Nations University (UNU) and other national and international organizations. Beside the support of the sponsors, the Conference is also being co-financed by AAAID, IFAD, OFID, and GFAR.

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Theme 1: Climate change in arid lands and its impact on natural resources of land and water and biodiversity in the dry areas

1.1. Effects of interannual climatic fluctuation on habitat use of Mongolian gazelles

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Interannual climatic fluctuation in drylands affects plant productivity, and would also affect habitat use and seasonal migrations of wild animals. Besides precipitation fluctuation, snow cover would also affect plant availability for herbivores in middle-latitude drylands. Mongolian gazelles (*Procapra gutturosa*) inhabit steppes of Mongolia, northern China, and southern Russia, and conservation and management of the species are urgently required as their numbers are decreasing. Mongolian gazelles would be one of the species most susceptible to climatic fluctuation, because they exhibit seasonal long-distance movements. To examine the effects of inter-annual climatic fluctuation on habitat use of Mongolian gazelles, we analyzed the relationship between satellite-tracked locations of three adult female gazelles captured in central Mongolia and normalized difference vegetation index (NDVI) in gazelle home ranges derived from satellite images as an indicator of plant availability from 2002 to 2005. During winter, relatively high NDVI areas in the gazelles' annual ranges changed among years, and the gazelles used high NDVI areas in each year. During summer, NDVI values in the study area were generally lower in 2005 than in the previous two years. Their summer ranges of 2003 and 2004 overlapped, but summer ranges of 2005 located north about 50 km from those, where NDVI values were higher than summer ranges of the previous two years. These facts suggest that interannual change of spatial distribution of plant availability and snow covers affects habitat use of Mongolian gazelles, and that conservation strategies considering interannual climatic fluctuation are necessary for long-distance migratory specie.

1.2. Effect of air temperature under climate change conditions on potato productivity in Egypt

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These studies were conducted at three locations, Sakkara, at Giza; Bosaily, at Beheira and Nobaria, at Beheira, with two cultivars (Valor and Nicola cv's) grown on three planting dates: (Date 1: Oct. 1, Date 2: Oct. 10 and Date 3: Oct. 20) during 2003-2004 and 2004-2005 cropping seasons in order to investigate the production of potato (*Solanum tuberosum* L.)

under the years 2003 to 2005 and under climate change scenario in the years 2025, 2050, 2075 and 2100 by using a simulation model. The average temperature is projected to have an increase between 1.1 and 2.9°C during potato winter season for the years 2025 to 2100. For this period, potential potato yield is likely to decrease by 6 to 22% (without adaptation) and by 2% to 16% (with adaptation, sowing date). In the winter season, climate change will likely lead to delay the time of planting from October 1st to November 1st to avoid the heat stress. Under the current and climate change conditions it is projected that the lowest yield decrease will be at Nobaria location and the highest reduction at Bosaily location, but the production of Valor cultivar will be higher than Nicola cultivar. It is shown that the shifting of planting date and locations and the use of heat-tolerant potato cultivars could be used to mitigate the effects of climatic change in Egypt.

1.3. Impact of climate changes on wheat production under Egyptian conditions

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Wheat crop was grown for six seasons (2000 and 2005) in the Ismailia Governorate, Egypt. Two steps were investigated under this study. The first was validating SIRIUS crop model by using wheat cultivar “Sakha93” under central pivot irrigation system. Agro-metrological data was recorded by using automatic climate station. The actual collected data of wheat such as irrigation, fertilization and other agriculture applications were obtained from private farm. The climatic data from 2000 to 2005 was used as inputs in SIRIUS model. Also, the field measurements on soil, vegetative characteristics and yield component were used as a basis for validating the performance of the crop model. The accuracy of a crop model was judged by simulating the production level. The validation results indicated that the difference between simulated and observed dates of flowering, beginning of grain fill and the end of grain fill and maturity varies from 1 and 7 days, whereas, the deviation between the simulated and measured yield measured from 2000 to 2005 exceeds the $\pm 25\%$ interval only in 2000. The second step was to test the effect of different concentrations of CO₂ (380, 420, 460, 500, 540, 580 and 620 ppm) and the increasing rate of average annual air temperature (+ 1.5, + 3, + 4.5 and + 6°C) on yield of wheat. The obtained results showed that, the increasing of CO₂ concentration leads to increase in the yield of wheat, while increasing temperatures had a negative effect. The increase of wheat production as a result of increasing CO₂ was less than the reduction rate in wheat yield as a result of increasing temperature.

1.4. Economics of some vegetable crops under different climate zones in Egypt

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The climatic factors are known to affect plant growth, yield and quality. This study aims at determining the effect of temperature on the economics of tomato, potato and cucumber crops grown in different climatic zones during the period of (1990-2005). The study included four chapters in addition to reviews and references. The study showed that the increase in average air temperature by 1°C above the normal in March in northern Delta region caused a decrease in total yield by about 0.75 ton per feddan. Such an increase in temperature in February in Upper Egypt decreased yield by 0.48 ton per feddan. An increase in average air temperature of January by 1°C above normal in North Sinai caused an increase in total yield by 0.61 ton per feddan, whereas the total yield decreased by 0.74 ton per feddan, when the same increase occurred in March. The total summer tomato yield decreased by 0.33, 0.36 and 1.53 ton per feddan in south Delta, middle Egypt and south Sinai, respectively, as a result to the increase in average air temperature above the normal of March, April and July by 1°C.

1.5. Threshold temperatures and thermal requirements of the cotton leafworm *Spodoptera littoralis* Boisd.

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The present investigation aimed to study the effect of four constant temperatures (17, 22, 27 and 32 °C) on the development stages of cotton leafworm *Spodoptera littoralis*. The incubation period, larval duration, pupal duration, pre-oviposition period and duration of generation were estimated. The time required for development decreased as the temperature increased from 17 to 32 °C. The threshold temperatures were 12.0°C for egg, 8.2°C for larvae, 10.9°C for pupae 9.8°C for pre-oviposition period and 9.9°C for generation. The average thermal requirements needed for completing the development were 50.4, 283.1, 163.6, 27.2 and 524.3 degree-days for egg, larvae, pupae, pre-oviposition period and generation, respectively.

1.6. Climatic changes during Pleistocene time and its impact on groundwater accumulation in south-western Egypt

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During the past twenty years, a number of research projects were carried out in south-western Desert of Egypt and northern Sudan making use of different types of satellite imaging,

particularly, radar data with the purpose to investigate the factors responsible for groundwater accumulation in this area. Geological, hydrogeological and geophysical field investigations were conducted at different intervals of time. Agencies and organization that participated in these activates are Remote-Sensing Center, Boston University, U.S.A., UNESCO Cairo Office, ALESCO, Tunisia; Desert Research Center, Egypt and REGWA Comp., Egypt. The present work makes use of accumulation data and information to reveal the condition of groundwater formation in south-western Desert of Egypt and northern Sudan and its relationship with climatic changes that took place during Pleistocene time.

Theme 2: Desertification processes and tools for assessment and their application

2.1. Desert sand seas and dune fields of the world: a digital atlas

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Aeolian dunes are typically found in more or less continuous areas of sand accumulation known as sand seas or dune fields. Despite their significance and wide geographical extent, there is no complete and geographically accurate global map of these dune fields, although the location and general extent of individual sand seas and dune fields are depicted in many publications. Understanding the history of sand seas and dunes has been revolutionized in recent years by the application of luminescence techniques to directly date periods of dune formation and/or reactivation. An increasing number of local and regional studies has taken place in recent years, so providing the possibility to develop regional and multi-regional chronologies of periods of dune formation. The primary objective of this project is to develop a global database of geographically accurate maps of individual desert and other inland dunefields and sand seas using GIS technology. The map database will incorporate information on dune morphology, including dune trends, chronology and prior studies, so enabling regional and global correlation of periods of dune formation via construction of time-slice maps of dune development and extent. These compilations will be available for regional and global paleoclimate reconstructions using gridded data, and will include data on dune trends for paleowind assessments.

Further details available at: http://www.dees.dri.edu/Projects/Dune_Atlas/ (Project sponsored by INQUA Project 0704 and Desert Research Institute).

2.2. Spatial distribution of threshold wind speed for dust emission in east Asia and its seasonal changes

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Dust models have been developed by numerous researchers and have played important roles in assessing the impact of dust on climatic change. However, the current models still lack

accuracy, especially in the treatment of the emission process. Indeed, the magnitude of dust emission appreciably differs among the models. The threshold wind speed, which is the minimum wind speed that causes dust emission, has been regarded as a key parameter in the emission process. The threshold wind speed has been parameterized on the basis of wind tunnel experiments and *in situ* observations. However, the variation in land surface conditions where such experiments and observations can be carried out is finite in comparison with their immense variety in dust emission regions worldwide. In fact, dust emission in East Asia occurs from several kinds of land cover type: bare desert, semi-desert shrubs, grassland, cultivated land, etc. In addition to spatial variety, land surface conditions change seasonally and inter-annually in accordance with snow cover, vegetation cover, soil moisture, etc. This study will show maps of the threshold wind speeds for dust emission that are statistically evaluated from surface meteorological data, and their correspondence with land cover type will be discussed. We define two kinds of threshold wind speed. One is ut5%, which is the threshold wind speed at close to the most favorable land surface for dust emission in a given region for a given period. The other is ut50%, which often represents the threshold wind speed at the normal land surface in a given region for a given period. Seasonal variations in the threshold wind speed will also be discussed.

2.3. Integration analysis of LANDSAT-7 and SRTM DEM images for agricultural land expansion in the Western Desert of Nile Delta

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The local desert depressions of the Northern Miocene Limestone Plateau to the west of Nile Delta are promising areas for the expansion of the groundwater agricultural and fish farming in the northwestern desert of Egypt. The principal deep aquifer system is the non-renewable lower Miocene Moghra sandy aquifer which receives recharge from the adjacent east Nile Aquifer and the south Nubian Sandstone Aquifer systems. The objective of this study is to assess the natural land resources of the western Nile Delta fringe by integrating Remote Sensing (RS) and Geographic Information System (GIS) methodologies. Four recent LANDSAT-7 and SRTM DEM Images (p177 to p178, r038 to r039) and topographic maps, scale 1:100000, were used. Potential sites for agricultural land expansion and for groundwater exploration were identified in IDRISI/ILWIS/ERDAS environment. The tasks performed are described. The integrated methodology of this study could be considered as a ready module for application at different locations. The study output represents a significant geo-reference resource module to support an Information Management System for new groundwater agricultural land expansion in the western desert of Nile Delta of Egypt.

2.4. Trends of drought in North Africa: an application of Palmer Drought Severity Index (PDSI)

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Drought is one of the world's costliest natural disasters and affects a very large number of people each year. Generally, drought is defined as a naturally occurring phenomenon that exists when precipitation is significantly below the normal recorded level, causing serious hydrological imbalance that adversely affects land resource production systems. It is important to monitor and understand it. However the precise quantification of drought is difficult because there are many different definitions.

In order to monitor droughts, numerous specialized indices have been devised using readily available data such as precipitation and temperature. To estimate droughts, precipitation plays a critical role. However the magnitude of drought depends on the deficit between the atmospheric moisture supply (i.e. precipitation) and demand at the surface (i.e. evapotranspiration). According to the Forth Assessment Report of IPCC, increases in global average air temperature have been observed over the past century. Increases in air temperature will cause increases in evapotranspiration. Also increased precipitation has been observed over many large regions. Therefore, the magnitude of drought will vary from region to region. So the question arises which area was most affected by drought over the past half century? The Palmer Drought Severity Index (PDSI) is the most prominent index of meteorological drought used in the world. In this study, the trend of drought in North Africa over the past half century was estimated with the PDSI approach. To calculate the monthly PDSI, the Global Historical Climatology Network (GHCN-Monthly) station-based datasets were used. In determining soil moisture as part of the PDSI computation, the soil-available-water holding capacity map was employed. This study aimed at providing information on trends of drought in North Africa during the past half century and also intended to estimate which area shows a marked tendency to be affected by drought.

2.5. Drought monitoring by using remote sensing technique in Iran

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Drought is a complex natural event. A universally accepted definition does not exist. It is acknowledged that the major causes of drought are lower than average rainfall. According to wide impacts of drought conditions on Iran in the recent years it looks necessary for us to use some techniques for monitoring the impacts of this natural phenomenon on our region in a dynamic system. Also, it can help us to have an optimum risk management in during severe drought conditions. Recent researches around the world suggest that the best method for this aim is the application of remote sensing techniques. In this paper we explain this method, in particular reflective remote sensing, such as NDVI (Normalized Difference Vegetation

Index), VCI (Vegetation Condition Index), MVCD (Maximum Value Composite Differential) and MVCI (Monthly Condition Index).

2.6. Development of agro-ecological zones using geographic information system in Egypt

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Egypt has total area of about one million square km under arid and hyper arid climatic conditions of which only a small proportion (3% of total area) is agriculturally productive. The country is endowed with 4 main agro-ecological zones having specific attributes of resources base, climatic features, terrain and geographic characteristics, land use patterns, and socio-economic conditions. Since significant variations in the environmental characteristics are apparent in each agro-ecological zone, the active factors and processes of desertification, and their impacts are necessarily variable. Sustainable agricultural development requires a systematic effort towards the planning of land use activities in the most appropriate way, apart from several other institutional and policy programme initiatives. Agro-ecological zoning (AEZ) is one of the most important approaches for agricultural developmental planning because survival and failure of particular land use or farming system in a given region heavily relies on careful assessment of agro-climatic resources. This approach is used to categorize agro-climatically uniform geographical areas for agricultural developmental planning and other interventions. Modern tools such as satellite remote sensing and Geographical Information System (GIS) have been providing newer dimensions to effectively monitor and manage land resources in an integrated manner for agro-ecological characterization. The application of AEZ is limited by lack of geospatial data, particularly in new reclaimed desert areas in Egypt. Creating a new development map requires surveying and assessing the resources, comparative advantages, and clusters of economic activities representing competitive potentials, in various districts and localities. The aim of such a developmental map would be to redistribute the crop cultivation from the excessively high density areas to strategically important but low density areas. This paper tries to demonstrate incorporation of new tools to extend applicability of AEZ in newly reclaimed desert areas, notably Sinai, the Red Sea, and the western Desert.

2.7. Computer software for evaluating and improving the efficiency of drip irrigation systems

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A computer program has been compiled to facilitate the evaluation and improvement of water application and water-use efficiencies of drip irrigation systems. The program evaluates the system based on the application efficiency and distribution uniformity parameters. The software is developed as a tool to serve irrigation extension personnel, engineers, growers and small agricultural investors. The program uses input data of drip type, irrigation frequencies, emitter discharge and pressure on different drip lines among other data. An output report is generated by the program that includes both pertinent calculations and correction/and or improvement recommendations. Recommendations are then to be carried out by the grower and a new set of input data are given to the program which, again, generates a new report of the improved situation. This iteration process is executed by user until the most optimum efficiencies and uniformities are achieved. Once the most efficient system characteristics are known, they should be established for the system for the day-to-day application. The software was tested intensively in the laboratory for consistency and coherence of generated reports, and then it was tested in the field at a wide scale. For field validation, drip systems in forty fields in the Bostan region were tested and evaluated. Initial results appeared promising and the program is believed to be a very handy tool for improving drip irrigation systems, and appears to have good potential of significantly saving irrigation water.

2.8. Field and mathematical studies on solute movement through unsaturated soil under arid condition

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Societies use the land subsurface as a receptor for various contaminants, which include hazardous waste landfills, ponds and lagoons, bearing industrial or domestic wastewater. These activities have always resulted in the release of various pollutants into the unsaturated zone and, consequently, to the nearby environment including groundwater resources. The unsaturated zone is the medium through which soluble salts and pollutants originating at or near the soil surface are conveyed to the groundwater. Hence, the control of solute transport through this zone will enable predicting the rate of contaminant transport through the unsaturated zone and eventually to the groundwater. This research aimed to investigate solute transport through the unsaturated zone under predetermined boundary condition in the arid areas. A computer based solution of the unsaturated flow was developed using numerical technique approach in the analysis. The results will be presented in terms of soil water pressure, soil moisture content, and solute concentration. On the other hand a field and laboratory study was carried out under same initial and boundary condition applied in the numerical model. The results from the numerical model were compared with those obtained using field studies and there was a good agreement indicating that the numerical method was very successful in predicting solute transport through unsaturated soil.

2.9. GIS related to agricultural decision support system

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Major adjustments are needed in agricultural, environmental and macroeconomic policy, at both national and international levels, in both the developed as well as developing countries, to cope with the global climate change. The major objective of sustainable agriculture is to increase food production in a sustainable way and enhance food security. This will involve utilization of economic incentives and development of appropriate and new technologies. The main aim of geographical information system (GIS) in this study is to explore possibilities of supporting decision making in agriculture. This technology is generally concerned with the need for agricultural decisions that would be economically viable and environmentally positive. The study indicated that the GIS technology helps decision makers to make several agricultural applications such as: 1) agro-ecological zoning (based on temperature and potential evapotranspiration); 2) positioning of traps in an efforts to eradicate peach fruit fly, dealing with both agrogeographical data bases and Egyptian crop digital maps to determine trap distribution maps of Egypt, locate traps place in the field, fruit distribution maps and hot spots maps; 3) pest and disease forecasting, prediction of plant diseases or pests for some crops grown under local conditions, such as, potato late blight and pear fire blight; 4) GIS uses with DSSAT program to compare the multi area results in the same map in one treatment or different treatments; 5) determine best planting date for cotton crop all over the country in order to obtain good germination; and 6) future climate change impacts (temperature, sea level rise, distribution of each crop and the sowing date.

2.10. Development of evapotranspiration guide for different regions in Egypt

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This work was conducted in order to overcome the difficulties of obtaining reference evapotranspiration (ET_o) for various locations in Egypt on daily basis in order to estimate water requirement in Egypt. The most suitable weather parameters that could be easily obtained are maximum and minimum air temperatures, relative humidity, pressure and wind speed. The available daily and monthly metrological data for 48 stations were used for seven years, from 1998-2004. Using statistical regression analysis air temperature gave the highest correlation coefficient (r) of 0.81, followed by pressure with r = 0.74. This correlation was improved by including month number in a non-linear equation that gave r = 0.87. Correlation and regression analysis were performed to develop mathematical model that can be used to estimate ET_o for various locations throughout Egypt. The results obtained were evaluated by comparing ET_o calculated from all required weather parameters using Penman-Monteith equation with that obtained from the regression equations. Average temperature and the month number were the best estimators, with coefficient of determination (R²) ranging

between 0.945 – 0.995, standard errors between 0.13 - 0.57 mm per day for monthly ETo estimation for all stations. Egypt is divided in six regions according to their circumstances: West Delta, North Delta, Middle Delta, South Delta & Fayoum, Middle Egypt and Upper Egypt regions and the detailed equations are included for each. A general equation for the whole Egypt with lower accuracy of $R^2 = 0.87$ and $S = 0.72$ mm per day is $ET_o = - 3.0984 + 0.33002 * \text{Temp Average} + 1.3929 * \text{Month} - 0.27736 * \text{Month}^2 + 0.013819 * \text{Month}^3$. These results are of significant practical use where water requirements are needed in modern irrigated crops around the country. An ET guide was developed for each region using the month and average temperature.

2.11. Empirical methods for estimating air temperature in Egypt

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A comprehensive statistical analysis was done to determine the relationship between Dokki station and 48 stations in Egypt. This study presents a technique, based on correlation and regression analysis, for estimating daily average air temperature, daily maximum temperature, and daily minimum temperature in Egypt. The data obtained from Dokki Station were used to establish empirical transfer functions to transform air temperature data interpolated from Dokki weather stations to values that are valid for other station all over Egypt. First order regression models were performed for 48 sites for seven years from 1999 to 2005 with an R^2 of 0.83 to 0.98. The results show that using empirical transfer functions reduced the mean absolute errors between 0.9 to 2.5°C observed and estimated air temperature data significantly as compared to simple interpolation. This method could be used to forecast air temperature for Egypt because the Egyptian Meteorological Authority can give a forecast only for a limited number of stations. It is also a good method to predict missing data from the stations and to make data verifications as well as to downscale the global projections of climate variables from the GCM results that are required in climate change models.

Theme 3: Enhancing resilience of agriculture in dry areas through management of water and land resources and agronomic practices

3.1. Evaluation in soil properties following establishment of sand-fixing shrub *Haloxylon Ammodendron* on shifting sand dunes in arid region of Northwest China

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Combating desertification is important strategy for sustainable agriculture, socio-economic development and ecological conservation in arid land and oasis in northwest China. Therefore, some effective methods, shelterbelt and straw check-board with indigenous herbage and shrubs as helper for sand fixing, were introduced. *Haloxylon ammodendron*, one of xerophilous and salt tolerant shrubs, is widely used with straw check-board in northwest China. But there is little information about the impacts of *Haloxylon ammodendron* on soil environment after it is established. The objectives of this study were to elucidate the impacts of *Haloxylon ammodendron* on soil physiochemical properties through field surveys in plots after 0, 2, 5, 9, 24, 32 years of its establishment in oasis-desert eco-tone area of Pingchuan oasis, Gansu, China. Soil samples were taken to a depth of 20 cm both from under the plant canopy and inter plant space. The mechanism of sand fixation on mobile sand dune could be understood on the basis of these results. Field survey results indicated that the survival rate per 100 m² of *Haloxylon ammodendron* dramatically decreased after 24 years of growth. Moreover, soil crust was prominent and increased in thickness under the canopy of *Haloxylon ammodendron* with the passage of time. While, results of physicochemical analyses showed that porosity increased until 9 years and then got stable. EC and pH of soil (1:5) was higher under the canopy than inter-plant space. Similarly total organic carbon (TOC), Total-N and Olsen-P increased with the passage of time and readings were higher under the canopy. These results suggested that there are differences between the soil under the canopy and inter-plant space, and *Haloxylon ammodendron* may act as “islands of fertility”. In addition, TOC, plant litter and salt contents of plant litter have important role in soil crust formation. Thus, this study suggested that *Haloxylon ammodendron* contributed to fix mobile sand dunes and controlled desertification in arid oasis-desert eco-tone area.

3.2. Stand structure and growth of a natural *Quercus liaotungensis* forest in a water-insufficient area of the Loess Plateau, China

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To understand if *Quercus* forest is sustainable or not in the Loess Plateau of China, stand structure and growth of natural *Quercus liaotungensis* forest under frequent drought stress were investigated near Yan'an area (N36°25', E109°31'). The area that has an annual precipitation of 517 mm is located in the transition zone between forest and grassland regions. In October 2003, we set a study plot of 20m × 40m at the ridge part of slope in a natural stand near Yan'an area. Each tree that has a diameter at breast height (DBH) of ≥1.0cm in the plot was marked with a plastic tag and the species name was identified. DBH and tree height of all trees were measured. For canopy trees of *Q. liaotungensis*, core samples at 30cm height were also collected using a core sampler to analyze the tree age. The forest investigated was secondary forest of 30-50 yr-old. Dominant tree species was *Q. liaotungensis* and its dominance (expressed as basal area percent) was 93.6%. Tall tree species of *Acer stenolobum*, *Armenica sibirica*, *Pyrus betulaefolia*, *Acer ginnala* and *Platyclusus orientallis* were found mixed with *Q. liaotungensis*. Shrub species of *Cotoneaster multiflorus*, *Spiraea pubescence* and *Caragana microphylla* were dominant in under story. Result of growth analysis for *Q. liaotungensis* showed that it took about 50 years to reach 21.9cm in DBH and 9.83m in height on a ridge site. Size and age structure of *Q. liaotungensis* population showed a L-shaped pattern with many saplings. It is estimated that *Quercus* forest is a sustainable vegetation in this area.

3.3. A contributing factor to soil water movement in dune

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When we work around water problems in sandy areas, especially in natural dune, the percolation phenomenon is generally analyzed on the assumption that the sand sedimentary structure is homogeneous. Actually, sandy soils are formed with a uniform material compared with other soils. However, it has been observed that the soil water content inside dunes differs greatly depending on depth, and forms the layer structure. In this research, the aim was to clarify the factor controlling the soil water movement in dune. Moreover, the

method of detecting of the contribution factor from surface was also designed. The research area was Tottori sand dune in Japan. We made 2 outcrops and confirmed a detailed soil moisture profile and sand sedimentary structures. As a result the research point has compound cross laminae structure, which is sedimentary pattern of dune, with a clear boundary. In addition, the soil water content was relatively high on all boundaries. It is clear that the laminae structures control the vertical soil water movement in dune. Additionally, we examined new method of detecting the laminae structures from surface using the simple penetration tests. Generally, this penetration test measures soil strength with impact weight of 5kg. We developed the variable impact weight that is resolvable in every 1kg to detect a thin layer of 2-3mm scale. Sand soil strength was measured with this device. The value changed relatively on all laminae boundaries. Results showed that variable impact weight penetration test is able to detect the laminae sedimentary structures.

3.4. Evaluation and improvement of the soil water storage in a water harvesting system in the Loess Plateau, China

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The Loess Plateau in China is one of the most seriously affected regions by soil erosion in the world. Chinese government has promoted large-scale greening project, called “Grain for Green”, as a countermeasure against this problem. For afforestation on hillslopes in the Loess Plateau, a small scale water harvesting system, called “fish-scale-pit (FSP)”, is commonly used to reduce erosion and increase soil water storage. A field experiment was conducted in Liudaogou Basin located in the north of Loess Plateau to evaluate and improve the soil water storage ability of the FSP. A fenced experimental site was established (4 × 4 m) on a 15 degrees slope covered with natural short grasses. The upper half of the site was undisturbed as a runoff area. Two FSPs (0.3 m deep) were made at the lower half of the site. The bottom surface of one pit was covered with gravel mulch (5 cm thick). Dielectric moisture probes and temperature sensors were buried in the soils under each plot (0.02, 0.05, 0.15, 0.35 and 0.60 m in depth). Meteorological conditions were also monitored in the site. As results, the normal FSP did not show significant water storage ability compared with the runoff area in a dry year. In contrast, the soil water content in the FPS covered with the gravel mulch was much higher than in the runoff area and normal FSP; this was probably due to the reduction of water evaporation from the soil surface by mulching. These results suggest that normal FSPs are not necessarily effective in water storage, and simultaneous use of the FSP and

mulching is effective even in dry years. In addition, the observed results suggested that making deep pits are inefficient not only from the aspect of labor but also from the aspect of water storage.

3.5. Performance of ridge and furrow planting system for rain harvesting agriculture in Loess Plateau of China

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Ridge and furrow planting system (RFPS) for rain harvesting agriculture has been commonly practiced for decades in the Loess Plateau of northwest China resulting in significant improvements in soil and water conservation and economic returns. In the conventional RFPS, the ridge serves for planting and the furrow serves for water conservation. This study is focused on the reversed RFPS where the ridge serves for rain harvesting and the furrow for planting and water conservation. The relationships between the amount of harvested water versus ridge surface treatment and ridge-to-furrow ratio were quantified. Two types of ridge surface treatment (bare and plastic covered) and three ridge-to-furrow ratios (i.e., 30:60, 45:60 and 60:60 by width in cm) were studied experimentally. The results showed that the plastic covered ridges could harvest about 60% of precipitation compared to about 6% for the uncovered bare ridges in the study area with an annual precipitation of 263 mm (or 10.4 inches) varying between 150 mm (5.9 inches) and 400 mm (15.7 inches). Because of raindrop splashing from the plastic surfaces, the narrower ridges lost more water than the wide ridges. The wider ridges gained about 5% more runoff per 15- cm increase in the ridge width ranging from 30 cm to 60 cm (1 to 2 ft). Visual examination of the crop growth status indicated that the 60-cm wide, plastic covered ridges produced the best promise for higher crop yield. Therefore, the plastic-covered ridges with the highest ridge-to-furrow ratio (60-cm to 60-cm) were recommended for applications in this region.

3.6. Comparisons of the physical environments with the biological sand-control system constructions along the linear project areas of the two large deserts in Xinjiang

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The highway and water-drawing channel run parallel in linear zones connecting the two large deserts in Xinjiang, the Taklimakan Desert and the Gurbantunggut Desert. The linear zones have limited spatial ranges, and then their spans are wide, crossing through different geographic- geomorphologic units and multiple eco-environmental areas. The Taklimakan

Desert is a warm- temperate zone desert with extremely dry climate and meager precipitation, and its groundwater is abundant. The activities of blown sands are frequent and the mobility of sand dunes is strong in the desert. The mobile aeolian sand soil, with poor fertility and extremely low water-content, is mainly characteristic in the desert. The vegetation cover is low and the population is simple with poor diversity of plant species. Salt-tolerant psammophytes and meadow plants dominate, so the ecology in the desert is very fragile. The Gurbantunggut Desert is a temperate zone desert with less precipitation. There is no runoff on the sandy surface and the groundwater is deeper. The stable and semi-stable aeolian sandy soils dominate. The species of vegetation are richer and their life forms are more diverse, forming a desert grassland and shrub landscape. Establishing a biological sand-control system along linear project area in the Taklimakan Desert results in a blown sand control system of physical obstacle (consisting of the checkerboards and fences) that ensures that the highway remains smooth. Based on the site condition, the plants (such as *Calligonum roborovskii*, *Tamarix taklamakanensis*, and *Haloxylon ammodendron*) that can stabilize sand and are salt-tolerant, are chosen and planted. Then, pumping the saline groundwater, these plants are irrigated using appropriate irrigating technique. As a result, the obstruction of sand in the front and stabilization in the back is achieved. The eco-environment of the Gurbantunggut Desert is better than that of the Taklimakan Desert. Under a condition without irrigation, establishing a biological sand-control system by planting is basically feasible.

3.7. Nanoclay for revegetating desert lands

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Sandy soils are well known as being draughty, erodible, infertile and non-economical to develop. Research with natural clay as a soil conditioner showed an increase of up to 176% in yield and a reduction in water use of 50%. The Desert Control Institute Inc. (DCI) has developed a technology, based on their patented invention ‘Clay Nano Flakes,’ to achieve permanent benefits from the degraded soils with much lesser amount of clay. Nanoclay flakes are homogenized in water and applied on soil surface to control wind erosion, reduce water consumption by about 50%, enhance seed germination, and increase crop yield on sands. Field tests have shown 99% reduction in wind erosion with velocities of up to 27 m/s. In fine dune sand, application of 2 liter of nanoclay flake suspension per m² resulted in a penetration depth of 10 mm. The surface strength can be modified from barely binding to nearly 1 kg per cm² by varying the concentration of nanoclay flakes. For achieving effect up to 10 cm soil depth, 10 liter suspension per m² is needed and 43 litres for 40 cm depth. Verification tests have been performed by Desert Research Center, Cairo, Egypt, in April 2006. Currently 25 ha of desert land has been treated with nanoclay and planted with 10,000 trees in the Thar desert, east of Bahawalaphur, Pakistan, at DCII’s own expense with the aim to establish plantation and pass it on, free of cost, to the owners after some years. The experience up-to-date gives the confidence to start the next larger phase.

3.8. Could addition of either loam or compost help *Thevetia thevetioides* K. Schum. transplants to tolerate heavy metals toxicity under sandy soil conditions?

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A study was carried out in the open field at Orman Botanical Garden, Giza, Egypt during 2007 and 2008 seasons to determine the effect amending the sandy soil with 25% of either loam or compost to depress the deleterious effects of lead, cadmium and nickel in combinations at 500+50+25 ppm respectively (T₁), 3 fold (T₂) and 5 fold concentrations (T₃) on growth and chemical composition of Orange oleander (*Thevetia thevetioides* K. Schum) transplants grown in 25-cm diameter black polyethylene bags filled with about 3.0 kg of the above soil mixture. The results indicated that survival % was significantly decreased in response to T₂ and T₃ treatments, but significantly increased in sandy soil amended with either loam or compost. All vegetative and root growth parameters were progressively decreased with increasing toxic metals concentrations, except for stem diameter which slightly improved due to the low level of heavy metals (T₁), and the number of leaves / transplant, which greatly raised as a result of T₁ and T₂ treatments. Application of either loam or compost significantly improved all vegetative and root growth, even under high level of toxic metals. The percent of pollution resistance index (PRI%) in the two seasons was more than 60% indicating the ability of *Thevetia* transplants to tolerate metallic pollution, even under the high level. However, addition of the loam or compost to the sand did not improve this character. Heavy metals at low level (T₁) caused an increase in the content of chlorophyll a, b, carotenoids, N and P in the leaves. On the other hand, they were progressively decreased as heavy metal concentration increased. In general, addition of loam to the sand gave better results than those attained when compost was added. In conclusion, *Thevetia* transplants can tolerate toxicity of Pb, Cd and Ni combinations, even at high concentrations when grown in sand amended with 25% of either loam or compost.

3.9. Combating the desertification in Mexico dry lands

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Mexico has a surface of 1960000 Km and various types of weather: temperate, warm humid, dry and arid Desert. The territory is mostly mountainous, with little deep soil (leptosoles), with varied levels of degradation, because of deforestation, changing land use and overgrazing, caused by water and wind erosion. The country has programs of the preservation and restoration of soils as well as for the infiltration of rainwater through the soil. This work is done by the communities living in rural areas, where workmen and women, with the participation of indigenous group, mainly use hand tools and in some cases heavy machinery. Works involves the maintenance and restoration of soils, using materials that are there in the

region, such as stone, wood, the material of dead wood left by forest fires, discarded tires, and other materials which are simple and economical. Men and women are trained to do the work; they are provided simple learning material for the work and are advised by the technical advisers. The poster illustrates some of the 30 types of works suited to the specific needs of the watersheds, and the type and intensity of soil degradation. This work has managed to preserve and restore eroded soils on several thousand hectares, recovering native vegetation and achieving successful reforestation, recharge of aquifers, retaining stored carbon in the soil and preventing the soil reaching dams.

3.10. How far diluted sea water can be used for irrigation of some pot-plants?

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Two pot-experiments were conducted at Orman Botanical Garden, Giza, Egypt during 2007 and 2008 seasons to study the effect of diluted sea water at the levels of 0, 10, 20 and 30% on growth and chemical composition of Australian Banyan (*Ficus macrocarpa* L. var. Hawaii) and Spindle tree (*Euonymus japonicus* Thunb. cv. Aureus) plants grown in pure sand or sand amended with 25% of either compost or peat moss. Survival was 100% for *Ficus* Hawaii plants irrigated with either fresh or diluted sea water up to 30% under different soil media used, while for *Euonymus* plants, that was true only with fresh water on all media, and those ones watered with 10% of sea water and grown in sand strengthened with 25% compost or peat moss. In general, all vegetative and root growth parameters of both plants were progressively decreased in response to increasing salinity level, except for 10% sea water treatment, which slightly improved some vegetative and root growth characters, especially for plants cultivated in media fortified with either compost or peat moss. The least survival and growth rates were found in the pure sand medium or irrigation with sea water at 30% level, while the best results were obtained when plants were irrigated with 10% sea water and grown in compost sand medium. The salt resistance index (SRI %) was slightly increased in *Ficus* Hawaii plants due to 10% sea water treatment, but was significantly depressed with increasing salinity of irrigation water up to 30%. In *Euonymus* plants, SRI declined with raising salinity level. In general, SRI % for both plants was about 60% or relatively less, indicating their ability to tolerate diluted sea water up to 30%. The content of chlorophyll a and b and carotenoids (mg/g F.W.), as well as percentages of N, P and K were increased in the leaves of both plants as a result of irrigation with sea water at 10% level, but were greatly decreased with elevating salinity level. On the other hand, the content of Na and Cl (mg/g D.W.) and proline ($\mu\text{mole/g D.W.}$) exhibited a gradual increment in the leaves of both plants as salinity level increased. Data also showed that E.C. values (mmohs/cm.) of the different media gradually increased with raising salinity level, but the rate of was less in pure sand medium than in medium of sand amended with either compost or peat moss. However, using the compost caused a higher reduction in E.C. values than using of peat moss, and cultivation of Australian Banyan reduced this trait more than cultivation of Spindle tree. Therefore, it could be recommended to use *F. macrocarpa* var. Hawaii, and to some extent *E. japonicus* cv. Aureus in sandy soil for production of foliage pot-plants able to tolerate diluted sea water

up to 20 or 30% provided the sandy soil is amended with 25% (by volume) of well decomposed compost (as a cheap component) rather than peat moss, which is expensive.

3.11. Effect of irrigation delivery system and planting orientation on yield and technological qualities of sugar beet under North Delta conditions

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Two field experiments were carried out in North Delta during 2005/06 and 2006/07 winter seasons to study the effect of two irrigation systems, improved and traditional mesqa, and three sowing patterns ,i.e., ridges, platforms and rows, on root yield and quality of sugar beet. The experimental design was a split-plot, with four replications , where the irrigation systems were allocated to the main plots and planting patterns were arranged in the sub-plots. The results indicated that the improved mesqa irrigation system gave the highest root yields, gross and white sugar percentage and yield, while traditional mesqa gave the lowest values. Also the irrigation efficiency was better under improved mesqa method. Sowing in ridge or platform pattern produced better results. The improved mesqa irrigation system saved water by 14.8 and 18.0%, where as the platform pattern saved water by 18.8 and 19.9 % in the first and the second seasons respectively.

3.12. Effect of three irrigation regimes and three intervals on bulb yield and its quality under drip irrigation

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Two field experiments were conducted on at Bustan sandy soils on the newly reclaimed sites of the western desert of Egypt. Onion (*Allium cepa L.*) 'G.20' variety was used with three irrigation regimes (Irrigating with 100, 75 and 50% of Etc) at 1, 2 and 3 day intervals to study the effect of saving water on bulb yield and its components. The experiments were conducted in 2002/2003 and 2003/2004 winter seasons at Aly Mobark research station (Bostan region), which is characterized by soils of sandy texture, poor in fertility and low water holding capacity. Drip irrigation system was used. There were significant effects of the tested variables on yield and TSS values. The average yield was 25.73 t/feddan (1fed =4200 m²) for the two years with 100% ETC and intervals every one day.

3.13. Effect of irrigation regimes and soil amendments on the yield and its component of cantaloupe under drip irrigation in calcareous soils

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Two field experiments were carried out in the newly reclaimed calcareous soils at Horticulture Research station at Nubaria in 2005 and 2006 summer seasons. The objective of this research was to study the effect of two irrigation regimes (100% ET_c and 80% ET_c) and addition of natural and manufactured soil amendments (Organic matter, Taflah, and polymer). Tested amendment treatments were: 1) Control without any soil amendment; 2) Organic matter 20m³/feddan; 3) Polymer 0.1% as weight + organic matter; 4) Taflah 0.2% as weight basis +organic matter; and 5) Polymer + Taflah + organic matter. Results showed that the average branch length per plant was significantly higher with the irrigation at 100% ET_c and with the amendment treatment organic + polymer + taflah. Average cantaloupe yield (ton /feddan) was highest with the irrigation regime of 80% ET_c and with the treatment (organic matter + Taflah + polymer). These values were 17.32 and 15.12 ton/feddan for the seasons 2005 and 2006, respectively. Average total soluble solids (TSS) was higher in value for treatment (organic +Taflah) than the other treatments at irrigation regime of 100% ET_c.

3.14. Effects of drought stress on yield of maize (*Zea mays* L.)

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In order to investigate the effect of drought stress at different growth stages on grain yield and yield components of two maize hybrids, a field experiment was carried out in a split plot design with four replications at the Gorgan University in 2005. The main plots included: drought stress during late vegetative (S2), flowering (S3), grain filling (S4), both late vegetative and flowering (S5), both flowering and grain filling (S6), both late vegetative and grain filling (S7) stages and control (S1) (normal irrigation). Drought stress was imposed by withholding irrigation during each stage(s) until soil water potential reached to -1.5MPa. The subplots included two corn hybrids of single cross 704 and three way cross 704. Drought stress during both late vegetative and flowering stage (S5) had the greatest effect on biological yield, grain yield and yield components. Both biological yield and harvest index were significantly correlated with grain yield. Among the yield components, number of kernels per ear, thousand seed weight and number of kernels per row were highly correlated with grain yield. There was a significant difference observed between hybrids in terms of grain yield, harvest index, thousand seed weight, number of kernel rows per ear, diameter of ear, ear length and number of kernels per ear. The three way cross 704 appeared to be more sensitive to drought stress as its yield loss due to drought was greater than that of the single cross 704. In order to achieve high grain yield and water use efficiency under dry conditions, irrigations should be limited to the most sensitive growth stages such as late vegetative and flowering stages.

3.15. Effect of phosphate fertilizers on the cadmium content in soil and some grown vegetables

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Two years experiment (2005/2006) in sandy loam soil at Abu.EL-Atta village, in the west Nubaria region evaluated four levels of phosphate fertilizer (0, 100, 200, and 300 Kg P₂O₅ / feddan (1feddan = 4200m²) on the cadmium levels in three types of vegetable - fruit (tomato), leafy (lettuce) and root (radish). There was a significant increase in the Cd content of tissues with increasing rates of phosphate fertilizer. The (Cd) concentration in tomato juice was 0.1 mg kg⁻¹. In lettuce, the Cd content was 0.2 mg kg⁻¹ and in radish it was 0.7 mg kg⁻¹. We can conclude that phosphate fertilizers, which is used as source of phosphorus, also has high levels of Cd that could affect on agriculture and environment adversely.

3.16. Effects of nitrogen and phosphorus on safflower varieties in the dry lands

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Safflower is an important oil crop with deep and strong roots and resistant to drought that can be planted in rotation with dryland crops. In order to determine the effects of different levels of nitrogen and phosphorus fertilizers on the yield and oil content of new safflower genotypes, a study was carried out in 2 different dryland research stations (Maragheh and Sararood) in Iran. The experiment was arranged with 4 N fertilizer levels (0,30,60,90 kg ha⁻¹) and 3 phosphorus fertilizer levels (0,30,60 kg ha⁻¹) with 2 safflower genotypes (V1=No. 36 and V2=79-299) in Maragheh and (V1=537598 and V2=S-541) in Sararood in a factorial RCBD with 3 replications. Nitrogen fertilizer was supplied as urea and phosphorus fertilizer as triple super phosphate. In Maragheh, the results indicated that increasing nitrogen fertilizer increased the grain and biomass yield but phosphorus fertilizer did not affect the yield. In the interaction effect of Variety with nitrogen and phosphorus fertilizers, application of V2N90P60 had the highest seed yield (961 kg.ha⁻¹) and treatment V2N90P0 had the highest biomass yield (4173) kg.ha⁻¹. In Sararood, increasing nitrogen fertilizer did not increase seed yield but it increased plant height. In nitrogen and phosphorus fertilizers interaction, application of N60P30 had the highest seed yield (1283 kg.ha⁻¹). Considering the amount of precipitation and yield in different years, application of 90 kg.ha⁻¹ nitrogen fertilizer together with 30 kg.ha⁻¹ phosphorus (N90P30) is recommended in Maragheh regions and application of 60 kg.ha⁻¹ Nitrogen fertilizer together with 30 kg.ha⁻¹ phosphorus (N60P30), is recommended in Sararood dry lands for safflower production.

3.17. Nitrogen application in wheat varieties in different dry and cold regions of Iran

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Study of nutrient requirements of rainfed crops has been of great interest to drylands. While in certain locations and seasons yield response of these crops to fertilizers application is significantly high, in other places and under different climatic conditions, there is either no response or even a negative impact. Generally speaking, the relatively low average yield of crops under dry-farming is partly attributed to improper soil fertility management. Since nitrogen deficiency is common in the rainfed areas of Iran, the effects of different levels of N fertilizer on yield and other agronomic traits of new wheat Genotypes were studied in an experiment carried out in three different dryland research stations (Maragheh, Ormey, Iilam). The experiment was set up with 4 N fertilizer levels (0, 30, 60, 90 kg/ha) and three cold tolerant promising wheat genotypes (KVZ/TM71/3/, SBN/TRM/K253 and SBN/1-27-56-4) in factorial RCBD with four replications for three years (1999-2001). The amount of yearly precipitation was 235.1, 264.7 and 210.6 mm respectively. The results showed that using 60 kg/ha N in line KVZ/TM71/3/ resulted in the highest grain yield, nutrient (N, P and K) content and harvest index. This line namely Azar2, is comparable with the Sardari, the common previous dryland wheat variety. Increasing of nitrogen level from 60 to 90 kg/ha did not increase grain yield, but increased straw in different wheat genotypes. Considering the amount of precipitation and the biomass yield of different wheat varieties, application of 60 kg nitrogen together with 40 kg/ha P₂O₅ is recommended for wheat production in dry lands.

3.18. Utilization of vermicompost technique as entrance to sustainable agriculture

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This study aimed at investigating the possibilities of developing a management system for organic wastes using epigieic earthworms to increase the efficiency of composting, recycle different organic wastes (farm or household), offering nutrient-rich compost for sustainable agriculture and to get several byproducts via vermicomposting (cast, vermiliquid and earthworm biomass). Horse, cattle, and rabbit manure, grass clippings, vegetable and fruit waste (kitchen wastes), newspaper, cardboard, and farm wastes (rice straw and broad bean stalks) were used to make vermicompost via epigieic earthworms *Lumbriscus rubellus* (Red Worm), *Eisenia fetida* (Tiger Worm), *Perionyx excavatus* (Indian Blue Worm) and *Eudrilus eugeniae* (African Night Crawler) compared to the conventional composting. The results showed that using of vermicompost process resulted in a compost with increased N, P and K content compared to conventional composting, while it decreased the heavy metal content. High content of macro and micro elements were found in vermiliquid compared to the compost-tea of ordinary composting.

3.19. Methane emission in different Egyptian rice lines as related to morphological and physiological traits

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Global climate change is one of the most important issues of contemporary environmental safety. A scientific consensus is forming that the emissions of greenhouse gases, including carbon dioxide, nitrous oxide and methane, from anthropogenic activities, may play a key role in elevating the global temperatures. Rice (*Oryza sativa* L.) fields contribute to global methane (CH₄) emission and warming. Rice cultivated areas are about 8.5 million ha in Africa. Egypt is growing rice on about 504,000 ha every year. It is estimated that rice agriculture will be further expanded by 70% by 2025. Unfortunately, all possible mitigation options (water regime, straw/ residue management, fertilizer application etc.) of methane in paddy fields have negative relationship with yield. Moreover, they are costly. Selection of suitable cultivars is an expensive way to solve the problem. This study determined the variations in 40 rice lines in CH₄ production and emission in relation to the vegetative characteristics, aerenchyma formation and use of atmospheric oxygen (dissolved oxygen, DO) at the vegetative, reproductive and ripening stages of the plant. A positive relationship was established between the intensity of soil anaerobiosis and both aerenchyma formation and DO. Dissolved oxygen use increased with increase in these vegetation characteristics in all rice lines. Results of this study demonstrates that vegetation characteristics influence soil net CH₄ flux from rice in two ways: (1) directly determine the amount and rate of DO use in the rice rhizosphere, (2) initiate morphological and physiological changes in the rice plant that affect gas exchange between the soil and the atmosphere. Although these laboratory conditions may not necessarily reflect actual conditions in the field, they provide a theoretical basis for provide fundamental basis for cultivar selection as a mitigation strategy to reduce CH₄ emission from rice fields.

3.20. Effect of partial root zone drying and deficit irrigation techniques on the tomato crop yield, water productivity and its physiological effects under drip Irrigation system in calcareous soil

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Partial root zone drying is a new irrigation technique for the optimum utilization of the limited water resources. The present study was carried out at the Experimental Farm of Nubaria Horticulture Research Station, Agriculture Research Center during the summer seasons of 2005 and 2006 to test the effect of partial root zone drying (PRD), deficit

irrigation (DI) and regulated deficit irrigation (RDI) techniques as well as the potassium fertilizer levels on the productivity of tomato crop in calcareous soil. Six irrigation treatments were tested: 1- Control (100% ETo), 2- PRD, (75% ETo), 3- PRD2 (50% ETo), 4- DI, (75% ETo), 5- D13 (50% ETo), and RDI. The potassium levels were (0, 119 and 238 kg K₂O/ha, designated as K0, KI and K3, respectively). Under the calcareous soil conditions of Nubaria region, optimum tomato yields could be obtained with K fertilizer level at 238 kg K₂O/ha and irrigation with amount of water equals 75% of ETo using PRD| and 50% of ETo in the last stage using RDI techniques. However, the addition of K fertilizer should be economically adjusted to meet the optimum cost for tomato production. Plant's proline and ABA content increased with water stress, especially in the dry side of soil under PRD technique, and helped plants in closing stomata to reduce water losses with minimum reduction in yield. Under the same amount of applied irrigation water (AIW), the water use efficiency is more under PRD than the DI technique. Practicing PRD will save about 25% of AIW and will give from 5.21 to 7.2 kg tomato fruits per m³ of AIW.

3.21. An artificial neural network approach for estimating pan evaporation

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Computer simulation moduls are important tools in research and decision making related to agricultural production and hydrological studies. Evaporation is one of the fundamental elements in hydrological cycle, which affects the yield of river basins, crop management and crop response to weather conditions. In general, there are two approaches for estimating evaporation: 1) the indirect methods such as the Penman equation and Priestley-Taylor which are based on meteorological variables; 2) the direct methods include the class A pan evaporation measurement. The objective of this research is to develop artificial neural network (ANN) models as an alternative approach of pan evaporation estimation using measured weather variables as inputs. Meteorological daily records from twenty weather stations covering different Egyptian governments were used to develop the models of daily pan evaporation. The data were divided into three location groups as Lower Egypt (from the Mediterranean coast to Cairo), Middle Egypt {from Cairo to Sohag) and Upper Egypt (from Sohag to southern border with Sudan). Additional meteorological data from these locations were used to test and evaluate the accuracy of these models. The results showed that there is agreement between the ANN estimations and measurements of daily pan evaporation. The multiple linear regression (MLR) models showed less accuracy for estimating the pans evaporation than the ANN models. The regression coefficient (r) for both training and validation phases of the ANN models exceeded 0.9.

3.22. Impact of irrigation with low quality water on the productivity of sgarbeet at Sahl El Hussinia plain

E.E.E. Khafaga; Kh. A. H. Shaban and H.S. Saied

This work was carried out at Sahl- El-Hussinia plain , El-Sharkia Governorate, a private farm, through two successive seasons (winter 2007 and 2008 season) to study the effect of different irrigation sources on sugar beet productivity. The sources of irrigation water was El- Salam canal Nile water mixed with agriculture drainage water (1 : 1); Bahr Hadoos drain (agriculture drainage water) and Bahr EI-Bakar drain (sewage effluent).

There was a reduction of soil pH as a result of irrigation with different sources of irrigation water specially the soil irrigated with Bahr EI-Bakar drain. There was a decrease of soil salinity by use of irrigation, highest being with the water of Kl-Salam canal. There was a relative increase of N, P, K and available Fe, Mn and Zn in the first season. There was a significant increase of sugar beet production in soil irrigated with Bahr El-Bakar drain, while the Sugar purity and sugar yield increased in soil irrigated with El-Salam canal. The different resources of irrigation water led to increase in the concentration of N, P, K , Fe, Mn and Zn in sugar beet shoot more than in the root.

3.23. Combined effect of fertilization and irrigation management on canola production under different Desert soils and irrigation systems

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The study aimed to evaluate the response of canola (*Brassica napus* L.) to three of N, K fertilization levels, and three irrigation water quantities under newly reclaimed calcareous (surface irrigation system) and sandy (sprinkler irrigation system) soil conditions at Nubaria region. The results for calcareous soils revealed significant increase with increasing applied water up to 2100 m³ fed⁻¹ in seed yield and various yield attributes. With increase in K fertilization from 24 to 48 and 96 kg K₂O fed⁻¹, yield increased but the oil % and oil yield were highest at 48 K₂O fed⁻¹. Under sandy soils the response of canola to irrigation regime indicated that irrigation treatment Irr3 (2154 m³ fed⁻¹) produced the highest significant SY, BP, PH, PN, O%, OY, and KUEs. Increasing nitrogen levels from 40 and 80 up to 120 kg N fed⁻¹ increased significantly SY, StY, BP, PH, PN, and OY, but decreased significantly N and K use efficiency. Significant increase in SY, StY, BP, HI, PH, PN, OY, KUEs and NUEs, NUEo occurred with increase in K fertilization. Maximum yields of high quality canola cannot be obtained without adequate fertilization if the crop is grown on soils deficient in essential elements. However, fertilization may not increase yields or quality of canola if other management inputs are not at a high level.

3.24. Study on planting date effects on seed and oil yield in landrace and advanced safflower cultivars in dry land condition

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Safflower (*Carthamus tinctorius*) has been planted in Iran for many years. Rain fed planting of safflower is possible in 3 ways: fall, entezari and spring planting. In order to determine the best time of safflower planting in dry land conditions this experiment was conducted in 2002-2004 with 5 lines and varieties in 3 planting dates in North Khorasan dryland research station at Shirvan. Entezari planting had the highest seed yield in both years. Also PI-537598 was cold tolerant and suitable for dry land fall planting.

3.25. Evaluation the effects of planting density on grain and oil yield of two safflower varieties under entezary planting system (dormant seeding) in dry land conditions

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Optimum seed rate through changing plant population and utilization of environmental resources affects yield components and seed yield. In order to determine the best planting density for rainfed safflower, this experiment was conducted as factorial design based on RCBD with four replications. The highest grain yield (606.6 kg/ha) was obtained with 25 cm row distance and 5 cm distance between plants in row and genotype no. 1, and this plant density is recommended for Shirvan and other regions with similar climatic conditions.

3.26. Introductoin of some artropode herbivore for biocontrol of canada thistle (*Cirsium arvense* (L.) Scop.)

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Canada thistle is one of serious weeds throughout the world and third serious weed in Europe. This weed has a high competition ability and appear in different region and climates. The control of canada thistle is very difficult due to its extensive lateral and

diffused root systems, the lignified and spiny form of its stem and leaves and also the ability of high seed production. Canada thistle seriously decreases crops yield. Therefore, control of this weed in field is very important. As Iran is one of the best regions with diverse flora and fauna, this region is attractive by biocontrol specialists throughout the world. This experiment as started from 2006 and so far 12 branches arthropod contain a mite herbivore belonging to Arachnida and 12 species belonging to Coleoptera have been found. Among these agents, four species showed high population and efficiency on Canada thistle and therefore this species can be a promising biological control agent for *Cirsium arvense*.

3.27. Water behaviour of soybean in north Middle Nile Delta region under application of microbial and mineral fertilizers

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Two field trials were conducted at Sakha Agricultural Research station during the two successive growing seasons 2007 and 2008 in the North Middle Nile Delta region to study the impact of irrigation water depth, application of microbial inoculants and nitrogen fertilization on some water relations, yield and yield components of soybean plants. Increasing irrigation depth up to 6.0 cm resulted in higher seed yield but the highest mean values were recorded under irrigation depth of 4.0 cm. So, here we can say under the conditions of the studied region we should irrigate with 4.0 cm irrigation depth instead of 6.0 cm because this leads to saving a large amount of irrigation water, improves soil properties and decreases pressure on the drainage system in the area. Data also showed that adding microbial inoculants increased seed yield comparing with non-application treatments. Applying nitrogen, increased seed yield where the highest mean values were recorded under the highest dose of (100% recommended).

3.28. Sustainable management of the eco-product on greenhouse cucumber and pepper crops

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The two experiments were conducted in 2007 and 2008 at El-Bosaily farm in the north coastal area of Egypt and Agrofood Farm, El-Noubaria, Egypt to evaluate the effectiveness of the both environmental friendly plant protection products (e.g. Agri-Colle® and Agri-50NF®) at greenhouses on commercial and organic crops. The main objective of this study was to evaluate the effect of eco-product (AGRI-COLLE® AND AGRI -50NF®) on pest and diseases infected cucumber and pepper crops under greenhouse and reduce environment pollution. The two products were sprayed on the plants with two treatments and 3 replicates

within the Cal-Agi treatment (Eco products treatments). The used dose was 175ml / 125 L / greenhouse. The products effectiveness was assessed by determining the powdery mildew severity with interval (7-10 days) on the cucumber and pepper. The number of insects (Aphids, White flies and Leaf miners) was determined by counting on 10 randomly selected plants from each of two replicates per treatment. The effects of the Eco products was evaluated by comparing the Cal-Agri treatment to active treatment at Agrofood organic pepper greenhouse, and to active and passive conventional cucumber and pepper greenhouses at El-Bosaily Research Unit. Spraying by eco product (AGRI-COLLE® and AGRI -50NF®) can be an alternative method to control powdery mildew disease severity and pest population. That can reduce the need for chemical pesticides to minimize environmental hazards and reduce emission of gases. In addition, it increases the cucumber and pepper yield. Thus using eco product (AGRI-COLLE® and AGRI -50NF®) can help to facing the food demand and reduce the climate change influence.

3.29. Methane emission in different Egyptian rice lines as related to morphological and physiological traits

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Global climate change is one of the most important issues of contemporary environmental safety. A scientific consensus is forming that the emissions of greenhouse gases, including carbon dioxide, nitrous oxide and methane, from anthropogenic activities, may play a key role in elevating the global temperatures. Rice (*Oryza sativa* L.) fields contribute to global methane (CH₄) emission and warming. Rice cultivated areas are about 8.5 million ha in Africa. Egypt is growing rice on about 504,000 ha every year. It is estimated that rice agriculture will be further expanded by 70% by 2025. Unfortunately, all possible mitigation options (water regime, straw/ residue management, fertilizer application etc.) of methane in paddy fields have negative relationship with yield. Moreover, they are costly. Selection of suitable cultivars is an expensive way to solve the problem. This study determined the variations in 40 rice lines in CH₄ production and emission in relation to the vegetative characteristics, aerenchyma formation and use of atmospheric oxygen (dissolved oxygen, DO) at the vegetative, reproductive and ripening stages of the plant. A positive relationship was established between the intensity of soil anaerobiosis and both aerenchyma formation and DO. Dissolved oxygen use increased with increase in these vegetation characteristics in all rice lines. Results of this study demonstrates that vegetation characteristics influence soil net CH₄ flux from rice in two ways: (1) directly determine the amount and rate of DO use in the rice rhizosphere, (2) initiate morphological and physiological changes in the rice plant that affect gas exchange between the soil and the atmosphere. Although these laboratory conditions may not necessarily reflect actual conditions in the field, they provide a theoretical basis for provide fundamental basis for cultivar selection as a mitigation strategy to reduce CH₄ emission from rice fields.

3.30. Impact of precision farming technology on enhancing soil resilience case study – site specific farm management in El-Nubaria region, Egypt

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Precision farming is a spatial information technology applied to agriculture. Also it is known as site-specific farming that encompasses collecting and analyzing data for different locations within a field in a way that allows management decisions to vary in those diverse locations. Spatial information technologies include global positioning systems (GPS), geographical information systems (GIS), variable-rate technologies (VRT), and remote sensing (RS). Precision farming as a system approach based on detailed site-specific information to manage farm operations according the spatial and temporal variability of growing conditions within a field for sustainable profitability is a relatively young field of agricultural research that emerged in the last decade. Reluctance towards implementation of precision agriculture in Egypt seems to be based upon accessibility to well-trained and knowledgeable people, cost and availability to obtain quality education and training. The learning processes of precision agriculture technologies and methods are outlined as six sequential steps. The uniformity trial was conducted during winter wheat season at El-Tanmeya village, sugar beet area, El-Nubaria region to evaluate on-farm spatial and temporal variability of nutrients level and wheat yield as representing the soil resilience indicators. The semi-variogram model with its parameters and Kriging interpolation maps were drawn to indicate the inherent spatial on-farm micro-variability distribution of some soil properties and wheat yield.

3.31. Rice straw-seedbed for producing modified mat nursery of rice seedling

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This paper describes a new culture media for rice seedling nursery - the rice straw-seedbed (RSS). The conventional soil-seedbed system (CSS) has major problems of heavy weight of nursery boxes that are required to be carried for transplanting. A modified mat nursery (RSS) establishes seedlings in a layer of treated rice straw, arranged on a firm surface. It saves labor, water and fertilizer in comparison with the CSS or hydroponics systems. One type of seedling mats developed was short-mat seedbed, SS (1.2 m long). The length of the conventional nursery box in the CSS is 60 cm. Therefore, the length of one SS is equivalent to that of double nursery boxes in the CSS. And, for the same amount of seedlings, the weight of SS is about one-third of that of the CSS, and therefore it is easier to carry to the field. The mat can be rolled up into small diameter bundle that farmer can package it using the plastic bag. The volume of the rolled seedlings is about one-third that of the equivalent amount of seedlings in the CSS. The seedlings can be transported by a pickup truck. A

pickup truck can carry seedlings for a rice field of 2 ha at one time. The labor intensity of short-mat technology by RSS is less than half of that in the CSS. The typical working posture in the CSS, bending the waist to lift heavy nursery boxes, is not needed. Cultivating rice seedlings in rice straw improved the seedling characteristics such as plumule length, seedling nutrients content, biomass and seedling vigour. Irrigation water required for RSS was very low. The study indicated that modified mat nursery using RSS is a good method for rice field.

3.32. Stevia growth, yield, and its technological parameters as affected by different soil types and water table depths

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The present study was undertaken to determine *Stevia rebaudtana* Bertoni growth habit and its technological parameters under two different soil types and five soil water table (SWT) levels, which reflected the environmental conditions of north Delta region. Only two cuts were taken due to the weather conditions in winter time, with its short day length and low temperatures that reduce the growth and yield. Loamy soil was significantly better than the calcareous soil. A 40 cm of soil water table (SWT) produced heavier fresh and dry leaves (by 7 to 30 %) than deeper depths. The same advantage was found for plant dry weight. The relationships between technological parameters were detected where fat percentage was identical in both soils, whereas loamy soil produced higher protein than calcareous. No effects were detected of SWT levels on any of these parameters. Stevia sweeteners, stevioside, Reb A, and total carbohydrate contents were identical under the tested soil and water table treatments.

Theme 4: Biodiversity conservation and utilization

4.1. Genetic diversity of glutenin subunits and gliadins in Asian common wheat

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Common wheat, *Triticum aestivum* L., appeared about seven thousand years ago in the southeastern coastal area of the Caspian Sea. During its transmission to Europe, Africa and southern and eastern Asia, common wheat became adapted to a wide range of climatic conditions. For instance, since in Asia, there are high mountainous areas and desert areas under harsh conditions, the eastward spread from the center of origin was not simple. Glutenin subunits and gliadins, which are major contributors to wheat flour quality, are expected to display a wide diversity because they are encoded by a multigene family. We analyzed the genetic diversity of glutenin subunits and gliadins in Asian common wheat cultivars. Frequency of these proteins in the Japanese cultivars was very different from those in other Asian cultivars. The frequency of each genotype from the Asian collection or breeding areas varied. These cultivars have been growing in each area for a long time and accumulated or selected the land area specific genes not only for wheat flour quality but also for tolerance to biotic and abiotic stresses. These genes might be useful for breeding of wheat cultivars with elasticity in dry conditions.

4.2. Agricultural practices and sustainable biodiversity conservation in cotton region of Eastern Burkina Faso

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Like most of the Sahelian countries, Burkina Faso faces a perpetual degradation of his natural resources with anthropic factors the most important. The aim of this study was to make a diagnosis of agricultural practices and their induced effects on biodiversity in the eastern region of Burkina Faso. A methodological approach based on monitoring of sixty cotton exploitations in Kompienga province allowed data collection. The diagnosis highlighted that cotton production systems are extensive, space consuming with use of chemical fertilizer and pesticides. During the period of study, the cultivated surfaces in cotton per farmer were $3,23 \pm 3,35$ ha and $3,31 \pm 2,60$ ha respectively in 2005 and 2006, which represented 40% of total cultivated areas. In addition, soil conservation and recovering techniques (fallow, agroforestry, compost use) are seldom. The study revealed an intention to increase the field surfaces (70,5% of cotton farmer), encroaching the boundary of forest and fauna reserve areas. The matrix of ecological risks highlight the degradation of dense vegetation, water and

soil pollution, the decrease in biodiversity especially for entomology, microfauna and aquatic population. The main consequences of these risks are the compromise of sustainable development in the region. It is therefore necessary to develop strategies that mitigate the negative effects due to climate change.

4.3. Ecological and genetical studies of mangrove (*Avicennia marina*) forests in the Sultanate of Oman

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Coastal area of the Sultanate of Oman had been covered by large and dense mangrove forest of *Avicennia marina*. However, most of them were destroyed by overuse for fuelwood and overgrazing by livestock. As a result, only small patches of mangrove forest can survive at studded mouth of wadi and lagoon along the north-east shoreline.

In seven *A. marina* populations growing along the coastal area of the Sultanate of Oman, we investigated forest structures and measured stomatal conductance and transpiration rate in 2003. In addition to the ecological analyses, the DNA analyses were held by CTAB method and DNA polymorphism was measured by the RAPD method. *A. marina* controlled transpiration rate by changing stomatal conductance to drought stress or saline stress increasing along the tidal inundation level. There were the forest structural differences among the northern part and the central and southern parts. In northern part, the maximum height of *A. marina* was about 6 m with high tree density. On the other hand, in the central and southern parts, it reached over 8m with big CPA (Crown Projection area). Annual change in precipitation and difference of temperature affected tree growth. And canopy gap formation and fresh seawater inundation affected regeneration and establishment of seedlings. Genetic distances between the northern and central populations and the southern population were longer than the distances between the northern populations and the central populations. It suggested the necessity of consideration for the mutual transplantation of seeds and seedlings for the afforestation program. Genetic diversity showed significant positive correlation with forest area. Therefore it was important to maintain *A. marina* population occupying a large forest area for the conservation of genetic diversity.

4.4. Some exotic invasive and predicted to be invasive plants in Yemen: a preliminary survey

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Exotic invasive plants are amongst the most significant threats to biodiversity, and are responsible for major changes to ecosystem structure and functioning. The objectives of this

study were to survey the most harmful mainly the environmental and widely spread- exotic invasive plants in some parts of Yemen, and to carry out a preliminary assessment of their impact. This was done by field observation and interviewing local people. Pilot surveys were done from November 2006 through April 2008, concentrating on the most prevalent exotic invasive plants in various natural ecosystems such as wastelands, roadsides, grazing lands, and abandoned agricultural fields. Many well-established invasive plants were found, like *Prosopis*, which is of three species. *Prosopis* and *Opuntia dillenii* (Ker-Gawel.) were introduced deliberately. *Opuntia dillenii* (Ker-Gawel.) causes blindness to human and animals by its small spine. Due to its dense thickets, it also changes ecosystems, blocks natural water flow, and excludes grazing animals. *Prosopis juliflora* has negative impact on water resources and biodiversity. *Tagetes minuta* is a noxious mountainous weed; it displaces and reduces native and other edible plants. *Verbesina encelioides* was not reported in Yemen. It was seen for the first time in Taiz city and in the western part of Sana'a city. Another new record in Yemen is *Nicotiana glauca*. *Verbesina encelioides* and *Nicotiana glauca* are predicted to be noxious invasive plants in Yemen. In this paper the presence of the most significant invasive plants and their observed impact will be presented.

4.5. Diversity in digestibility of straws from 20 different wheat genotypes

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To study the diversity in digestibility of straws from different genotypes 20 genotypes of durum wheat were used. All the Genotypes were grown under the same agronomic condition in a randomized complete block design. They belonged to medium maturity and were harvested on the same day when they were considered physiologically mature judged from their color and brittleness. Harvesting was performed manually at ground level; six intact plants were randomly selected from each replicate. The harvested materials were immediately made into sheaves, tagged and transferred to laboratory. The total weight of the individual plant was recorded and then separated into grain and straw. Straw yield per plant was calculated by subtracting the grain weight from total weight. Two- stage invitro digestibility was carried out to measure digestibility of dry matter (IVDMD) and organic matter (IVOMD) of straws. Genotype '75-3-3-5' showed the highest ($p < 0.05$) IVDMD (523g/kg) and IVOMD (541g/kg) while the lowest ($p < 0.05$) values (378 g IVDMD/kg and 385g IVOMD/kg) were observed in genotype Arthar71/Bcr/ch5. There was also 41 % difference between in digestible organic matter in dry matter (DOMD) per kg of the above two genotypes. When gram digestible dry matter or organic matter per plant of the different genotype was calculated the difference was even much more pronounced (over 55%). The results from this experiment showed that a great diversity exists in digestibility and the amount of digestible organic matter produced per plant in straws from different wheat genotypes. The results also emphasize the fact that differences in quantity as well as quality of the residue after harvesting wheat should be taken into consideration in addition to the yield of seed from wheat varieties in any breeding program.

Theme 5: Range management and forage and livestock production

5.1. Integration of Landsat ETM+ data with field measurements for mapping leaf area index in grassland of Central Kazakhstan

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Leaf area index (LAI) is a basic quantity defined as half leaf surface area per ground surface area and plays a significant role in agricultural, ecological and meteorological models at local, regional and global scales. LAI has been effectively estimated from remote sensing measurements. The common approach for mapping LAI from remotely sensed data is to relate in situ measured LAI values to spectral reflectance in satellite bands. This paper reports about the retrieval of a fine-resolution LAI data set over a 250 km*250 km region in Central Kazakhstan using ground measurements of LAI and Landsat ETM+ imagery acquired at the time of the field survey. LAI was inferred from canopy gap fraction measurements taken at 150 test sites across a 120-km transect through the study region. Single and multiple spectral bands and multi-spectral indices were used as explanatory variables in different regression models. The best predictive power was achieved using the regression model employing canonical index (CI), which combines all the contributions of individual Landsat ETM+ bands into a single index. This model explained more than 85% of the variation of LAI over space. The data set of LAI retrieved in this study can serve as a basis input variable for modelling net primary production and its variability at the regional scale. Finally, it can be also used for validation and improvement of the MODIS LAI product for grasslands of Kazakhstan.

5.2. Using animal tracking technologies to determine site preference, location and intensity of grazing

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Grazing animals can be managed so they provide milk, meat and other products while simultaneously sustaining natural ecosystems in good condition. Domestic stock can also be mismanaged and cause severe environmental damage. Proper management of livestock requires knowledge of both the forage production calendar and the animal nutritional demand calendar. It also requires knowledge of the behavior of grazing animals including the locations animals choose to graze, plants selected, and the timing and intensity of grazing. The process of balancing forage production with nutritional demands of the flock or herd is further complicated by the vagaries of weather, periodic long-term drought, and global climatic change. Modern global positioning systems (GPS), geographic information systems (GIS), and computer technologies offer scientists and planners unprecedented power for analyzing animal movement. We have studied the movement of domestic and wild animals to determine site preference for both resting and foraging as well as estimating the duration and intensity of grazing. GPS collars that record position (latitude, longitude and altitude) and movement (velocity and bearing) at 1 second can be used to extract animal resting locations, grazing areas, and directed movement to and from water or corrals. By tallying the time spent or number of positions logged while grazing on each vegetation type, we determine an index of site preference (% grazing time on a vegetation type/% of the vegetation type on the landscape). By tracking several animals in a herd, relative grazing intensity can be calculated. Animals tend to choose low energy cost routes across a landscape. Topographic and man-made features such as hills streams escarpments, highways and fences restrict animal movement and may funnel animals into confined areas leading to degradation. Examination of transit routes and watering locations in a GIS program can also identify areas susceptible to trampling damage and overuse.

5.3. Soil chemical properties of the mound formed by *Caragana microphylla* in Mongolian grassland

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Most of plants distributed discontinuously and patchily in arid and semiarid regions can make mounds beneath their canopy through trapping of flowing particles, accumulation of plant litter, and preventing loss of deposits by wind. Soil of mound is thought to become fertile because shrub gathers nutrients from surrounding area and accumulates nutrients beneath its canopy. Thus, some shrub species in arid and semiarid regions supply suitable place to other plants through forming mound. A leguminous deciduous shrub, *Caragana microphylla*, is one of the plants which forms mound. Although there are erosion control engineering studies about *C. microphylla*, no research has been reported about ecological function of *C. microphylla* and its mound. Our objective is to clarify soil chemical properties of the mound formed by *C. microphylla* in Mongolian grassland. Soil samples taken from the mound, under the mound and the surrounding ground indicated that amounts of total nitrogen (N) and carbon, and available N were larger, and net N mineralization rate and net nitrification rate were higher in the mound than in the surrounding ground. These results suggested that

mound formed by *C. microphylla* accumulated more organic matter by litter deposition, and decomposition of organic matter is faster than surrounding soil. Therefore, it is likely that the mound beneath the canopy of *C. microphylla* forms “islands of fertility”, which locally accumulate nutrients in Mongolian grassland.

5.4. Performance of Hungarian vetch as a winter crop in cold drylands

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Introduction of winter type Hungarian vetch (*Vicia panonica*) is essential for soil conservation and forage production in cold drylands of Iran. In this research, 25 accessions of *Vicia panonica* received from International Center for Agricultural Research in the Dry Areas (ICARDA) were studied as winter crop at Dryland Agricultural Research Institute and cold tolerant single plants were selected in the first year (2004). Seventy five pure lines were studied in the second year (2005) and finally 15 cold tolerant pure lines were studied at four research stations during 2006-2007. The results showed that some genotypes could pass winter in cold highlands successfully. Some lines including Sel-1326, Sel-515, Sel-474 and Sel.686 produced more than 5 ton dry biomass yield over four locations and there was record of 7 ton dry biomass yield by Sel-515 at Maragheh. It is concluded that promising lines of Hungarian vetch may be planted as winter crop in wheat rotation in cold area where the land is left as fallow after wheat or is considered for low performance and risk full spring type food legumes.

5.5. Improvement of *Lolium multiflorum* under north-western Coast of Egypt

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Two field trials were conducted at the Maryut Experimental Station of the Desert Research Centre during the winter season of 2005/2006 and 2006/2007 to evaluate forage quantity and quality of ryegrass (*Lolium multiflorum*), with different rates (30, 45 and 60kg N/feddan, 1 feddan=0.42 ha) and sources (formaldehyde-coated urea, rock phosphate-coated urea, bentonite-coated urea) of nitrogen and under different irrigation intervals (irrigation every 7, 14 and 21 day). Irrigation at short intervals (7 days) significantly increased growth, and fresh and dry forage yields. The fodder yield decreased to 74.2 and 28.5 % with increasing irrigation interval from 7 to 14 and 21 days. Short irrigation period significantly increased crude protein content while crude fiber content was decreased. Rock phosphate and bentonite showed superiority over urea formaldehyde. Increasing levels of nitrogen increased growth and forage yields. In general, it can be recommend that for raising ryegrass forage quantity

and quality under north-western coastal zone irrigating ryegrass at 7-day interval and fertilizing with rock phosphate- and bentonite-coated urea at the 60 kg N/fed would be best.

5.6. Identification of drought tolerant feed legumes for Iranian highlands

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Development of feed legumes as cover crops and for hay production in highlands has become first priority because of increased demand for livestock in one hand and increasing soil productivity depression along with environmental contamination associated with N fertilizer, on the other hand. Selection of suitable species for grazing along with soil conservation is a critic decision in the forage crops establishments in the drylands conditions. Indigenous germplasm lines of two chickling species (*Lathyrus sativus* and *Lathyrus cicera*) and three vetch species (*Vicia villosa*, *Vicia sativa* and *Vicia ervilia*) were evaluated in dry-highland conditions of Iran in the west Azarbaijan province. Different species were selected for more study in different agro-ecologically zones. Both chickling species were suitable for cold and warm areas. However *V. sativa* was good for warm area and *V. villosa* had good potential for cold and semi-cold areas. It was concluded that more detailed trials should be done for identification of suitable cultivars from each vetch/chickling species to be used as alternative crop in drylands rotation or to be replaced for fallow in highlands of Iran.

5.7. Efficiency of poultry manure and seed coating of *Avena sativa* under calcareous soil conditions of Egypt

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A field trial was conducted at the Maryut Experimental Station of the Desert Research Centre during 2005/2006 and 2006/2007 to evaluate the effect of poultry manure (30, 45 and 60 m³/fed) and seed coating in EDTA at the rate of 0.3 g for either Zn or Fe and 0.15 g for Mn per kg seed individually or in all possible combinations on growth and productivity and quality of *Avena sativa* L. under calcareous conditions. The poultry manure application increased growth and forage yield of oat. Micronutrient treatment suppressed these traits as compared to control. The soil pH and electrical conductivity decreased and OC content increased.

5.8. Developing synthetic population through selection in Egyptian clover (*Trifolium alexandrinum* L.)

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Selection and random cross pollination for fresh and dry forage yields and protein content within seven local Egyptian clover genotypes (*Trifolium alexandrinum* L.) was applied for two generations to develop a synthetic population. Syn₁ and Syn₂ were tested against the base populations and two imported Italian varieties (Nilodi and Sacramento). Enormous improvement was achieved where Syn₂ had higher values in all studied traits than the best parent (Gemmeza-1), Syn₁ and the imported varieties. The realized gains from selection ranged from 13.2- 34.4% for fresh forage yield, 11.4 to 37.7% for dry forage yield and from 2.8 to 8.9% for protein percentage. Heritability in broad sense were high for seasonal fresh and dry yields (88.7 and 88.2%) and 65.0% for protein percentage. The environmental variations were 11.3, 11.7 and 35.4% for fresh and dry yields and protein percentage. The expected genetic advance for fresh, dry yields and protein percentage were 8.1, 2.3% and 0.8% respectively.

5.9. The most common insect species in Alfalfa field in Egypt

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Alfalfa is a superb forage, but it can shelter a complex of insect pests, natural enemies and pollinators. Alfalfa insect populations can vary greatly from field to field. Therefore, it is essential to check each alfalfa field frequently for the presence of insects. The survey of the insect fauna of alfalfa (*Medicago sativa*) was carried out in different areas of Egypt (Ismailia, Suez, Swia Oasis, and The New Valley). In Suez, Swia Oasis, and the New Valley a high number of insects was collected from alfalfa fields. Some samples were collected for one to twice only. The samples were taken from alfalfa experimental field at university farm in the season 2003, and different species were categorized in the following groups: pests, natural enemies and pollinators.

5.10. Vital role of *berseem* in Egyptian agriculture

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Due to the limited natural resource base of land and water for raising field crops and rapidly growing food demand of rising population, there is a big competition between wheat and *berseem* (Egyptian clover) for allocation of land in Egypt. The need for increasing area under wheat to increase self-sufficiency of this strategic crop is undisputable. Unfortunately, the only immediate possibility to increase the wheat area would be at the expense of *berseem*, since the latter covers a major area during the winter season. However, *berseem* has enabled livestock to be closely integrated with cropping for many centuries, and it is playing vital role in the sustainability of Egyptian agriculture. It has nourished the soils in the Mediterranean region for millennia. It is an excellent plant for suppressing weeds and for providing a disease break in cereal-dominated crop rotations. It is a major foraging crop for honey bees and it enhances the biological control of deleterious insects damaging other crops. It can be mowed several times for forage and then ploughed under as green manure. It helps to conserve soil by preventing wind and water erosion and increasing the organic matter content of the soil, especially in newly reclaimed lands, thus improving soil physical, chemical and biological properties. It is a crop best suited for no-till planting especially after rice. It is also a major seed export crop of the country, with some 29,000 tones exported every year. *Berseem* is an environment-friendly crop as little pesticides are used on it. Increasing the wheat acreage at the expense of *berseem* would result in losing all these benefits accruing from *berseem* in rotation with cereal crops. Continuous planting of wheat has been shown to result in dramatic yield losses (about 1/12 of the existing productivity). Replacement of *berseem* area by wheat would therefore have a penalty in terms of loss in sustainability of animal and cereal production in the country.

Theme 6: Stress physiology: drought, heat, cold and salinity

6.1. Effects of defoliation on photosynthesis and grain yield in sorghum under drought stress

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It is anticipated that water resource and food will be scarce in near future, especially in arid and semi-arid regions. We hypothesized that under drought stress, defoliated (cut lower leaf) plants can produce more grain yield and consume littler water than non-defoliated plants. To clarify this hypothesis and the most appropriate growing stage and levels to defoliate, we set up the pot experiment for a drought-susceptible sorghum cultivar from Sudan grown different water regimes. Unlike in middle vegetative stage, defoliated plants in booting stage increased grain yield only in moderate and severer drought stress condition. This increment attributed to the increase of grain number through alleviation of sterility. Defoliated plants also increased dry matter production and harvest index in spite of less leaf area. Although amount of absorbed water by defoliated plants was not less than non-defoliated plants, water use efficiency was enhanced with increasing defoliation level, especially in severe drought stressed condition. Despite of defoliation stages, in wet condition, photosynthetic rate and stomatal conductance was same among defoliation levels. On the other hand, these parameters showed the tendency to increase with increment of defoliation level under moderate drought stress, and higher value only in 90% defoliated plants under severe drought stress. However, leaf water potential between defoliation treatments had no differences. These results indicate that defoliation in booting stage may be useful to increase grain yield of sorghum under drought stress. This effect is affected by soil water content and defoliation stage and level, and attributed decreasing sterility and increasing assimilation rate in maturing stage and translocation of assimilates to panicles.

6.2. Effects of drought stress and defoliation on sunflower (*Helianthus annuus*) in controlled conditions

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In order to evaluate the effects of drought stress and defoliation on sunflower a study was conducted under controlled conditions. Treatments were combination of three levels of drought (100, 60 and 30 percent of Field Capacity) and three levels of defoliation (control, removal of 4 and 6 leaves from lower part of plant) and were laid out on a Completely Randomized Design with four replications. Drought stress was applied from 4-leaf- stage to the end of plant growth period and leaf removal was conducted in heading stage. Results indicated that drought stress affected most measured parameters. Plant height, dry matter weight, stem diameter, head size, seed number/head, 100-seed weight and seed weight/ head were reduced compared to control. SPAD reading increased as drought stress was increased. Defoliation affected seed number/head and SPAD reading. Defoliation caused an increase in SPAD and a decrease in seed number/head. Leaf number was not affected by either drought or defoliation.

6.3. Contribution of post-anthesis assimilates to grain yield of durum wheat genotypes under drought stress

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This research was conducted to evaluate contribution of pre- and post-anthesis assimilates to drought resistance in durum wheat. Six genotypes of durum wheat were grown under rainfed and rainfed with 40 mm supplemental irrigation before and after anthesis at ICARDA research station, Tel Hadya, south of Aleppo, Syria in the 2006/2007 season (precipitation during the cropping season 230 mm). Tel Hadya station has a typical continental Mediterranean climate. Aboveground dry matter at anthesis and at maturity and grain yield were measured, and remobilization of pre-anthesis assimilates to the grain and its contribution were evaluated. Supplemental irrigation increased grain yield of all durum wheat genotypes. Grain yield of durum wheat genotypes under rainfed with and without supplemental irrigation was positively correlated with harvest index and aboveground dry matter accumulation from anthesis to maturity (post-anthesis assimilates), and negatively correlated with the remobilization and contribution of pre-anthesis assimilates to grain yield. There were no significant relations between grain yield and aboveground dry matter at anthesis and at maturity under rainfed condition. Supplemental irrigation reduced contribution of pre-anthesis assimilates to grain yield of all durum wheat genotypes. The results indicate that higher grain yield of durum wheat under drought was attributed to the higher post-anthesis assimilation and more effective translocation of post-anthesis assimilates

to the grain. Thus the physiological traits related to higher post-anthesis assimilation under drought may be promising selection criteria for drought resistance in wheat.

6.4. Effects of drought stress on osmotic regulation substances accumulations in 12 desert plants of Tengger Desert

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Plants can accumulate various compatible osmolytes in the cytosol, thus lowering the osmotic potential to sustain water absorption from soil. The present study was aimed to evaluate the ability of osmotic homeostasis to drought stress of 12 desert plants that grow in Tengerli desert, China. All the desert plants were investigated for their variations in the content of free proline, glycine betaine, trehalase, total soluble sugar and total flavonoid in drought stress environment. They were all compared with that of the glycophytes plant *Arabidopsis thaliana*. The results showed that examination of the contents of trehalase accumulation in 12 desert plant leaves was more than 40-300 times of *Arabidopsis thaliana* leaves, and more than 6-30 times, 2-20 times, 1-8 times, 10-40 times in the contents of proline, glycine betaine, total flavonoid and total soluble sugar, respectively. The 12 desert plants thus significantly differed from *Arabidopsis* in drought stress, and among all organic substances proline, glycine betaine and trehalase are the major osmosis-regulating substances of desert plant adapting to dry land environments. The contents of five osmotic regulation substances treated by software of Fuzzy Cluster Analysis system indicated that the 12 species can be divided in 4 types in plant adaptation mechanism of osmotic homeostasis: Type1: *Cornulaca alaschanica*, *Corispermum mongolicum*, *Bassia dasyphylla*, *Agriophyllum squarrosum*, *Caragana korshinskii*. Type 2: *Caryopteris mongolica*, *Artemisia ordosica*, *Artemisia sieverstana*, *Tamarix hispida*. Type 3: *Atraphaxis bracteata*, *Calligonum mongolicum*. Type 4: *Peganum harmala*. Thus, different osmotic homeostasis strategies are adopted by different desert plants.

6.5. A comparative response of salinity between and among the C₃ and C₄ cereals and its relation with transpiration efficiency

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In this paper we examine if there exists any general mechanism of salinity tolerance between C₃ and C₄ plants. Five cereals; pearl millet (C₄), sorghum (C₄), maize (C₄), wheat (C₃) and barley (C₃) were studied. Plants dry biomass weight (DW), transpiration efficiency (TE), transpiration, and Na⁺ accumulation in plant organs, were assessed upon treatment with 200

mM NaCl. TE was measured gravimetrically as the ratio of biomass increase per transpired water. Species differed a lot in how transpiration, shoot Na⁺ accumulation, and the Na⁺ concentration in the xylem (total Na in shoot / total transpiration) responded to salt stress. Pearl millet had the least reduction in DW (14%), highest gain in TE (39.24%) and restricted Na⁺ accumulation in stem compared to leaves upon salt stress. Upon salt treatment barley showed higher leaf area (36%), higher TE (20%), high Na⁺ accumulation in stem, and a DW reduction similar to millet (18%). Under salt treatment, DW reduction in maize was severe (35%), a likely consequence of a dramatic Na⁺ accumulation in shoot, suggesting that maize may have limited tissue tolerance to high Na⁺. Contrarily, DW reduction in wheat was limited to 22%, although TE did not increase and wheat accumulated higher Na⁺ in leaves than other cereals. Apart standing case was sorghum, having most reduction of DW (42%), a likely consequence of a large decrease in transpiration upon salt treatment; Sorghum accumulated little Na⁺ in the shoot. Sorghum may minimize Na⁺ entry into the xylem by also minimizing the water flux, which eventually penalizes transpiration and DW accumulation. We conclude that the strategies to deal with salinity are diverse across cereal species, and are not restricted to C3 and/or C4 species. Pearl millet and barley were the species most efficiently coping with salinity among studied cereals.

6.6. Evaluation of barley (*Hordeum vulgare* L. var. *karon dar kavir*) stress tolerant due to Cl/SO₄ anionic ratios of irrigation water

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Salinity is a major problem in crop production in the world. Chlorine and sulfate toxicity in waters and soils are the main factor in reducing growth and yield of most of plants. Tolerance and sensitive indices related to Cl⁻ and SO₄⁻⁻ in irrigation water and effect of nitrogen fertilizer on barley yield was evaluated in a Completely Randomized Design with three replications, under greenhouse condition. Quantity of salinity tolerance and susceptibility indices were determined. Results showed that STI had positive and high significant correlations with grain and plant biomass yields among other indices. Study of Standard Beta contents for grain and plant biomass yields with STI index showed that the effect of Cl⁻ ion was more than SO₄⁻⁻ in reduction of salinity tolerance. Also Cl/SO₄ anion ratios 1:3 and 1:2 imposed highest tolerance to salinity.

6.7. Mechanism of growth and development of *Salicornia herbacea* under high concentration of NaCl

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Arid areas are prone to salinization because the evaporation of water and transpiration tend to increase salt concentration of soil. Raising crops there becomes therefore difficult because of high salt concentration and salt tolerant plants are needed. Halophytes have a strong tolerance and can grow where glycophytes would not. In this study we investigated growth and development of halophyte *Salicornia herbacea*. Germination rate was not affected by high concentrations of NaCl up to 1 M NaCl, although it was delayed. The growth was better in the medium containing 100 to 200 mM NaCl than in the medium free of NaCl, while water content in the plant was the same. These results suggest active water uptake by *S. herbacea* in the presence of high NaCl. We also investigated parameters regulating the growth. Osmotic concentration in cell sap increased at higher concentration of NaCl, because of increased accumulation of the salt. Cell wall extensibility was also investigated. Viscosity of cell walls of hypocotyls decreased under 100 mM NaCl. These results suggest that Na⁺ promotes growth and development of this species by maintaining water uptake and by promoting cell wall elongation through decreasing the viscosity of cell walls in 100 to 200 mM NaCl.

6.8. Assessment of drought tolerance in different bread wheat genotypes

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Coinciding irrigation with the sensitive growing stage (grain filling period) of spring planted wheat allows it to cope with moisture deficit stress. To investigate the effect of limited irrigation on yield and its components and determining tolerant genotypes to stress, 20 promising lines were studied in two separate experiments using completely randomized block design with three replication in non stress and stress condition for two years (2001-2003) in Khorramabad research station. Combined analysis of grain yield and other traits was done. Five drought tolerance indices including stress susceptibility index (SSI), stress tolerance (TOL), Mean productivity (MP), Geometric mean productivity (GMP), and stress tolerance index (STI) were calculated. The results showed that year effect in stress condition was significant for the most characteristics and in non stress condition it was significant for grain yield, biomass, peduncle length, spike and grain number/m². The difference between genotypes was significant in stress and non stress for most of the traits. Analysis of regression showed negative correlation among yield components. According to sensitivity index (SI) grain yield decreased about 28% by stress in the stage of grain filling. The results showed that indices GMP, MP and STI were the best for drought resistance selection.

Multivariate biplot indicated that genotypes number 1, 8, 9, and 15 were located next to the vectors of drought resistance indices. Among these, number 8 was the most tolerant to drought resistance.

6.9. Evaluation of drought tolerance in different Durum and Bread wheat genotypes

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In order to determine the most desirable indices and screening genotypes of wheat for drought tolerance, an experiment with 15 genotypes of Durum and Bread wheat as sub-plot factor and three levels of stress including complete irrigation, terminal drought and rainfall as the main factors was conducted in a split-plot design in three replications in Khorramabad research station during 2006-2007. In this study, five drought tolerance indices were used based on grain yield under drought (Y_s) and normal (Y_p) conditions. The result of analysis of variance indicated that there was a significant difference among different genotypes and stress levels, but no significant interactions. The results showed that indexes GMP, STI and MP were the best for drought resistance selection. According to sensitivity index (SI) grain yield decreased about 34% and 24% in severe and terminal stress, respectively. Multivariate biplot indicated that genotypes number 1,3,12 and 13 were located next to the vectors of drought resistance indexes (GMP, MP and STI). Among these, number 13 was the most tolerant to drought resistance.

6.10. Study of drought tolerance in bread wheat genotypes under different moisture levels

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In order to determine drought tolerance in 12 advanced wheat genotypes an experiment was conducted in irrigated and no irrigation conditions as randomized complete block design with 4 replication at the dryland agricultural research institute during 2006-07. Different drought tolerance indices including SSI, STI, GMP, Tol and MP were used for evaluation of genotypes. Results showed that there is significant difference between studied traits. There was significant positive correlation between TKW and peduncle length with grain yield in the irrigated condition. Genotype 345GBM had the highest grain yield in both conditions and had the highest amounts of STI, GMP and MP indices as well. Since GMP, STI and MP indices had significant positive correlation with grain yield in both condition, they were recognized as suitable indices for identification of drought susceptible and tolerant genotypes.

6.11. Effects of drought stress on physiological and biochemical traits in wheat

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In order to study the effect of drought stress on physiological and antioxidant enzymes in three wheat cultivars, a green house experiment was arranged in a four replications in a randomized factorial design. Two resistant wheat cultivars (Sardari and Mahdavi) were compared to a susceptible one (Zagros) at four levels of water stress (control, stress at 50% anthesis and 10, and 20 days after anthesis). Water stress resulted in a decrease in relative water content, membrane stability and SPAD reading in all cultivars. The antioxidant enzymes superoxide dismutase (SOD) and catalase (CAT) activity also increased under water stress. Cultivars of Sardari and Mahdavi, which had higher SOD and CAT activity, had the lower relative water content and SPAD reading and higher membrane stability than cultivar of Zagros under water stress. The degree of oxidative stress tolerance seems to be closely associated with an increase in activities of antioxidant enzymes. It seems that drought susceptible cultivar uses the avoidance mechanism such as higher RWC and SPAD reading to stand drought stress.

6.12. Investigating effects of drought stress on physiological and biochemical traits in soybean

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In order to investigate the effects of drought stress on physiological and biochemical traits in Soybean, an experiment was carried out in a split plot design in four replications in 2005 at the experimental field of Gorgan University. Irrigations levels (normal and drought stress) were main plots and soybean cultivars (Williams, Harcor and Sayyad) and selenium spray application (0 and 18 g/ha) were sub plots. Results showed that drought stress significantly reduced seed and biological yields, pod number per plant, seed number per pod, 1000-seed weight, chlorophyll a and b, leaf cell membrane stability, but increased activity of Superoxide dismutase and had no effect on catalase activity. Williams had more resistance to drought stress than other cultivars, and had significantly higher pod number per plant, seed number per pod, 1000-seed weight, chlorophyll a and b, leaf cell membrane stability, activity of catalase and superoxide dismutase than other cultivars but had no significant difference with Harcor in seed and biological yields. Selenium spraying enhanced the tolerance of cultivars to drought stress and increased seed and biological yield, seed number per pod, chlorophyll a and b, activity of superoxide dismutase in all cultivars in drought stress conditions.

6.13. Calcium enhances the plant growth and carbohydrate metabolism in salt stressed rice

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Rice (*Oriza sativa* L.) cv. Giza 178 was gradually adapted to salinity (3.1 then 5.4 dS m⁻¹) for several seasons in a lysimeter experiment containing clay loam soil. The effect of saline irrigation water (0.5, 1.2, 1.8, 2.5, 3.1, 5.4, 7.5 dS m⁻¹) and calcium (0,100 mg.L⁻¹) on yield components and carbohydrate status in developing grains of salt-adapted rice was investigated. Despite adaptation, the threshold of salt tolerance, for plant growth or grain yield, was below 1.8 dS.m⁻¹ and, was not affected by calcium treatment. Higher salinities depressed both straw and grain yields with concomitant increase in leaf Na⁺ content and simultaneous decrease in carbohydrate accumulation in the grains. This was due, at least in part, to an inhibition of some enzyme activities involved in the conversion of sucrose to starch in developing rice grains. These enzymes included sucrose synthase, invertase, and PPi pyrophospho-fructokinase. Calcium improved both grain yield and its carbohydrate content, after partial stimulation of these enzyme activities, but could not reverse the depressive effect of salinity.

6.14. Effect of PEG concentrations on embryo formation and plantlet growth for some date palm cvs *in vitro* - Lower PEG concentrations

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This study was carried out at the tissue culture laboratory of the central laboratory of date palm research and development through the period from 2004 to 2006 to evaluate three date palms cultivars (Sewy, Zaghloul and Sakkoti) embryos and plantlets subjected to PEG concentrations (0.0, 0.4, 0.8, 1.2 and 2.4%) for six weeks. PEG levels at 2.4% included the lowest significant percentage of survived embryos for Zaghloul and Sakkoti cvs. while it was 100% for Sewy under all PEG levels (0.0-2.4%). However, the plantlet growth in terms of shoot length achieved the highest length under higher PEG level 2.4% for Sewy and Sakkoti cvs. with insignificant differences between them. Moreover, the number of roots increased with increasing PEG level for all the cultivars. However, in Sewy cv. it was significantly the highest indicating higher tolerance of this cv for drought. The same trend was clear for root length well.

6.15. Effect of salinity stress on some date palm cultivars during proliferation stage *in vitro*

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This study was carried out at the Central Laboratory of Date Palm Research and Development, from 2005 to 2006, to evaluate an *in vitro* technique for salt tolerance screening of three date palm cultivars Samani, Sewy and Bartamuda cultured on MS medium with 0, 4000, 8000 and 12000 ppm NaCl after 12 weeks for three subcultures. The effect of salinity on shoot length increased significantly for the three cultivars, especially Bartamuda cv., as it increased to 4000 ppm and then decreased thereafter. Number of shoots showed the highest value at 4000 ppm for the Bartamuda cv., however, at 8000 and 12000 ppm it decreased and the differences between Sewy and Bartamuda cvs were insignificant. The number of burned leaves was the highest at 12000 ppm for the Sewy and Samani cvs as compared with Bartmuda cv. Significant differences were recorded between Bartamuda and the other two cultivars. The growth vigor of Bartmuda was the highest even at 12000 ppm NaCl.

6.16. Subjective symptoms of the eyes and the respiratory system in inhabitants of Mongolia

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This study aimed to clarify subjective symptoms of eyes and respiratory system in inhabitants of Mongolia. A survey was carried out by questionnaire in a city area and a nomadic place in the end of May, 2008. Office workers of a research institute in the Ulaanbaatar were selected as the study population of the city area and the nomads living in the gels around the Choyr city were as the study population of the nomadic place. Subjective symptoms of eyes and respiratory system were questioned by face to face. A Chi-square test was used to assess differences between the city area and the nomadic place, and a p-value of 0.05 was accepted as statistically significant.

There were a total of 36 participants (office worker) in the Ulaanbaatar and 87 nomads. The subjective symptoms for eyes (itchy eyes, bloodshot eyes, and lacrimation) of the nomads were significantly more than that of the office workers. As high as 32% of nomads and 11% of office workers were with bloodshot eyes, and 36% of nomads and 8% of office workers with the lacrimation. Significant differences were found between the nomads and office workers. The subjective symptoms of the nomads for nose (sneeze, snot, and nasal congestion) were approximately the same as the office workers. 29% of nomads and 32% of office workers had respiratory symptoms of cough, sputum, and breathlessness within the

past 6 months. The symptoms of the eye and respiratory system were frequent in Mongolia. Especially, the symptoms of eyes were frequent in the nomads. These may be caused by sandstorm or dust.

6.17. Effects of the Asian dust events on daily symptoms of healthy subjects in Western Tottori, Japan

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Asian dust events originate in the Chinese and Mongolian deserts during spring season. It is thought that these events are an environmental problem due to human's impact caused by forest reduction, soil degradation, and desertification, rather than being simply a natural seasonal phenomenon. The occurrence of these events is a common problem including health issue throughout Northeast Asia. However, the effect of Asian dust on human health is not well-known in Japan. We evaluated the association between daily symptoms of healthy subjects and dust events in Western Tottori, Japan, using health survey sheets. Subjects were 17 healthy individuals (8 men and 9 women; mean age, 37.7+/-8.8 [SD] years) and distributed survey sheets on nasopharynx, eye, and respiratory symptoms, which were quantified from March to April 2008. Daily measures of suspended particulate matter (SPM) were obtained from Institute for Environment and Health. The scores for symptoms in March were significantly higher in April. Severe dust event occurred in early part of March and the levels of SPM decreased in April. The scores for symptoms, especially for nasopharynx symptoms, were positively correlated to the levels of SPM. Our result provides evidence that the Asian dust events are impacting on the symptoms of healthy subjects, although these symptoms are not severe.

Theme 7: Improvement of stress resistance in dry area crops, shrubs and tree species through conventional breeding and application of biotechnology

7.1. Path analysis of correlation coefficients for agronomic traits with grain yield of hull-less barley Genotypes under rain fed condition

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During 2003-2004 and 2004-2005 cropping seasons, an experiment was conducted using 20 rain-fed spring hull-less barley genotypes in a complete block design with 4 replications to determine the effect of each trait on grain yield components on grain yield. The experiment was carried out at Kouhdasht area of Lorestan province, Iran. Among the evaluated traits, biological yield had the highest degree of correlation coefficient with straw yield was $r = 0.95^{**}$. Correlation between grain yield and biological yield was $r = 0.81^{**}$. Among yield components, number of grain per spike had highest degree of correlation coefficient with grain yield, $r = 0.11$. To determine the characters most effective in determining the grain yield, stepwise regression analysis was used. Five traits, i.e. spike weight, number of grain per spike, peduncle length, plant height and number of days to heading, were the most effective traits on grain yield. The path analysis showed that spike weight ($r = 0.89^{**}$) and plant height ($r = 0.82^{**}$), had highest positive and direct effects on grain yield and peduncle length ($r = -0.70^{**}$) had highest negative and direct effects on grain yield.

7.2. Characteristics of three promising durum wheat lines adapted to rain-fed and moderately cold winter of western Iran

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The development of cultivars that combine drought resistance, high yielding ability, and yield stability is an important objective targeted by breeding programs in the rainfed areas. Three promising durum wheat lines, namely Syrian-4, Mrb3/Mna-1 and Mna-1/Rfm-7, selected from ICARDA germplasm, were tested in the national uniform yield trials and farmers' fields under rain-fed and supplemental irrigation conditions during five cropping seasons (2000-05)

to evaluate their adaptation to areas with mild cold winters. Under rainfed conditions, Syrian-4 and Mrb3/Mna 1 out yielded both the local durum check Zardak and the bread wheat landrace Sardari. Mna-1/Rfm-7 out yielded Zardak by 14%. Mrb3/Mna-1 and Syrian-4 showed also better grain yield stability and adaptability and good yield performance under supplemental irrigation. These promising durum lines showed better grain quality and protein content and better drought tolerance than Zardak. Syrian-4 and Mrb3/Mna-1 are recommended for the rain-fed conditions and under supplemental irrigation in the moderate cold winter areas of Iran. These lines can be used as parental germplasm for generating more adapted germplasm for similar areas in the Central, West Asia and North Africa region.

7.3. Comparative study in salt tolerance of different wheat genotypes

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A greenhouse experiment was conducted in Soil Salinity Lab., Alexandria during the growing season 2006/2007 to study the salt tolerance variability among 14 wheat genotypes. Treatments included four salinity levels (control, 4000, 8000, and 12000 ppm salts) developed by adding NaCl and CaCl₂ (2:1, molar ratio). Biological yield, grain yield and yield components as affected by salinity were determined at maturity. Increasing salinity up to 12000 ppm decreased significantly ($p \leq 0.05$) grain and biological yields, 1000-kernels weight, spikes number/pot, number of kernels/spike and harvest index. Grain yield was the most sensitive character to salinity among the other yield components giving relative yield of 15.31% at the highest salinity level compared to control. Irrespective of salinity, comparisons among genotypes revealed that G14 had the highest biological yield (161.25 g/pot), G4 produced the highest grain yield (41.68 g/pot), 1000-kernels weight (44.62 g) and harvest index (0.32). G10 ranked as the most salt-tolerant genotype as defined by relative yield (grain yield at the highest salinity level compared to control) giving 60.4 %, whereas, G1 ranked as the most susceptible genotype to salinity offered relative yield of 17.5%. These results are important not only for breeders interested in improving salt tolerance of wheat genotypes, but also for farmers who grow wheat in areas where the soil and ground water have high salinity conditions.

7.4. Correlation and path analysis for some agronomic traits in wheat genotypes

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To study the relationship of some traits with grain yield and to determine direct and indirect effects between grain yield and its components, an experiment with 15 genotypes of durum

and bread wheat at three levels of moisture supply was conducted at Khorramabad Research station during 2006-2007. The results indicated that grain yield had the most positive correlation with biomass ($r=0.827^{**}$), grain number per square meter ($r=0.655^{**}$) and Harvest Index ($r=0.586^{**}$). The stepwise regression model indicated that grain and spike number per square meter, and 1000-seed weight lead to 91% changes in yield. According to path analysis of the traits, the grain number per square meter and thousand-kernel weight had the highest direct effect on the grain yield (0.834^{**} and 0.747^{**} , respectively). The results are suggestive of the fact that direct selection for desirable genotypes is best both in ideal and stress conditions.

7.5. Screening faba bean breeding lines for drought and heat stresses

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Faba bean (*Vicia faba*) plays an important role in the nutritional security; it is grown in rotation with cereals in the Mediterranean region and East African countries. Faba bean is highly affected by drought and heat during early and reproductive stages of growth. The adaptation of faba bean to water limited Mediterranean conditions comprises drought escape (earliness) and vigorous growth. The development of drought tolerant cultivars is essential to improve the yield stability of faba bean under climatic variability. Plant breeders normally evaluate breeding materials at drought-prone sites based on grain yield. Two hundred ninety five lines were planted randomly in an augmented design using ILB 1814 as check in every 10 rows. Planting was done during the first week of April 2008 at Tel Hadya. These include 33 F4 independent vascular supply types and 80 breeding lines tolerant to orobanche. The remaining 80 early maturity types and 46 highly autofertile lines originated mainly from Bangladesh, Egypt, Ethiopia, Yemen, India, Nepal, Pakistan, Afghanistan, China, Columbia, Syria, Lebanon, Iraq, Morocco, France and Spain. At Tal Hadya, the total rainfall and irrigation water received by crop was 142.7 mm, with the evapo-transpiration range from 7 to 16.2 mm/day during the flowering to maturity. The temperature varied from 28.5 to 38.4 Celsius during the reproductive stage of the plants. Of the total 4425 plants only 114 plants reached the grain development stage. At the end of the experiment, only 18 single plants were selected with grain number varying from 8 to 15 per plant. These lines matured in 60 to 90 days under this condition. Those selected plants will be used by the faba bean breeding program at ICARDA as parents to develop breeding lines for drought prone areas.

7.6. Screening and improving faba bean lines for *Alternaria* spot disease resistance under rainfed conditions at eastern North Coastal zone

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The response of 10 genotypes of faba bean (*Vicia faba* L.) to the virulent isolate of *Alternaria alternata* was studied under rainfed and green house conditions at El-Sheikh Zewaied experimental station of the Desert Research Center. Most of the genotypes tested were moderately resistant to *Alternaria* spot disease according to their mass disease index (MDI). The genotypes Giza 461 and L9 were classified as resistant in the first season and became as moderately resistant in the second season, while genotype L4 was classified as moderately susceptible in the first season but in the second season it was moderately resistant. Under green house conditions, most of the genotypes were moderately resistant according to MDI values except L2 and L4, which were classified as resistant. Significant differences between mean performances were obtained in seed yield/plant and its components. Line7 recorded the highest means in both seasons for 100-seed weight and seed yield/plant. DNA analysis of different lines showed that there are molecular makers for each of drought tolerance and disease resistance. ISSR-PCR of five primers discriminated the genotypes tested and the SPSS dendrogram classified them into two main clusters.

Theme 8: Reducing greenhouse gas emission through harnessing renewable energy in the dry areas.

8.1. Greenhouse gas inventory from agricultural sector

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Agricultural activities contribute directly to the emission of greenhouse gases through various processes. The sources include enteric fermentation of livestock, manure management, rice cultivation, agricultural soils and the burning of agricultural residues in the field. These processes and activities are the main sources of CH₄ and N₂O. However, the field burning of agricultural residues is the source of CH₄, N₂O, CO and NOX. There are no ecosystems in Egypt that could be considered natural savannas; consequently, no greenhouse gas emissions therefore exist for this subcategory. In the last submission of Egypt of 1990/1991, the most important GHG in the agriculture sector was methane (CH₄) contributing 63.66 % of the sector and 9.78 % of total GHGs emissions expressed in CO₂ equivalent, followed by nitrous oxide (N₂O), accounting for 36.34 % of the sector and 5.58 % of the total emissions. The agriculture sector accounted for 15.53 per cent of the total GHG emissions. However, in the current submission of year 2000, the most important GHG in the agriculture sector is N₂O contributing 60.38 % of the sector expressed in CO₂ equivalent, followed by CH₄, accounting for 39.62 % of the sector. Total GHG emissions from the sector in 2000 amounted to 31715.08 Gg CO₂ equivalent. Agricultural soil is the main source of GHGs emissions from agriculture sector having a contribution of 32.24% of total agricultural emissions. Manure management was the second important source by contribution of 28.99%, and it is followed by enteric fermentation by having a contribution of 25.48%, rice cultivation a contribution of 7.82%, and field burning of agricultural residue a contribution of 5.47%.

8.2. Determining the quantity of emitted methane from Egyptian livestock

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The domestic animal population has increased by 0.5 to 2.0 percent per year during the last century, according to the Environmental Protection Agency (EPA). One result of this population increase is that emissions from livestock have become a significant source of atmospheric methane. In fact, domestic animals currently account for about 15 percent of the annual anthropogenic methane emissions. The estimated annual global production was 400 to

600 Tg (1Tg = 1 million tons) of methane, enteric fermentation in domestic animals contributed approximately 65 to 85 Tg. Gas emissions from enteric fermentation of the domestic livestock contribute to greenhouse gas inventories. Farming activities in Egypt have nearly doubled methane emissions during the past decade. Emissions of methane from enteric fermentation of different regions of Egypt were studied. The main objective of such work is to determine the quantity of methane that is emitted from the Egyptian livestock (domestic breeding) during the period of 1996 (as a base year) to 2004. Total CH₄ emission is calculated according to the methodology of the Intergovernmental Panel for Climate Change (IPCC) 1996. Results indicated that total annual emission from enteric fermentation was 325Gg CH₄ in 1995 equivalent to 6825.6Gg CO₂, while it was 8967.4Gg CO₂ in 2004. The projection of fermentation enteric gas emissions depends on the increase of the livestock, which was assumed for this study to be linear for 1996–2004 with an increment of 2.27%. In this overview, we examine past trends in the emission of methane due to the enteric fermentation and the sources and sinks that determine its growth rate.

8.3. Mitigation options for methane emissions from paddy rice in Egypt

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Three mitigation options have been studied and compared with the current plans and the current situation. The first mitigation option is to reduce cultivated rice area to 1.2 million feddans by the year 2017 as against 2.2 millions if the current trend of increase prevailed. The second option is the introduction of new cultivars. The current cultivars stay in field completely submerged in water for three months, while the new cultivars stay only for two months. That means one-third reduction in methane. In this option, the plan is to totally substitute the traditional cultivars by the year 2017. The last option is the intermittent irrigation instead of complete soil submergence with water. Draining the water once every four days will result in aerobic conditions without methane emission. This is expected to reduce CH₄ by one fourth. The option is to gradually introduce the intermittent irrigation to become 100% by the year 2017. The scenarios were made related to the use of the four combinations of the three above-mentioned options. The first scenario is to use the reduced area option simultaneously with switching cultivar option. The second scenario is to use the reduced area option simultaneously with intermittent irrigation option. The third scenario is to use switching-cultivar option simultaneously with intermittent irrigation option. The fourth scenario is to use the three options together. Methane emission and water consumption, yield production and cost of operation were estimated annually for each option and scenario. From the study, the fourth scenario gave the lowest cost compared with methane emission of 0.0872 Tg in comparison to 0.1260 Tg methane emission from the worst scenario.

8.4. Optimum tilt angle and orientation for a flat plate solar water heater under Egyptian conditions

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Solar water heater (SWH) is a most widely used for different agricultural and industrial applications in Egypt. But, there are many parameters that affect solar water heater thermal performance. Tilt angle and orientation are considered as an important factor influencing not only the thermal performance but also the heat energy acquired by the solar system. Four identical solar water heaters were situated on the roof of Agricultural Engineering Department to investigate under clear sky conditions the effect of tilt angle and orientation on their thermal performance. They were mounted individually on a movable frames which could be adjusted so that at any time the angle of incidence of the surface of the solar heater and the sun's rays could be set at zero. Water could be continually cycled through the SWH. After passing through the SWH, the heater water was stored in an insulated storage tank. The obtained result clarified that the solar heater which tracked the sun's rays once each half an hour from sunrise to sunset was more efficient than the other solar heaters. Overall thermal efficiencies were on average as high as 72.83%, and as low as 55.98%.

Theme 10: Enhancing livelihood of desert communities, socioeconomic studies and crosscutting issues

10.1. Future implications of the climate-security nexus: Declining ecosystem services as a driver of social destabilization and threat to human security in selected Arab Gulf States

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It is increasingly apparent that the effects of global climate change will not only alter ecosystem services and living conditions for future generations, but encompass salient human security dimensions. Especially in the developing world, the pressures of a changing environment such as the increase of the occurrence of droughts, desertification and rising sea levels will pose significant challenges for both states and regions, as social, political and economic dynamics come under pressure. Nevertheless while the importance of socio-cultural factors are getting more recognition in some parts of the world, little is known about the human dimensions, or the contexts in which they operate in respect to the oil economies of the Arabian Peninsula. The performance of institutions, governance structures and processes, patterns of social and economic distribution, and especially the capacity for action in policy terms have never been investigated to date. However the recent assessment by the Intergovernmental Panel on Climate Change (IPCC) has emphasized that understanding the institutional context in which policies are made and implemented is critical to define sustainable development paths from a climate change perspective. The general objective of this study will be to reposition the climate change debate within the context of long term human security by outlining some of the major environmental threats in this particular region and situate them within the larger socioeconomic and political contexts that cause them, and which shape the capacity of Gulf Arab societies to cope with and respond to this change. A special focus will be on the question if the effects of changes in these ecosystem services on human well being will eventually become a driver of social destabilization within the Arabian Peninsula. Finally, the paper will conclude with recommendations for future interdisciplinary research and sustainable development pathways.

10.2. Educating consumers of agricultural products about responsible water management and irrigation in arid zone agriculture – the 'WaterWise' lable

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Organic agriculture is increasing in importance in Egypt, for producing products both for domestic consumption as well as for export. Agricultural exports represent, by weight, significant exports of water, as well as, by yield, significant investment of water during the growing period. Just as consumers are able to make a choice regarding the purchase of local or imported, organic or conventionally produced agricultural products, there exists a need to introduce labelling of products to indicate the amounts of water used in production and whether the irrigation methods are optimal for the agricultural produce and the region in which it is grown. For example, rice which is cultivated by flood irrigation in arid zones represents an inefficient use of water given yield, economic and nutritional value, in comparison to rice which is irrigated using a less wasteful method. Equally, crops which are suited to arid zones, and which require less water for their yield, economic and nutritional value, represent more efficient user of water than crops grown there which are unsuited to arid zone climates, such as medicinal plants, sunflower, or sorghum. This paper discusses the concept of the 'WaterWise' label as a means to educate consumers, both locally and in export markets, of the efficiency of water use in growing the crops giving those products. Using an approach similar to the energy labelling on appliances, different agricultural crops, appropriate to different climate zones, together with appropriate and actual irrigation techniques, should be given a WaterWise number to indicate the degree of water use efficiency in production.

10.3. Public outreach activities of the Arid Land Research Center, Tottori University, Japan

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In Japan, Arid Land Research Center (ALRC) at the Tottori University is the only academic research institute which has systematically studied environmental and agricultural issues in the drylands. Although Japan does not have drylands and therefore does not directly suffer from the problems encountered by the people living there, the ALRC is strengthening both domestic and international collaboration on dryland studies in line with the ratification of the United Nations Convention to Combat Desertification (UNCCD) by the Japanese Government in 1998. As there are no drylands in Japan, it is necessary to enhance the awareness of the general public in the country on drylands and desertification issues such as aeolian dust originating in China and Mongolia. The ALRC is therefore giving high priority to improve the public understanding of the drylands in the world and the problems there through many public outreach activities for the last 10 years. Our outreach activities consist of (1) World Wide Web and media, (2) weekday and weekend visitors' program (WWVP), (3) regular public outreach program (RPOP), (4) special public outreach program (SPOP) and (5) education program (EP). For instance, as a part of the SPOP activities, we held exhibition events in Tokyo in 2007 and Osaka in 2008 for the benefit of the public. There, we surveyed the effect of the events on public awareness by serving questionnaires to the visitors. The results of the survey showed that our events successfully fostered an understanding of ALRC's activities. This paper provides an overview of ALRC outreach activities and

evaluation of the SPOP activities based on the survey mentioned above. Future challenges for the SPOP are also discussed.

10.4. JIRCAS' challenges in agricultural research and rural development in dry areas

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The Japan International Research Center for Agricultural Sciences (JIRCAS) is making many active contributions internationally to address the agricultural, forestry, fisheries, food and environmental problems in developing regions through research endeavours. JIRCAS' activities also focus on the dissemination of technology research and development outputs. Our posters will introduce two projects from JIRCAS' research activities targeting the dry areas.

1. Development of abiotic stress-tolerant crops

Desertification, global warming and unfavourable environmental conditions cause serious damages to agriculture in developing countries. Thus, the development of abiotic stress-tolerant crops has become extremely crucial. In this research, rice, wheat and soybean germplasm are screened to select lines which are tolerant to adverse environments, and DNA markers linked to the tolerance are identified. In addition, the transcription factor DREB (Dehydration-Responsive Element Binding), which regulates many stress tolerant genes related to drought and salinity response in plants, was introduced into rice and soybean. Development of drought tolerant varieties has great potentials and contributes to yield increase because rain-fed agriculture, which is seriously damaged by drought, is widespread in developing regions, even in the case of rice production.

2. Community-based prevention of desertification in Mali

JIRCAS has developed methods to solve global environmental problems such as desertification and soil erosion, as well as empower stakeholders to enable them to manage their natural resources by themselves. The project implemented in Mali has developed the methodology of community-based prevention of desertification. It was materialized through participatory approach aimed at developing the rural society while conserving natural resources. The project was selected as one of the four best examples of anti-desertification projects at the Seventh Session of the UNCCD in 2005. The government of Mali plans to carry out participatory rural development projects with this methodology in 100 villages using its own national budget.

10.5. Observed vulnerability and continuous adaptation of the rural community in the Nile Delta

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The most likely result of climate change over Egypt is a rise in average temperature, which would in turn cause sea-level rise, and 12-15% of the existing agricultural land in the Delta could be lost. Delta region is generally considered as a homogenous agriculture region in Egypt. The northern Delta could be the most vulnerable sub-region in Delta due to the combination of natural, human, agriculture management factors and economical and political conditions. Sea level rise, soil and water degradation, limited diversity in the cropping pattern, yield reduction, and irrigation and drainage management were the main key factors are the main factors that have increased the vulnerability of the agriculture sector in northern Delta. The initiation of integrated adaptation plan is a critical action aims to reduce the vulnerability of northern Delta. Regarding the current situation, there are continuous trends of adaptation by the rural community in this region in order to adjust to the current environmental conditions and to achieve new economical benefits. The aim of this study is to investigate the continues adaptive actions being taken in northern Delta region, based on field observations, and to explore the possible relationship between these adaptive actions and the impacts of climate change on this region.

10.6. Rural youth attitudes towards working in agriculture in Egypt

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Paying attention to agriculture sector is a vital requirement in providing the population with food security, realizing sustained development, and promoting industries, particularly under the increasing population. Youth is probably among the most important sources of energy for agricultural development because of their potential, ambition and high desire of accomplishment, when right environment is available. Thus, the main objective of this study was to determine the attitudes of rural youth of both sexes towards working in agriculture, and setting up agricultural enterprises as one of their first choices for work. Such an information would make it easy for policy makers and executives to set up strategies adequate to the needs and suggestions of such youth, and guarantee the realization of sustainable development.

10.7. Socio-economic norms affecting farmers' participation in some agricultural development projects in the Northwest Coast area of Egypt

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The success of the agricultural development projects and programs to achieve their goals depends mainly on the extent of actual participation of farmers. Farmers' participation in some or all the stages of these projects is affected by the underlying socio-economic norms in the social context the farmers live in. Hence, the scope of this study is to identify the dominating socio-economic norms in the studied villages and the degree to which farmers hold to them and then determine the degree of farmers' participation in the studied agriculture development projects. Also, this study explores the relationship between the degree of their participation in these projects and the degree of their holding to these socio-economic norms. The study took place in the villages of El-Matania, El-Negeela and Sidi Barrany on the north-western coast, Matrouh Governorate, where the studied agricultural development projects were implemented. The total sample size amounted to 364 farmers, included 182 participants in the stated projects and another 182 farmers who did not participate. The main results were: A majority of farmers (over 50% of the respondents both participants and non-participants in agricultural development projects) agreed at a high degree on the content of the items representing each of the following social norms – saving water, tribal affiliation, science consideration, respecting village elders, fatalism, work partnership, planting local varieties of crops and Bedouin's ownership of a camel. A majority of farmers (participants and non-participants) agreed at a low rate on the content of the items representing the norm of restricting animal grazing activities to women. The results revealed also that farmers' participation was high in the project of developing grazing areas, as it ranked first followed by the project of improving grazing areas, while the project of collecting and delivering seeds came last. A correlation was found between the respondents' degree of holding each of these socio-economic norms and the degree of their participation in the studied agricultural development projects. The multiple correlation and regression analyses (step-wise) revealed that the norms of Bedouin's ownership of a camel and tribal affiliation contributed significantly in explaining the total variation in the degree of participation in the studied projects.

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